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DVERTISING INDEX—PAGE 112 EXPORT NUMBER BUYERS'D IRECTORY—PAGE 104

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVI., No. 1 Published by the MacLean Publishing Company, Limited, London, Ont. July 7, 1921 $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Throw Away Files —not Time



WHEN you use a file that has become dull, you are wasting time.

To give efficient service, a file's teeth must bite keenly at every stroke.

Throw away that dull file and get a new one. Files cost less than labor.

Maximum service from every file is ensured if you specify one of these brands:

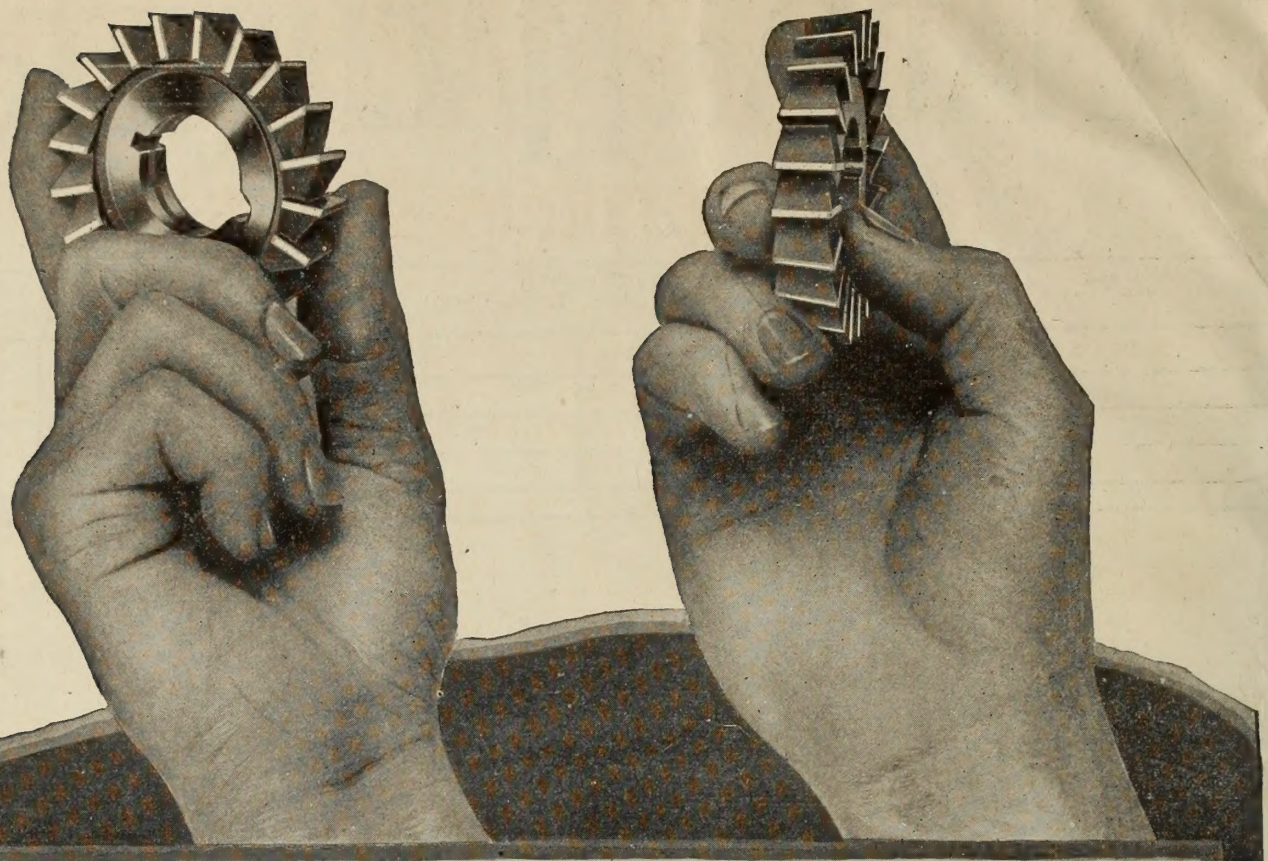
KEARNEY & FOOT — AMERICAN
GREAT WESTERN—ARCADE—GLOBE

FILES AND RASPS

Made in Canada by:

Nicholson File Company

PORT HOPE - ONTARIO



If it's speed you need--

One trial will prove the advantage of Pratt & Whitney Milling Cutters. No matter what the nature of the work they will give you the highest production the machine is capable of.

They're designed for free, fast cutting. And tempered and seasoned to last longer.

PRATT & WHITNEY MILLING CUTTERS

Ask us for prices and details on Plain Milling Cutters, Side Milling Cutters, Inserted Blade End and Side Cutters, Screw Slot Cutters, Coarse Tooth Side or Plain Milling Cutters, Involute Gear Cutters, Concave, Convex and Double Angle Cutters, Cutters for Spiral Mills, Roll Thread Die Hobs, Key-Seating and Slotting Cutters, Straight and Spiral Cut End Mills (B. & S. and M. T. Shank), Spiral and Straight Shell End Mills, etc.

And we make formed cutters for special work also. All are backed by the guarantee for goodness that the P. & W. trademark indicates.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Works: Dundas, Ontario

MONTREAL
723 Drummond Bldg.

TORONTO
1002 C. P. R. Bldg.

WALKERVILLE
103½ Sandwich Street

WINNIPEG
1205 McArthur Bldg.

HALIFAX
Roy Building

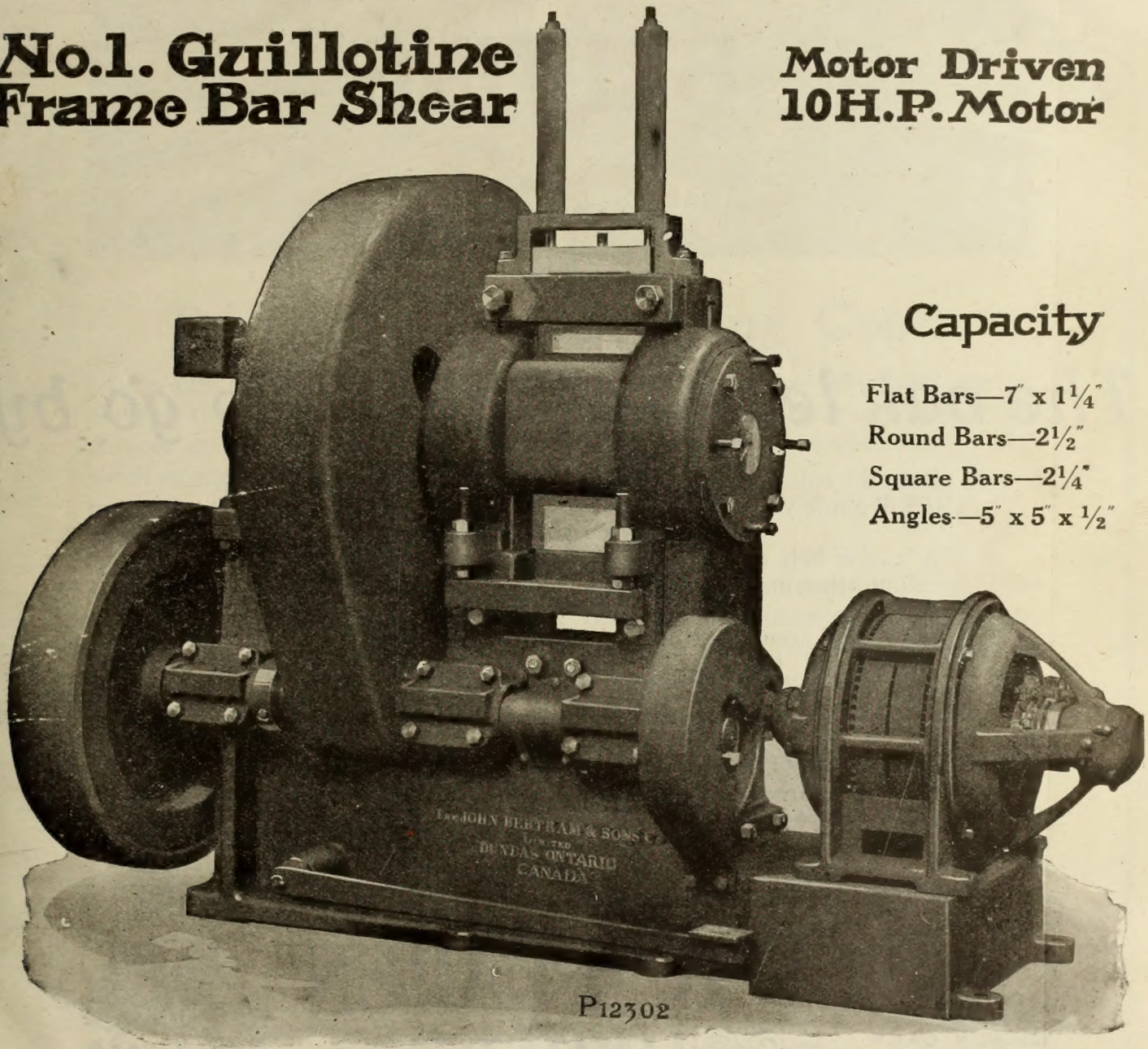
VANCOUVER
B. C. Equipment Co.

The BERTRAM Page

MACHINE TOOLS

No. 1. Guillotine Frame Bar Shear

Motor Driven 10 H.P. Motor



P12302

Capacity

Flat Bars—7″ x 1¼″
Round Bars—2½″
Square Bars—2¼″
Angles—5″ x 5″ x ½″

The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

MONTREAL	TORONTO	VANCOUVER	WALKERVILLE	WINNIPEG	HALIFAX
23 Drummond Bldg.	1002 C.P.R Bldg.	609 Bank of Ottawa Bldg.	103½ Sandwich Street	1205 McArthur Bldg.	Roy Bldg.

If interested tear out this page and place with letters to be answered.

D.K.McLaren's

GENUINE BRITISH-OAK TANNED

LEATHER BELTING

TRADE MARK

The oak leaf is the sign to go by

Bear the oak leaf in mind the next time you are buying belting—it will guide you to better belt service.

A leather belt will transmit 25% more power than the same sized belt of other material.

D. K. McLaren's Leather Belting is just as good as we know how to make it. Only the **backs** of the choicest steers are used. They are skillfully, Genuine British Oak tanned by experts and all stretcher ends cut off before they are made up into belting.

That is why D. K. McLaren's Belting is **cheap!** Why it saves its users a remarkable amount of power, time and labor. Why it is as serviceable as a leather belt can possibly be.

GENUINE OAK

D·K·McLAREN LIMITED

GENUINE OAK

HEAD OFFICE AND FACTORY:

351 ST. JAMES STREET, MONTREAL, P.Q., CANADA

VANCOUVER, B.C. 334 Cordova Street West

TORONTO, ONT. 194 King Street West

ST. JOHN, N.B. 90 Germain Street



To Decrease Operating Costs

The side carriage is an important part of the W.& S. turret lathe. It reduces operating costs, often by as much as one-half. It operates simultaneously with the turret and independently of it. The side carriage has a separate feed rod.

Take some of the simplest bar jobs; by cutting off with the side carriage while the turret tools are finishing their work, you save most of the cutting off time.

Here is the picture of a W.& S. 2-A. in a railroad shop. This machine makes bolts, pins, oil cups, valve parts, piston rods, and many other parts used in the repair of locomotives and cars.

On all these parts both turrets operate together.

Take this feature and the fact that the machine operates easily and accurately, and you know why the machine is popular with the shop men. It delivers the goods.

Send us blue prints of your parts and we'll tell you how long it will take to do your work the W.& S. Way.

The Warner & Swasey Company

Cleveland, U.S.A.

BRANCH SALES OFFICES:
NEW YORK: Singer Building.
CHICAGO: 618-622 Washington Boulevard.
BOSTON: Oliver Building.
BUFFALO: Iroquois Building.
DETROIT: 5928 Second Boulevard.
MILWAUKEE: 209 Sycamore Building.
INDIANAPOLIS: 940 Lemcke Annex.
DAYTON: 518 Mutual Home Building.

CANADIAN AGENTS—
A. R. Williams Machinery Company, Ltd., Toronto, Winnipeg, Vancouver, St. John.
Williams & Wilson, Ltd., Montreal.

FOREIGN AGENTS—
Charles Churchill & Company, Ltd., London, Birmingham, Manchester, Bristol, Newcastle-on-Tyne, Glasgow.
Allied Machinery Company, Paris, Turin, Zurich, Barcelona, Brussels.
Wilhelm Sonesson Company, Malmo, Copenhagen, Stockholm, Gothenburg.
R. S. Stokvis en Zonen, Rotterdam.
Benson Brothers, Sydney, Melbourne, Adelaide.
Yamatake Company, Tokyo, Osaka, Nagoya, Fukuoka, Dairen.
McLeod & Company, Calcutta.
Anderson, Meyer & Company, Ltd., Shanghai.
Brossard-Mopin & Company, Saigon, Singapore, Haiphong.



ALGOMA STEEL PRODUCTS

OPEN HEARTH

ALLOY STEELS

CHROME-VANADIUM

CHROME-NICKEL

NICKEL

All of these Steels are supplied in

HOT ROLLED BARS.

We also furnish in BLOOM, BILLET AND SLAB FORM

Sulphuric Acid
Nitre Cake

BLOOMS
BILLETS
SLABS

STRUCTURAL STEEL

MERCHANT BARS

CONCRETE REINFORCING BARS

IRON, BRASS AND BRONZE CASTINGS

STEEL RAILS
Open Hearth Quality (All Sections from 12 lbs. to 100 lbs. per yard).

SPLICE BARS

STEEL TIE PLATES

PIG IRON
BASIC
FOUNDRY
MALLEABLE

SULPHATE OF AMMONIA

For the better convenience of customers who may find it necessary to secure rush shipments of particular items, we are keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared. Your enquiries and business will be appreciated.

May we have your next order?

Algoma Steel Corporation, Limited

SAULT STE. MARIE, ONTARIO

Sales Offices: **Montreal—606 McGill Building. Toronto—Bank of Hamilton Building**

NAMCO



Making a Specialty of Specials

It makes no difference whether you need—

One thousand small brass electrical parts or—

50 thousand heavy machinery bolts up to 2-1/4″ diameter.

Our well-equipped Canadian Product Plant backed by 20 years of specialization in screw machine work are at your service.

Send the Sample.

THE NATIONAL ACME COMPANY

MONTREAL, P. Q.

DE COURCELLES G. T. R.R.

SEND FOR A SET OF LITTLE DAVID BULLETINS

LITTLE DAVID



AIR TOOLS

The Evidence of Little David Superiority

A convincing proof of the value of any article is the demand for it after investigation and trial. The repeat orders that filled this Toolroom with Little Davids tell a striking story of Little David worth.

Canadian Ingersoll-Rand Company, Limited
Sydney, Sherbrooke, Montreal, Toronto, Cobalt, Winnipeg, Nelson, Vancouver

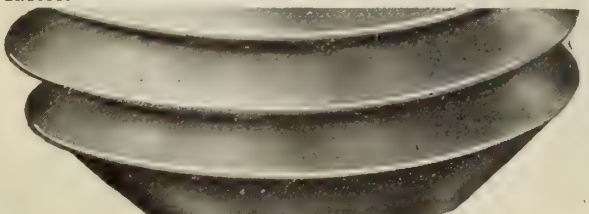
THEY ARE YOURS FOR THE ASKING

TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE
PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.

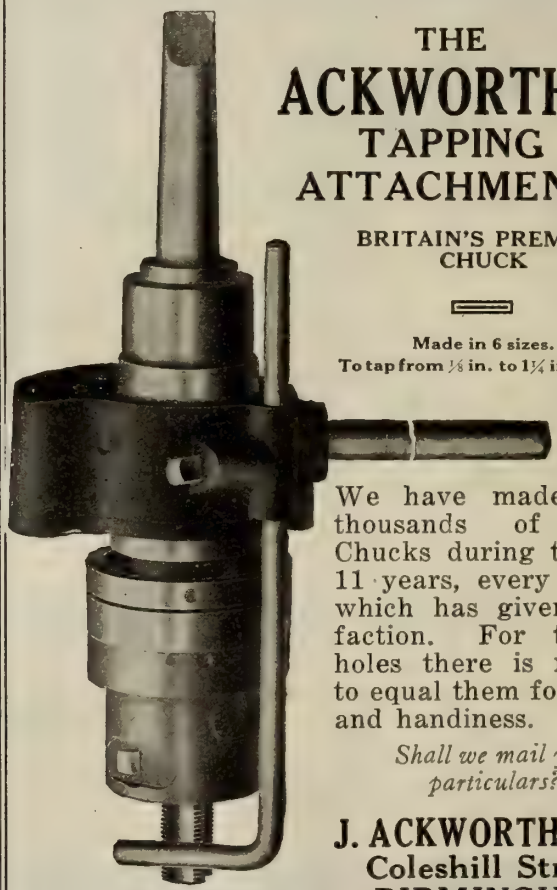


Get copy of new Bulletin I-810.

THE BRISTOL COMPANY
Waterbury, Conn., U. S. A.

THE
ACKWORTHIE
TAPPING
ATTACHMENT.

BRITAIN'S PREMIER CHUCK



Made in 6 sizes.
To tap from 1/8 in. to 1¼ in. Whit.

We have made some thousands of these Chucks during the last 11 years, every one of which has given satisfaction. For tapping holes there is nothing to equal them for speed and handiness.

Shall we mail you particulars?

J. ACKWORTHIE, Ltd.
Coleshill Street,
BIRMINGHAM

BANFIELD

Have You Need for a Factory to Make Special Machinery for You ?

We make an exceptionally high-grade phonograph motor requiring skillful workman, working to close limits. They are considered standard in the Phonograph Trade. We can manufacture complete or parts for anything you may need.

W. H. BANFIELD & SONS, LIMITED

370-386 Pape Ave. - - TORONTO

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to



The U.S. MILLER

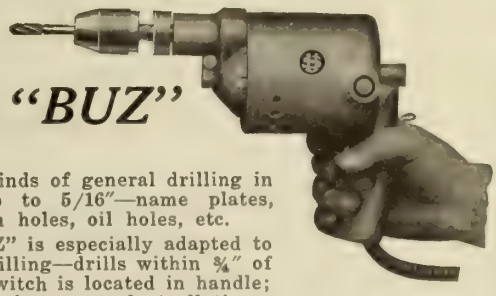
The Miller for Small Work

A small machine takes up less space, requires less power, is easier to operate and is more accurate.

The Paramount Miller of its size. Drop us a line for full details.

United States Machine Tool Company
Cincinnati, Ohio, U.S.A.

United States Electric Drills and Grinders



The "BUZ"

For all kinds of general drilling in metal up to 5/16"—name plates, cotter pin holes, oil holes, etc.

The "BUZ" is especially adapted to corner drilling—drills within ¾" of corner. Switch is located in handle; under absolute control at all times. Attaches to any lamp socket, alternating or direct current, 110 or 220 volts. Guaranteed the most powerful electric drill of its weight on the market.

Order a few to-day for trial. Their time and labor saving ability will convince you you need more!

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

THE JOHNSON FRICTION CLUTCH

The Case Against the Countershaft

The old familiar countershaft drive, through cross belts and tight and loose pulleys, stands accused of the following offences against efficiency:

1. Involves needless equipment.
2. Costs too much to set up.
3. Prevents economical and systematic use of space.
4. Operates sluggishly.
5. Multiplies belt troubles and the resultant cost of upkeep.

Modern practice has discarded the antiquated countershaft for the simplicity and efficiency of the clutch drive direct from lineshaft.

Adopt the Johnson Lineshaft Drive

The economical, efficient and durable method of power transmission through friction control.

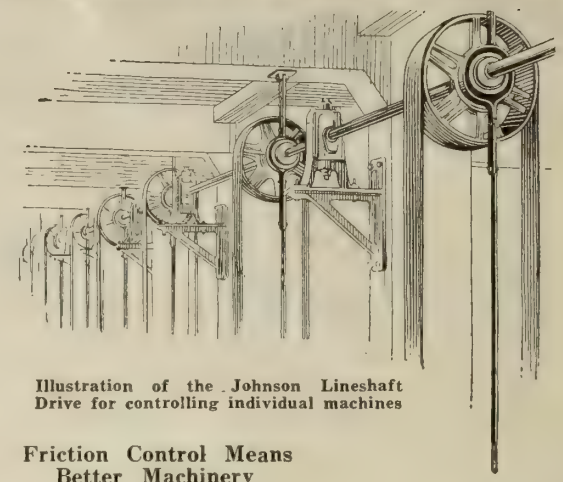
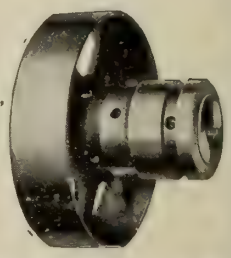


Illustration of the Johnson Lineshaft Drive for controlling individual machines

Friction Control Means Better Machinery

Whether it is applied overhead or in the machine itself.

Write for our Booklet "Clutches as Applied to Machine Building" and our Yellow Catalog.



CANADIAN AGENTS:
WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

Open a Bank Account in Canada

The present abnormal exchange situation between Canada and the United States is affecting trade relations between the two countries. Exporters in the United States can meet this by opening Bank Accounts in Canada.

This Bank has 730 Branches, of which 626 are located in Canada from the Atlantic to the Pacific Coast. Write for a complete list of Branches and for terms respecting a Canadian account.

THE ROYAL BANK OF CANADA

Capital and Reserves $40,000,000 Total Resources $544,000,000

Head Office: **MONTREAL**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

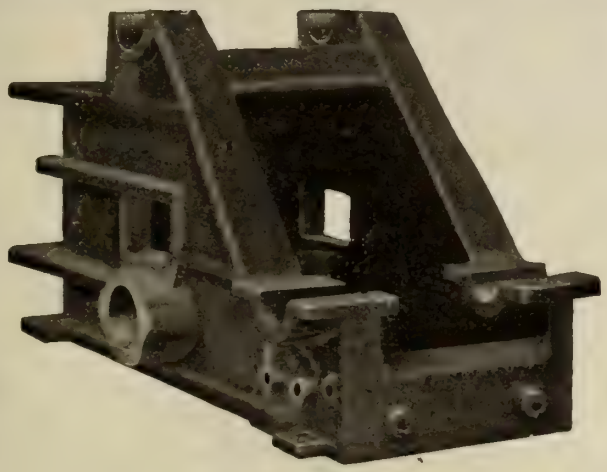
MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal



Cast Steel
Stone Crusher Frame

Machinery Parts

of every description

in

Cast Steel

Chrome-Nickel

and other forged gear blanks

Forged Shafts

Dominion Foundries & Steel Limited

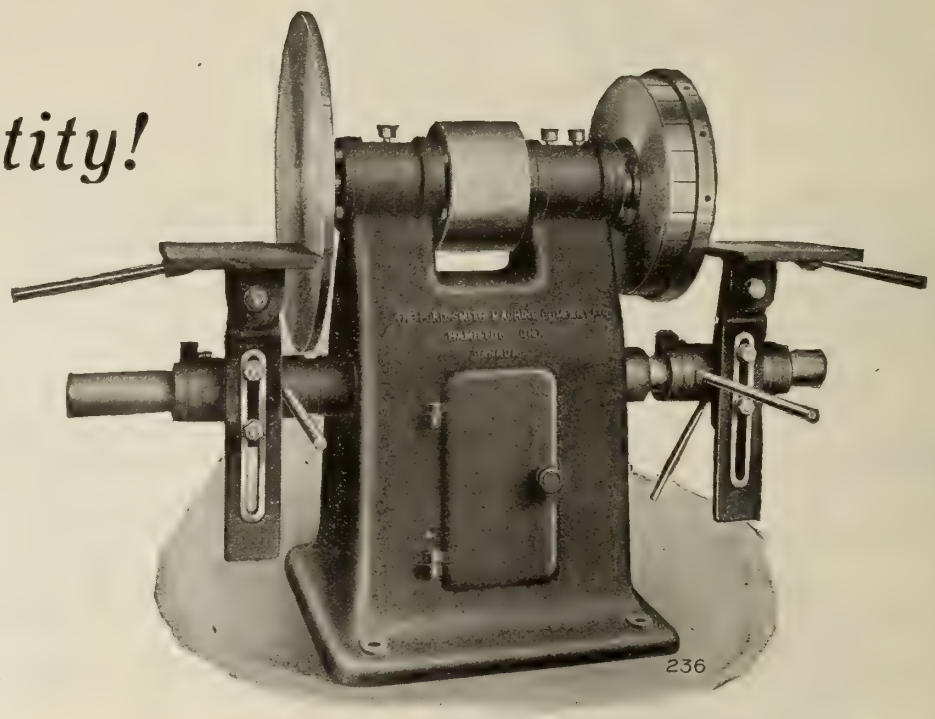
Hamilton, Canada

If interested tear out this page and place with letters to be answered

FORD-SMITH

Grinders

Quality and Quantity!



THERE are difference in grinders. Differences that make it worth your while to consider carefully which grinder you will buy.

Ford-Smith Grinders have established a reputation for quality as well as quantity. They have proven their ability to do quicker, better, more satisfactory work and at the same time keep costs down to the minimum.

There's a size of Ford-Smith Ginder to meet every grinding need. The line consists of Motor Drive Grinders, Floor Grinders, Disc Grinders, Water Tool Grinders and many others.

Suitable grinding equipment may be the means of saving you a considerable sum during a year. One of our engineers will be glad to put it down in black and white.

Let us furnish full information.

THE FORD-SMITH MACHINE CO., LTD.

HAMILTON, ONTARIO, CAN.

FOREIGN AGENTS:

W. E. Storey, London, England.
McLeod & Co., Calcutta, India.
Collin & Co., Melbourne, Australia.
British & Canadian Hydraulic Tube Co., Johannesburg, S.A.

BROWN-BOGGS

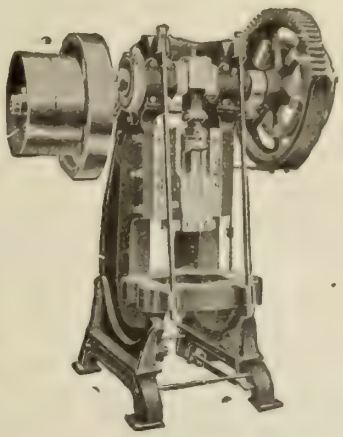
B B

Do You Find Ordering Hard?

We mean ordering a new machine—intended as a labor-saver and production-spreader.

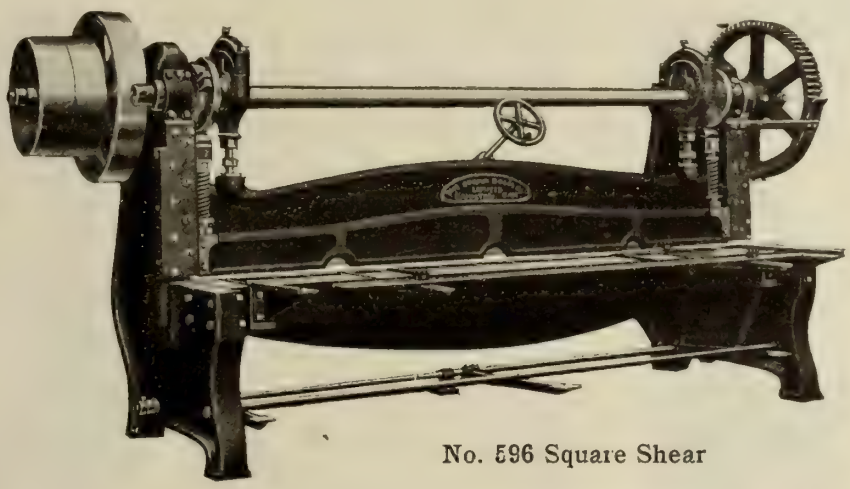
There was a time when it **was** necessary to send for sheafs of catalogues, spend hours of valuable time investigating and end up with a choice which was perhaps 90 per cent. guesswork.

Today things are different. It's a simple matter to order "B-B" tools. The "B-B" trade mark represents Sheet and Metal Workers' tools of proven worth plus an advisory and consulting service which is always at your command.



No. 215—Power Press

We are always ready to talk over your problems with you. If you wish advice consult us freely.



No. 596 Square Shear

A Complete Line of

Tinsmiths' tools and sheet metal working machines of all kinds; canners' and evaporators' machinery, shears of every description, power presses for punching, forming, embossing, blanking.

THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.

Bilton

GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

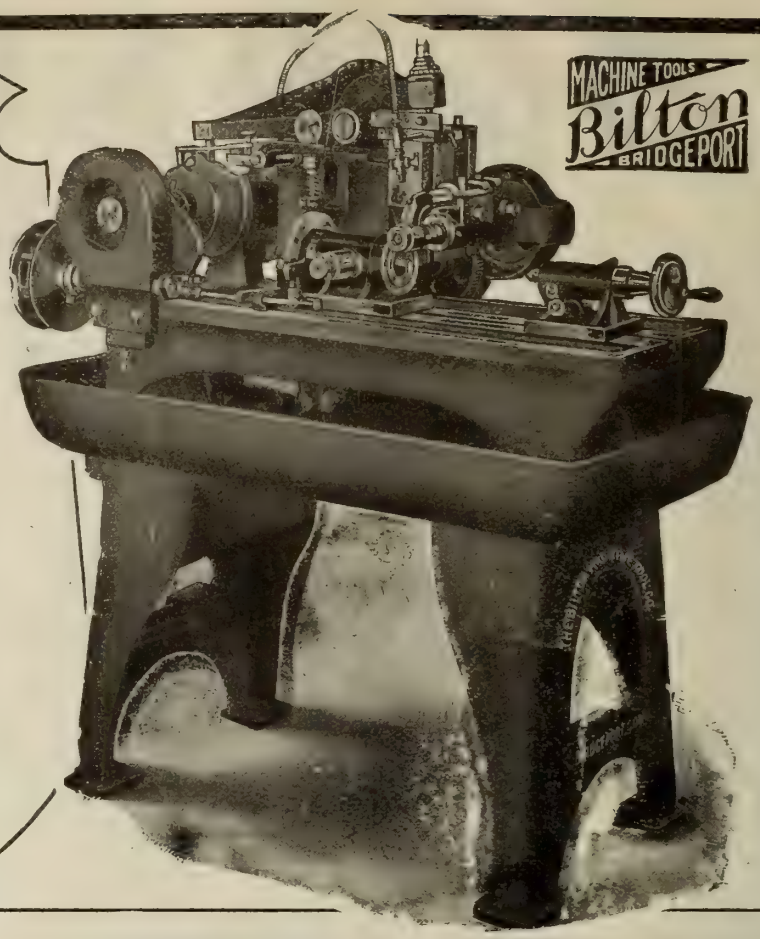
Big business everywhere is adopting the Bilton for high production on accurate work.

May we send you our catalogue?

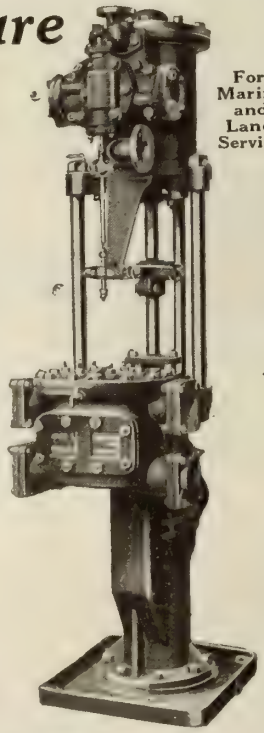
Bilton Machine Tool Company

Bridgeport, Conn., U.S.A.

Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co., Ltd.
M. Mett Engineering Co.



High Pressure Pumps!



For Marine and Land Service

Note the construction of this Hepburn "Special" Vertical Ram Feed Pump. We claim it is the most efficient pump on the market and we stand ready to prove it. It is of the outside-packed type, operating with Outside Lever Valve Motion. The Pump Ram works in a brass Sleeve and has only one gland to be packed. Full strokes maintained at variable speeds.

Get full particulars; also on Vertical Engines, Compressors, Winches, Cut Gears.

JOHN T. HEPBURN, Limited
Engineers and Iron Founders
18-60 Van Horne St., Toronto

HEPBURN

"Special" Vertical Ram Feed Pumps

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

A. R. Williams Machinery Co., Ltd.

64-66 Front Street W., Toronto

Halifax St. John, N.B. Montreal Winnipeg Vancouver



Which is yours?

THIS ← WASTE

and fire hazard go hand in hand where the oil is slopped around "any old way."

Handling your oil in any old way, just because it is oil, or putting it in a safe like the real money it is? On the left is shown a picture of what daily happens where oil is stored in faucet or "jigger" pump tin cans.

BOWSER ESTABLISHED 1885

THIS → SAVING



Oil Storage and Distributing Systems

meet with the most particular insurance exactions—they have back of them over thirty years' pioneer work and study built into them—they are an investment and not an expense.

Send for illustrated descriptive literature—Give us some of the facts—the way and kind of oils you store and handle—whether volatile or non-volatile—lubricating or paint oils—and we will gladly co-operate with you.

Absolutely No Obligation Incurred in Writing

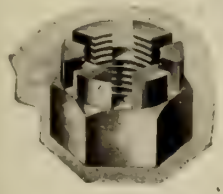
S. F. BOWSER COMPANY, LTD.,
TORONTO, CANADA



ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

GALT, ONTARIO

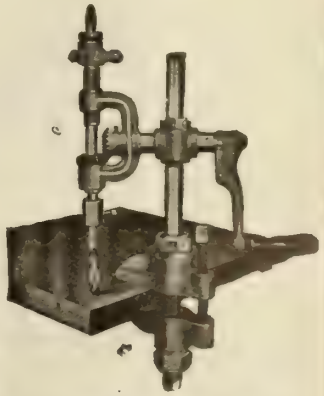
Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.

Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.





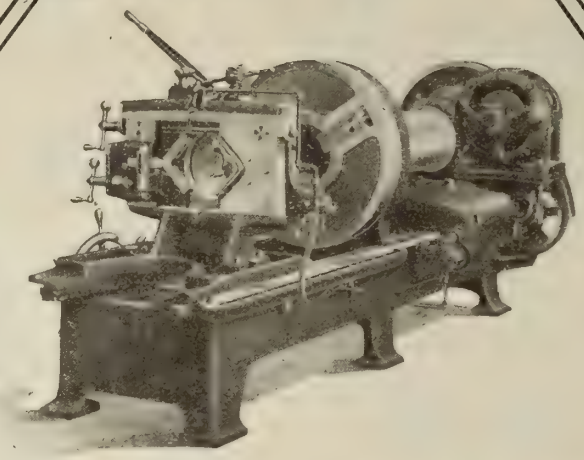
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

WILLIAMS



PIPE MACHINES

Outstanding Features:

1—Single Pulley Drive, through.
2—Dodge Friction Clutch, on machine.
3—Clutch Lever at operator's left hand.
4—Rigid Bearing Bracket on drive shaft.
5—Gear Box Drive away from operator.
6—Individual Adjustment for each bearing.
7—Large Spindle Bearings are ring oiling.
8—Compact Control Levers on operator's side.
9—Large Die Cabinet and Tool Tray.
10—Substantial Oil Trough around top of ways.
11—Specially constructed Reservoir and Filterer.
12—Low-down Sliding Head.
13—Rotary Geared Pump reversible for left-hand thread.
14—Specially designed Carriage to drain off oil and cuttings.
15—All Gears amply protected.

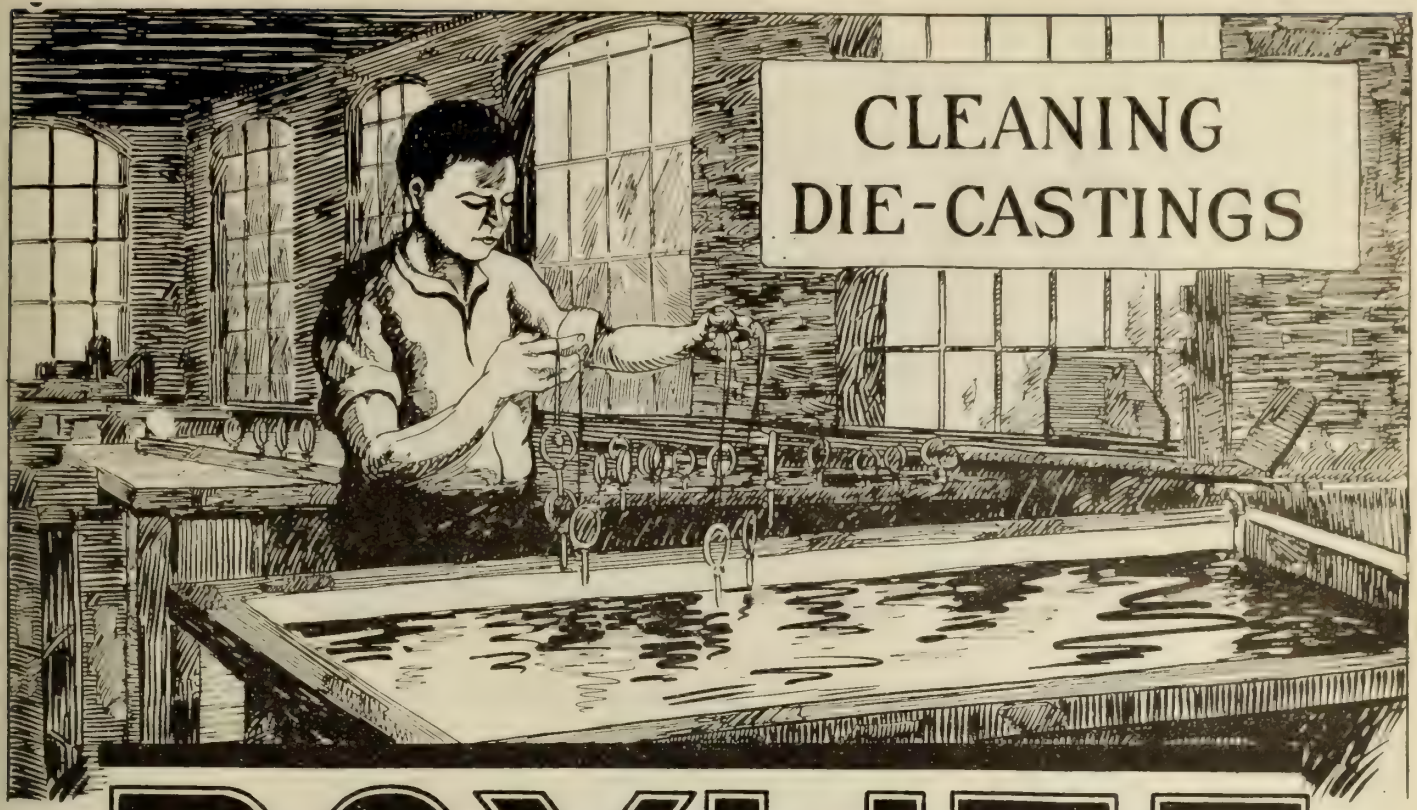
Send for Catalog of Various Styles

WILLIAMS TOOL CORPORATION

of Canada, Limited — Brantford, Ontario

Successors to

JOHN H. HALL SONS, LIMITED



ROYLITE
CLEANER

Roylite Giving Good Results in a Hamilton Plant

In above illustration (drawn from actual photograph) is seen the cleaning of Die Castings with *Roylite Cleaner* This operation is performed before the castings are plated. and was difficult because the heavy oil and grease on work could not be cleaned effectively without discoloring the soft metal. *Roylite* proved very successful and removed every particle of grease and dirt without injuring the metal. It is doing it quicker and more economically than any other solution has ever done it before. The head plater here says *Roylite* is the best solution he has ever had.

In this case the castings are immersed for three seconds in *Roylite Cleaner*. Only four ounces of *Roylite* are required to the gallon and very little extra cleaner is required to keep the solution up to required strength.

Roylite works equally satisfactorily on Brass, Steel, Copper or any other metal.

Roylite Cleaner lasts longer, works quicker and costs less—prove it to your own satisfaction with a trial order. Sample sent on approval. Our experts give free demonstration.

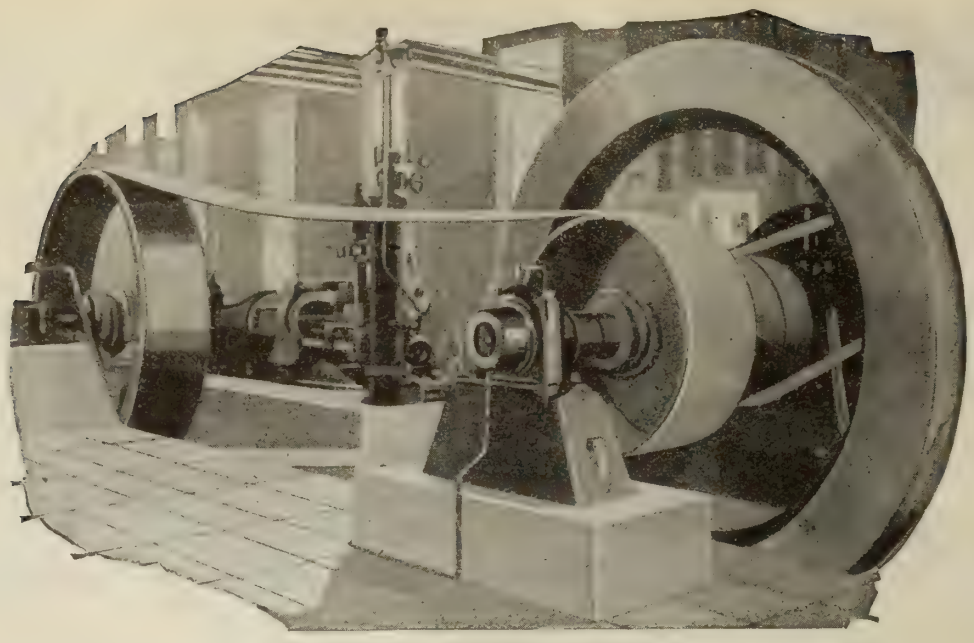
Write for Booklet. ***Put up in 500 lb. Barrels.***

Manufactured by

CANADIAN HANSON & VAN WINKLE CO., LTD.

TORONTO, ONTARIO

"MADE IN CANADA"



The Nearest Approach to Absolute Reliability in Belting Performance

Dominion Friction Surface Belting is the result of the combined experience of all our industrial rubber factories. It is the finished product of the finest materials put together with all the skill of the belt-maker's art. The in-built strength and pulley-gripping power of

Dominion Friction Surface Belting

make it the most dependable and economical for all drives. Every *Dominion Friction Surface Belt* installed means so much power conserved and so much more freedom from troubles due to stretch and slip. It will cost you nothing to have one of our belt experts study your belting problems and submit recommendations for your approval.

PHONE OR WIRE OUR NEAREST SERVICE BRANCH

DOMINION RUBBER SYSTEM

SERVICE BRANCHES

Halifax	Ottawa	Kitchener	Brandon	Calgary
St. John	Toronto	North Bay	Regina	Lethbridge
Quebec	Hamilton	Fort William	Saskatoon	Vancouver
Montreal	London	Winnipeg	Edmonton	Victoria

DOMINION RUBBER SYSTEM PRODUCTS

Belting

Transmission: "Dominion," "Keewatin," "Para."

Conveyor: "Rockproof," "Canadian," "Hiheat"

Elevator: "Dominion," "Rockproof."

Agricultural: "Dominion," "Star."

Grain Elevator: "Metcalf Standard," "Grain King."

Hose

Air: "Kushion Kover," "4810 Airtite," "Star."

Steam: "Indestructible," "Rockproof," "Para."

Water: "Indestructible," "Para," "Kushion Kover," "Star."

Suction: "Para," "Star," "Trade."

Garden: "Canadian," "Dominion,"

Packing

Sheet: "Join-Tite," "Star," "Importers."

Rod: "Cabestos," "Valve-Bestos," "Canadian."

Valves: "Montreal," "Commercial" "Canadian."

Miscellaneous

Mats, Matting and Flooring.

Moulded Goods.

Plumbers' Specialties.

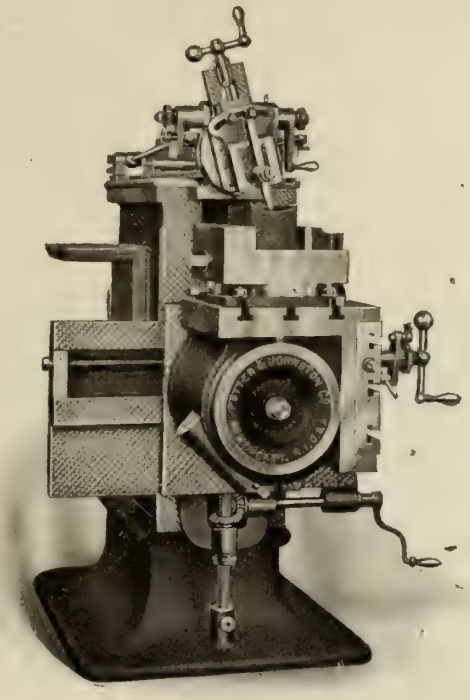
Hard Rubber Goods, Tubing.

Rubber Covered Rolls, Deckle Straps.

Friction Tape, Splicing Compound.

DOMINION RUBBER SYSTEM — CANADIAN CONSOLIDATED RUBBER CO. LIMITED AND ASSOCIATED COMPANIES

UNIVERSAL SHAPING MACHINES



15″ Type

Swivel table with auxiliary tilting side.

Power down feed on any angle.

Automatic feed stop.

Graduated collars on tool head feed screw and table feed screw.

Swivel vise with graduated base.

24″ Type

Swivel table with auxiliary tilting side.

Power down feed on any angle.

Automatic feed stop.

Graduated collars on tool head feed screw and table feed screw.

Swivel vise with graduated base.

Swivel table raised and lowered by power.

No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to:—

Die Work
Tool Making and
General Manufacturing

Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

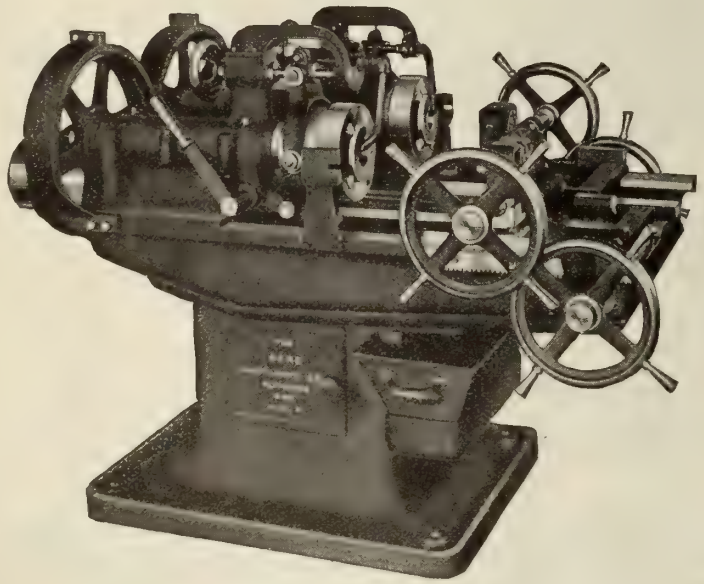
Head Office and Show Rooms:
11 Wellington Street East, TORONTO, CANADA

Are You Cutting Your Own BOLTS?

IF you are are not already cutting your own bolts there's just one injunction we'll make. Simply this. Some day you're going to wake up to the high cost of buying them. When that time comes a glimpse in other progressive shops will disclose Acme Bolt Cutters speeding production.

Acme Bolt Cutters are designed to produce clean, accurate highly finished threads at high speeds. They are built in various sizes for cutting bolts from ¼ to 1 in. diameter. Heads allow micrometer adjustments while in motion and dies can be changed in less than a minute.

Write for our 220 page catalog.



The Acme Line includes Bolt, Rivets, Heading Upsetting and Forging Machines, Bolt Cutters, Hat Pressed Nut machines, Hammer Headers, Bolt Pointers, Nut Tappers.

The Acme Machinery Company

4530 St. Clair Avenue

CLEVELAND

Canadian Agents

The John Bertram & Sons Co., Limited, Dundas

Acme Bolt Cutters



Canadian Hart Wheels

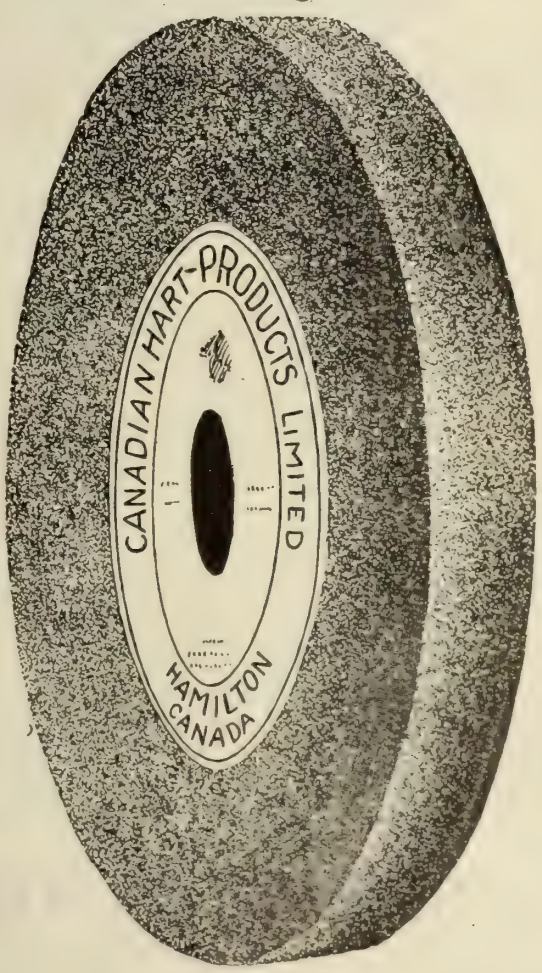
Vitrified — Silicate — Shellac

TELL us what you want to grind and we will tell you the wheel to use for the best results.

Canadian Hart Vitrified Wheels—recommended for the majority of grinding jobs. May be used wet or dry; give better all-round satisfaction and have a longer life.

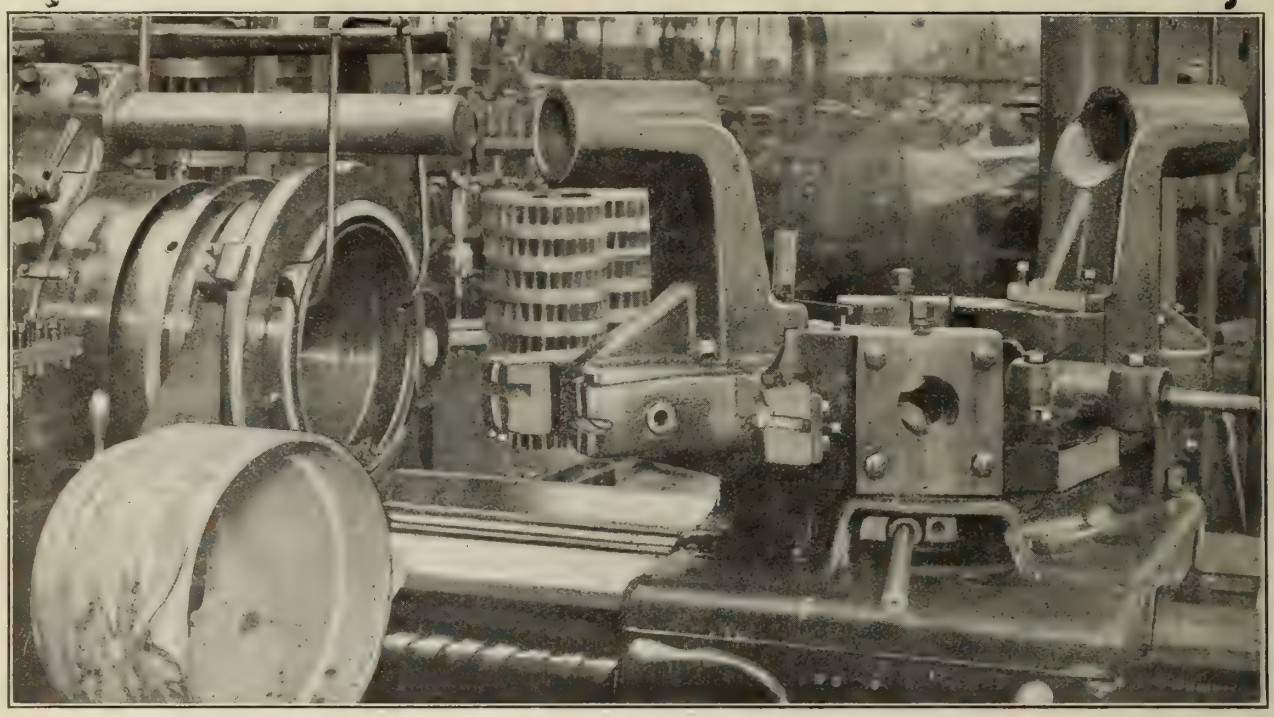
Canadian Hart Silicate Wheels—can be made in twenty-four hours and are often substituted when it is inconvenient to wait the required length of time for Vitrified Wheels.

Canadian Hart Shellac or Elastic Wheels—indispensable for slotting work where a thin wheel is required, or for work requiring a special finish. Can be operated wet or dry.



Canadian Hart Products
LIMITED
Hamilton - Ontario

Made In Canada



Machining Delco Generator Frames

The photograph above shows a tool set-up on a Steinle 24-in. Turret Lathe for turning out Delco Generator Frames at the plant of the Delco Light Company of Dayton, Ohio.

The chucking fixture revolves in a steady rest and is equipped with centering and stop pins for centering and locating rear end of frame by pulling sleeve collar forward. Set screws hold the front end in place. The turret fixture is reinforced in the machining operation by the overhead bar support; thus preventing undue chatter or jar under the heavy cuts taken.

This is only one of a number of installations in plants manufacturing electrical equipment where the Steinle is called upon to produce various parts from castings, forgings or bar stock.

In view of present manufacturing conditions it is invariably performance that counts and the Steinle qualities of accuracy, speed, ease of operation, power, reliability and economy of upkeep are guarantees of satisfactory performance on your own work.

Material—Cast Steel

Finish—Bore, Counterbore, Face Bottom, Face Lugs

Time—25 Minutes Each

Why not send us your blueprints if your requirements call for the installation of equipment of this character? We shall be glad to furnish you with production and tooling estimates, or to have a qualified representative call and take up the question of Steinle methods as applied to your production problems.

STEINLE TURRET MACHINE CO.

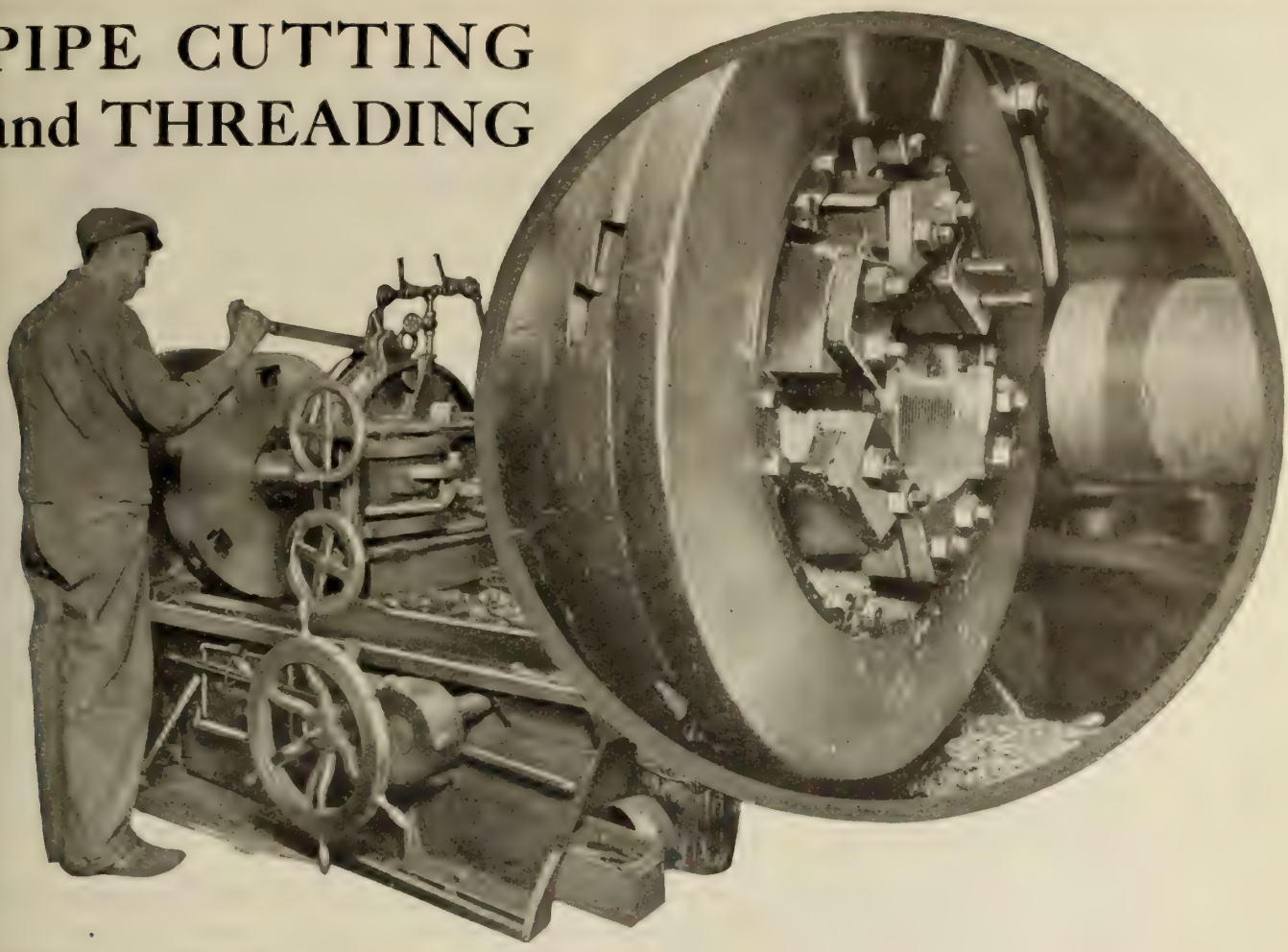
Originators of the full swing side carriage turret lathe

MADISON, WIS., U.S.A.

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California.
FOREIGN—Leo. C. Steinle, 53 Victoria Street, London, England.

If interested tear out this page and place with letters to be answered.

PIPE CUTTING and THREADING



The Landis is Liked Instead of Tolerated

There are some tools and machines you will put up with in spite of the fact that you are disappointed in their results. You know how it is---good machine as any others in your plant but not just what you were looking for. You tolerate it because you can use it. But you wouldn't buy a second machine.

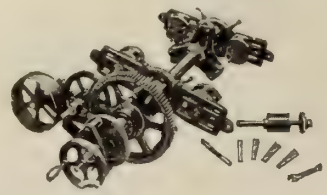
When you like a machine you are sold to that machine. It's the machine you are going to consider when you find it necessary to increase capacity.

Landis Pipe Cutting and Threading Machines are the kind of tools you can't help liking---the machines you buy again. The Ford & Kendig Co., Philadelphia, installed these Landis, herein illustrated, three years ago. To-day they are using three of the same type for cutting and threading 6-in. wrought steel pipe.

Ask for Information

LANDIS MACHINE COMPANY

Waynesboro, Pa.



Locomotive Boring Bars

for Boring Cylinders and Valve Chambers

This bar, which is regularly made in any size, with cutter heads to bore diameters of various sizes, is similar to our other standard portable bars.

Fixtures are furnished to rebore, the cylinders when both heads are removed or with the guide head remaining in place. The equipment is complete with tools, wrenches and pulley, ready for installation when unpacked from the boxes.

Full information will be forwarded upon request.

H. B. Underwood Corporation
1015-1025 Hamilton St., Philadelphia, Pa.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

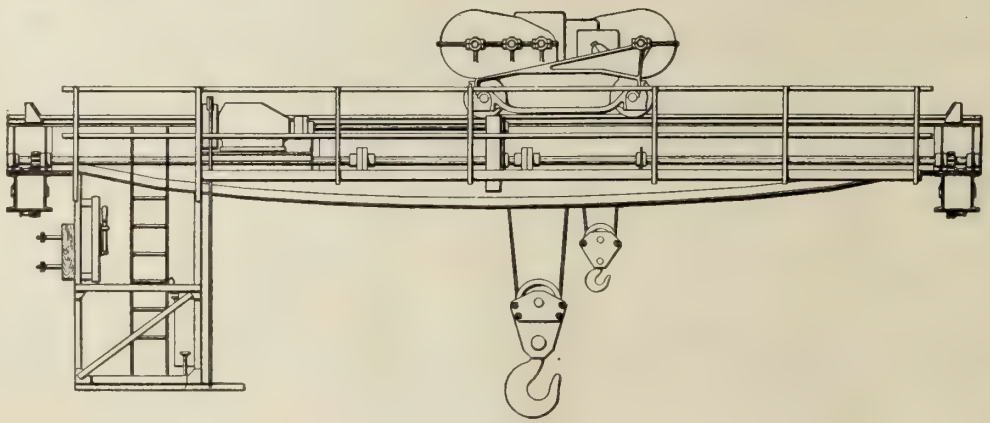
Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.
Hartford, Conn.

CRANES

ELECTRIC AND HAND OPERATED



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HEAD OFFICE & WORKS: MONTREAL BRANCHES:-OTTAWA, TORONTO, WINNIPEG

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HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.; Music Wire for Springs, Steel Balls, Cold Rolled Tool Steel in Strips and Sheets, Circular Saws, Machine Knives.

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Sole Agents for
JONAS & COLVER, LIMITED
Novo and Continental Steel Works
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New York, N.Y.

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WE DID IT FOR YOU YEARS AGO



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

Write For Prices

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

GREY IRON AND SEMI-STEEL CASTINGS

ANY WEIGHT UP TO 75 TONS

SPECIAL EQUIPMENT FOR HEAVY MACHINING
INCLUDING
BORING AND TURNING MILL TO SWING 35 FT. DIAM.

HEAVY HYDRAULIC WORK A SPECIALTY

YOUR ENQUIRIES WILL HAVE OUR CAREFUL ATTENTION

DOMINION ENGINEERING WORKS
LIMITED

MONTREAL, QUE.

The Sign of Efficiency

MORSE DRIVES

The Sign of Durability

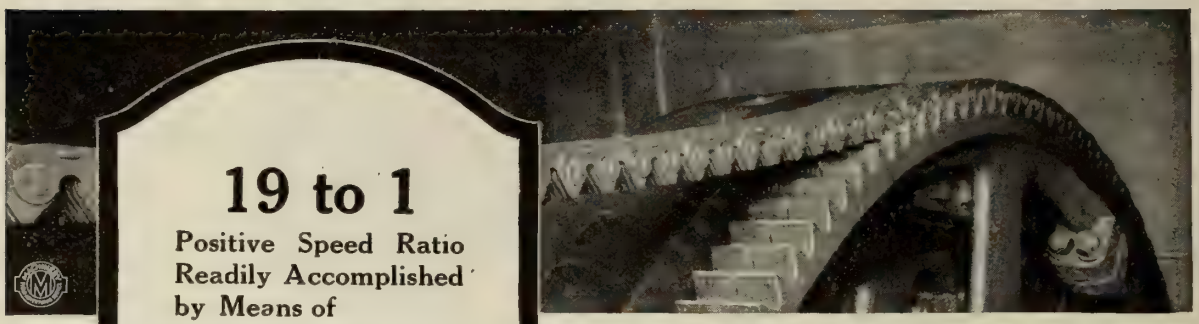
SILENT CHAIN — THE MORSE ROCKER JOINT

Positive as Gears

Flexible as a Belt

Longer Life

The Rocker Joint Silent Chain with Center Guide Links



19 to 1

Positive Speed Ratio Readily Accomplished by Means of

MORSE SILENT CHAIN

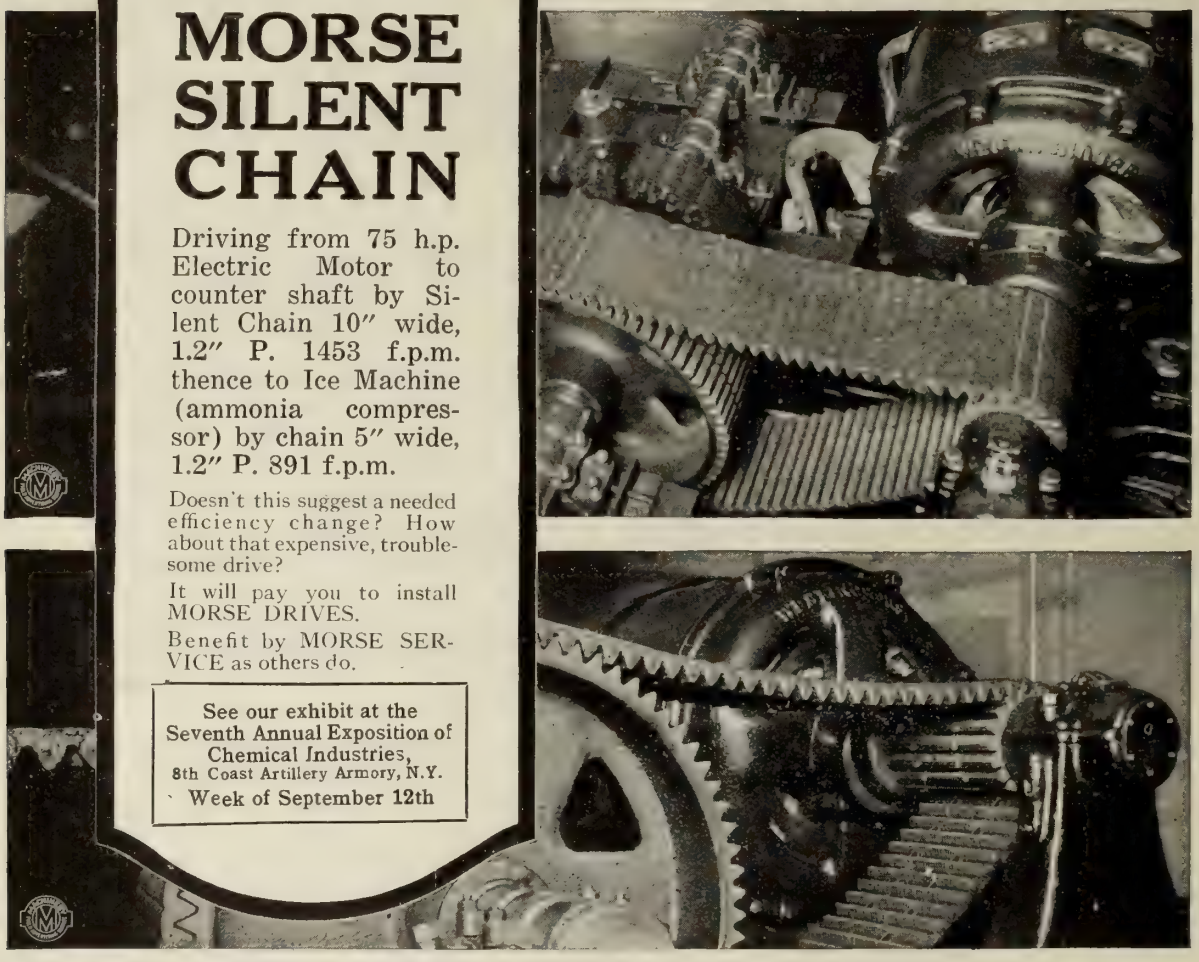
Driving from 75 h.p. Electric Motor to counter shaft by Silent Chain 10″ wide, 1.2″ P. 1453 f.p.m. thence to Ice Machine (ammonia compressor) by chain 5″ wide, 1.2″ P. 891 f.p.m.

Doesn't this suggest a needed efficiency change? How about that expensive, troublesome drive?

It will pay you to install MORSE DRIVES.

Benefit by MORSE SERVICE as others do.

See our exhibit at the Seventh Annual Exposition of Chemical Industries, 8th Coast Artillery Armory, N.Y. Week of September 12th



Prominent Packing House, Brooklyn, N. Y.

Morse Silent Chains Run Cool—Oil Baths Not Required

MORSE CHAIN CO., *Morse Engineering Service*

LARGEST MANUFACTURERS OF SILENT CHAINS IN THE WORLD

Write for Booklet

ITHACA, N. Y. *Assistance Without Obligation*

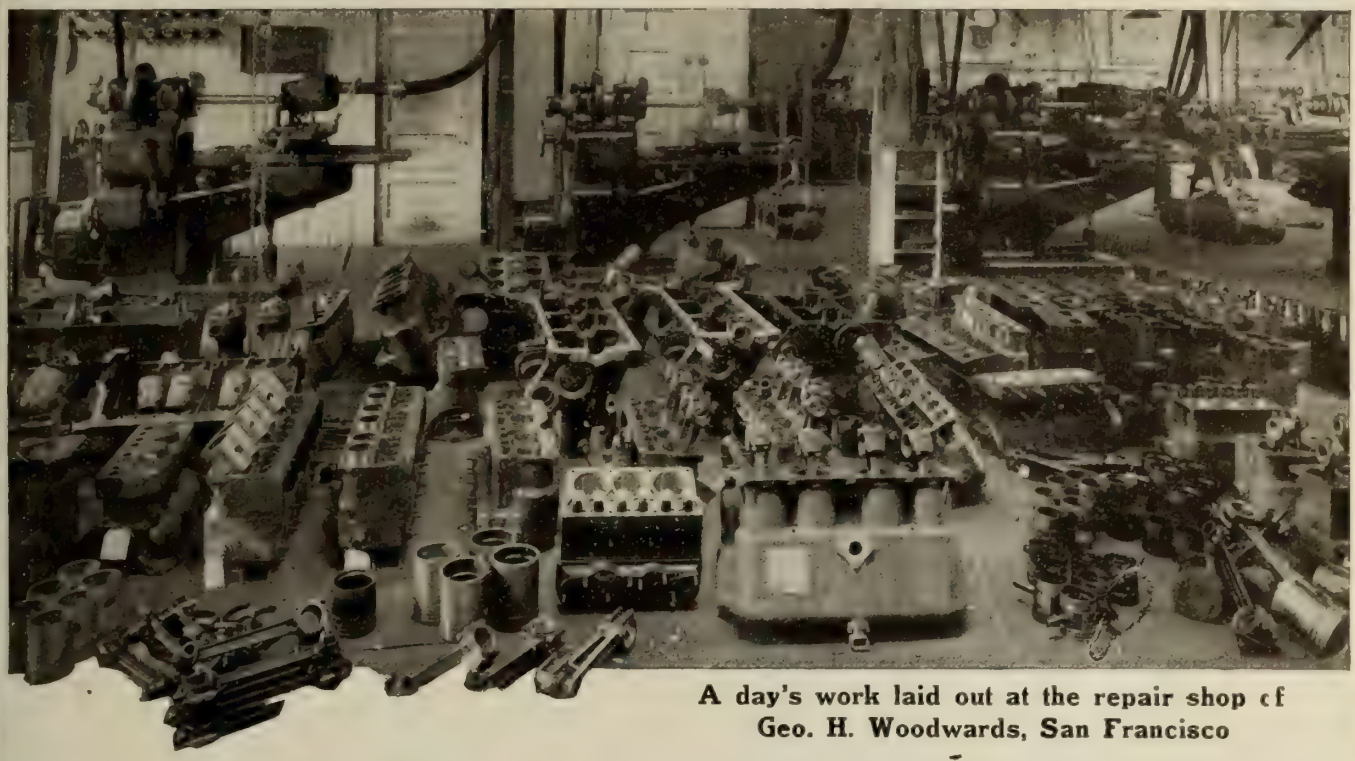
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ST. LOUIS, MO., Chemical Bldg. ..... Morse Engineering Co.

"Morse" is the Guarantee Always Behind the Efficiency, Durability and Service

Small Machine Shops, Auto Repair Shops Welding Companies

Do you want a business like this?



A day's work laid out at the repair shop of Geo. H. Woodwards, San Francisco

Opportune Time

There is no business to-day that has the possibilities and which fits so nicely into a small machine shop, automobile repair shop, or a concern doing welding, as the regrinding of worn or scored cylinders.

Many companies would have had to close their doors this Spring but for the business obtained through regrinding. It does not require skilled mechanics for operators, and the profit received on the capital invested is unusually large.

The Field for Regrinding.

There were over 9,000,000 commercial and pleasure cars registered during last year. Truck and tractor cylinders require attention once a year. Passenger cars should be looked over at least once every two or three years. Figure out for yourself what your chances are with only approximately 350 concerns properly equipped for such work.

Consider also the fact that three 4-cylinder blocks a day will bring profitable returns.

Advantages to the Automobile Owner.

Reground cylinders fitted with new pistons and rings will give the motor as much, if not more, power and pep than when it was new. It cuts the oil and gas consumption in two and stops all excessive smoking.

Necessary Equipment.

Eighty-four per cent. of all pleasure cars, and ninety-one per cent. of all commercial motors manufactured are ground, and Heald Machines are used exclusively. The Style No. 55 is built expressly for regrinding work. It is simple, moderately priced, self-contained, and has a very large capacity and range, easily taking care of singles, doubles, four and six en bloc cylinders.

In addition, to handle the work satisfactorily, one should have a small lathe and drill press, bench and hand tools. A small external grinder would be convenient for finishing pistons, thus enabling the shop to purchase semi-finished pistons and grind them to the oversize required.

Now is the logical time to get started. If you want figures, in addition to the above facts, write, wire or 'phone

The Heald Machine Company

51 New Bond Street **Worcester, Mass.**

Branches at New York, Philadelphia, Buffalo, Cleveland, Detroit, Chicago, Cincinnati

If interested tear out this page and place with letters to be answered.

GTD HELIX

July 1921

Published Monthly by the

GREENFIELD TAP AND DIE CORPORATION

Sales Promotion Division

The following article comprises important information for all users of screw threads. Similar articles appear monthly in the GTD Helix. Isn't this service worth 25 cents for a year's subscription? Send your quarter now (stamps, if you like).

The Folly of the Full Depth Thread

Do you know that a common nut drilled out so that it contains only 50% of a full depth thread will break the bolt before it will strip, or that a full depth thread is only 5% stronger than a 75% depth thread, yet requires three times the power to tap?

We honestly believe that a majority of tapping troubles, tap breakage and spoilage of work can be laid at the door of ignorance of the proper tap drill size. We have encountered tapping operatives actually forcing taps to *ream* as well as thread the hole. That is, using a tap drill smaller than the root diameter of the tap itself and then wondering why the taps broke or would not stand up for more than a few holes, or why the work didn't run "to size."

Perhaps the operator becomes annoyed because his belt slips and causes the tap to chatter and spoil the work, or the spindle bearings require too frequent adjustment; or possibly he figures the company is too stingy to buy him a good cutting lubricant.

The use of too small a tap drill does cause all of these troubles and many more that are not always immediately traceable to it, and the average workman does not stop to analyze these effects to discover where the fault really lies. If he has trouble he waits for the "fixer" and chafes because his earning ability is impaired.

Considered from the manufacturers' standpoint the choice of the proper tap drill for each threaded hole is of far greater importance than might at first seem to be the case. It frequently makes the difference between "immediate delivery" of a product and delivery in the distant future. Increasing the depth of thread over the minimum required for strength, hinders production to a very great extent, raises the tapping cost out of all proportion to its value, and adds but a trifling amount to the strength of the part. Only in a very few instances is it necessary or desirable to have a full 100% depth of thread, and then only under advisement after the situation has been diagnosed by a Threading Specialist of recognized standing. If manufacturers in general will give more consideration to the specification of the proper drill size for tapping operations indicated on their drawings, they will anticipate and prevent any number of manufacturing difficulties they would otherwise encounter.

Some of the more progressive manufacturers have taken advantage of the opportunity to obtain expert advice by sending for a GTD Threading Specialist. These GTD Specialists are men of broad experience, and are competent to analyze and recommend threading equipment and shop practice for a single operation or to lay out and design tools and gages for a complete product.

In order that engineers, draftsmen and machinists may have always before them the approved tap drill sizes for each size of thread ordinarily used in Canada and the United States, SAE, or A. S. M. E. (Machine Screw) standards, the Greenfield Tap and Die Corporation has prepared for distribution, small pocket charts containing this information. These will be sent free to any address upon request.

To superintendents, works-managers, foremen or other factory executives who are interested we will be glad to mail larger charts containing similar data and suitable for hanging in each department for ready reference by workmen using drills and taps.

Whether you happen to be the "Super" or a machinist, an engineer or a draftsman, the little coupon in the corner filled in with your name and address and mailed to GTD Corporation of Canada, Ltd., Galt, Ontario, will bring you by return mail a GTD Tap Drill Chart. No obligation involved. Send for yours to-day.

GTD CORPORATION OF CANADA, LTD.
Galt, Ontario.

Please send me free your Tap Drill Charts as noted below:

..... Pocket Charts for Personal Use.

..... Large Charts for Departmental Use.

I enclose 25 cents for full year's subscription to GTD Helix ☐, or please send me sample copies ☐. (Check your choice.)

Name .....

Position .....

Firm .....

Address C.M.207

ALLIGATOR

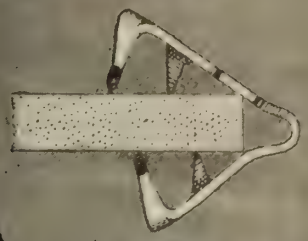
TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING

Best for Every Type of Belting

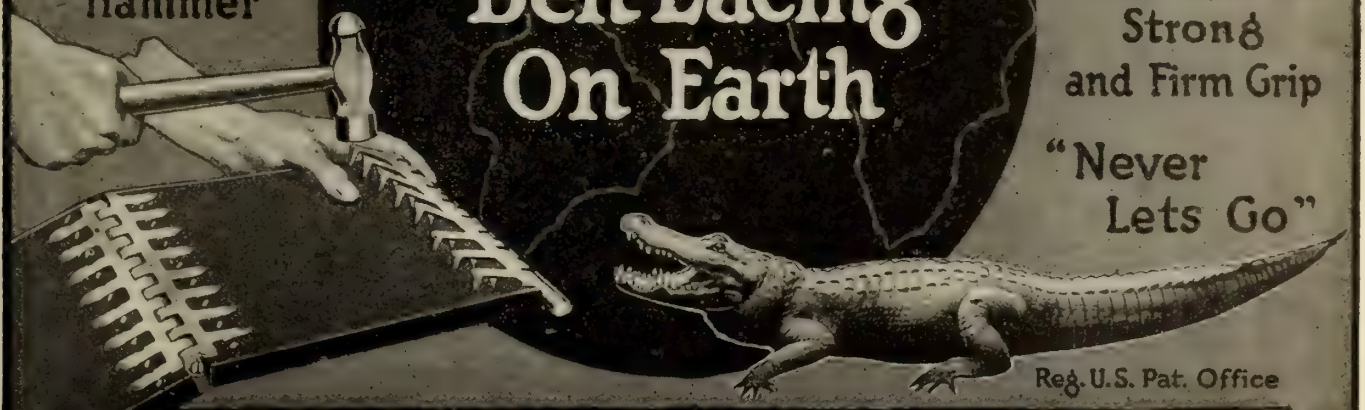
Nothing Needed But a Hammer

The Strongest Belt Lacing On Earth



Double Staggered Teeth Insures Strong and Firm Grip

"Never Lets Go"



Reg. U.S. Pat. Office

Jobbers—Dealers

Sell Satisfaction and Economy When They Sell ALLIGATOR Steel Belt Lacing

Go over these features that make "ALLIGATOR" the best belt lacing proposition for you and for your trade.

First: National and local advertising in carefully selected general publications, trade papers and consumer class publications interests all belt users and creates a demand that has been growing for twelve years.

Second: ALLIGATOR is preferred by Master Mechanics in every industry all over the world for its ease and facility of application, long life in operation, belt saving characteristics and economical features. The decision of hundreds of thousands of belting users should influence you to stock it.

Here are other reasons:

ALLIGATOR is the most easily and quickly applied of all belt lacings. **Only a hammer needed and three minutes average time** to lace a belt. Anyone can put it on.

Besides this important feature, this belt lacing has proven the strongest and consequently the **most efficient** in every test.

It outlasts any other type of belt lacing—and **saves the belting.** See illustration and note how the staggered teeth penetrate without injuring the belt and clinch down flat. Also note the sectional steel rocker hinge pin which makes a flexible hinge joint that hugs the pulley, is no thicker than the belt, and permits belt to be run on both surfaces.

In addition the use of ALLIGATOR Steel Belt Lacing is the most economical manner of taking up stretch on new belts and of relacing and repairing old ones. Only one end of belt need be cut off in shortening; or to lengthen, insert stub of correct length.

Can be kept handy in stockroom or tool box for immediate service thus avoiding any possible delays. Represents big saving and convenience to your customers on any kind of belting. A complete service for all thicknesses of power or conveyor belting. A size and type for every need. Write on letter head for samples and trade prices.

FLEXCO-LOK

Reg. U. S. Pat. Office

Steel Lamp Guards



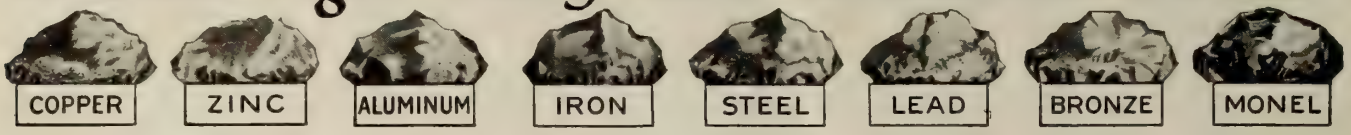
Protects lamps from breakage and theft—property from fire. An efficient, inexpensive security against danger, losses and delays.

Made in all styles and sizes with reflectors and handles if desired. Patent lock prevents theft. Sold at a distinct economy to the purchaser. Write on letterhead for information, prices, etc. Not in stock in London.

FLEXIBLE STEEL LACING CO.

4610 Lexington St., Chicago, U.S.A. *Stocked by the Best Supply Houses in Canada* 135 Finsbury Pavement, E.C. London

Of these eight widely used commercial metals-



Acids destroy

COPPER ZINC ALUMINUM



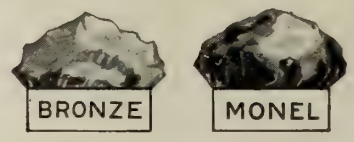
Rust corrodes

IRON STEEL



Heat weakens

LEAD



Steam wears & salt water pits BRONZE



Monel alone stands up against the many destructive forces that quickly break down the resistance of most commercial service metals. Because it is strong as steel, more corrosion resisting than copper, more wear-resisting than bronze, an increasing number of manufacturers are using MONEL metal for products for the most exacting and difficult industrial service, as well as for the most common domestic uses.

The name Monel identifies the natural nickel alloy — 67% nickel, 28% copper and 5% other metals—produced by The International Nickle Company.

THE INTERNATIONAL NICKLE COMPANY OF CANADA, LIMITED

Harbor Commission Building. Toronto, Ont.

INCo Monel metal

THE INTERNATIONAL NICKEL COMPANY





Mechanical Details

Built as an enclosed unit with a series of pipe coils mounted above a powerful fan-wheel. Coils heated by exhaust or live steam. Cold air is drawn into the heater by the fan, impelled upward and around the coils, heated, and then diffused through outlet hoods to every part of the open area.

Where steam is not available, we supply our direct-fired type DF, which burns coal, coke or wood. Fan operated by any power available.

"At First, I Didn't Believe What I Heard About This Heater"

"But there it is—one single heater, with no outside pipes or ducts—keeping this whole place warm. It is the only system that has ever heated our plant *all over, all the time.*"

Investigate This Yourself

The amazing ability of Skinner Bros. (Baetz Patent) Heaters to thoroughly heat large factories, foundries and plant interiors is almost unbelievable. But we guarantee it—if a Skinner Heater ever fails it becomes immediately returnable to the factory at our expense and every dollar of your money will be refunded. The heater is portable—requires no special foundation—costs 15% to 50% less to install than any other system. Operating cost is equally low.

Find out more about this heater. If you wish, we will send you names of users so you can make an independent investigation.

Skinner Bros. Mfg. Co., Inc.

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Buffalo.....706 Morgan Bldg.
Cleveland.....616 Marshall Bldg.
Chicago.....1508 Fisher Bldg.
Indianapolis.....330 Occidental Bldg.
New York.....1706 Flatiron Bldg.
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Skinner Bros.

Baetz Patent HEATING SYSTEM

Skinner Bros. Mfg. Co., Inc.,
1438 S. Vandeventer Ave., St. Louis, Mo.

Please send complete details on Skinner Bros. (Baetz Patent) Heaters to

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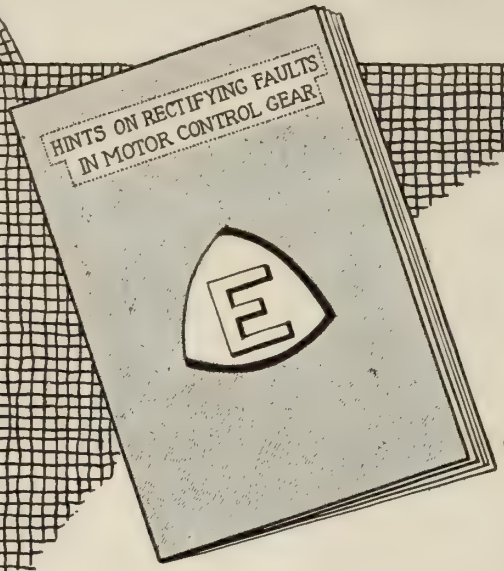
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We can / cannot use steam.

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Packed full of practical wisdom and knowledge based upon prolonged experience, designed expressly to furnish the maximum amount of information to the reader who uses the apparatus of which it treats.

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MORSE TWIST DRILL AND MACHINE CO.

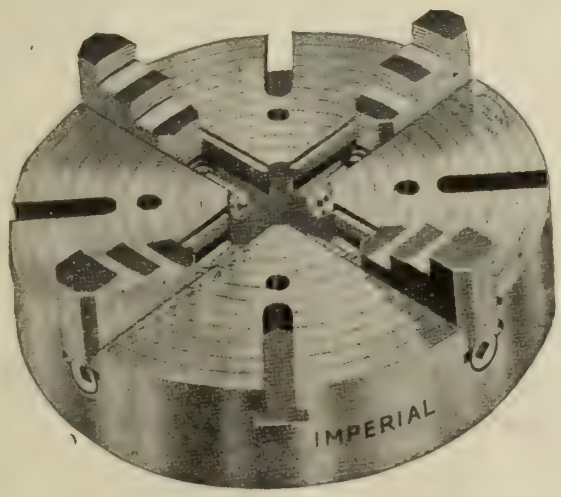
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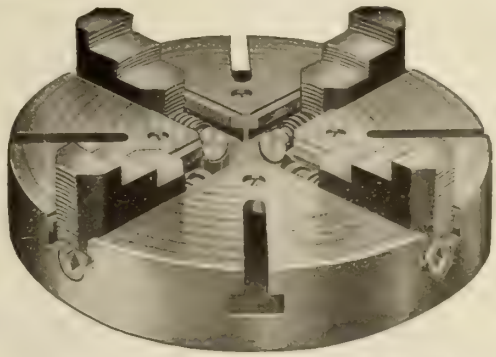


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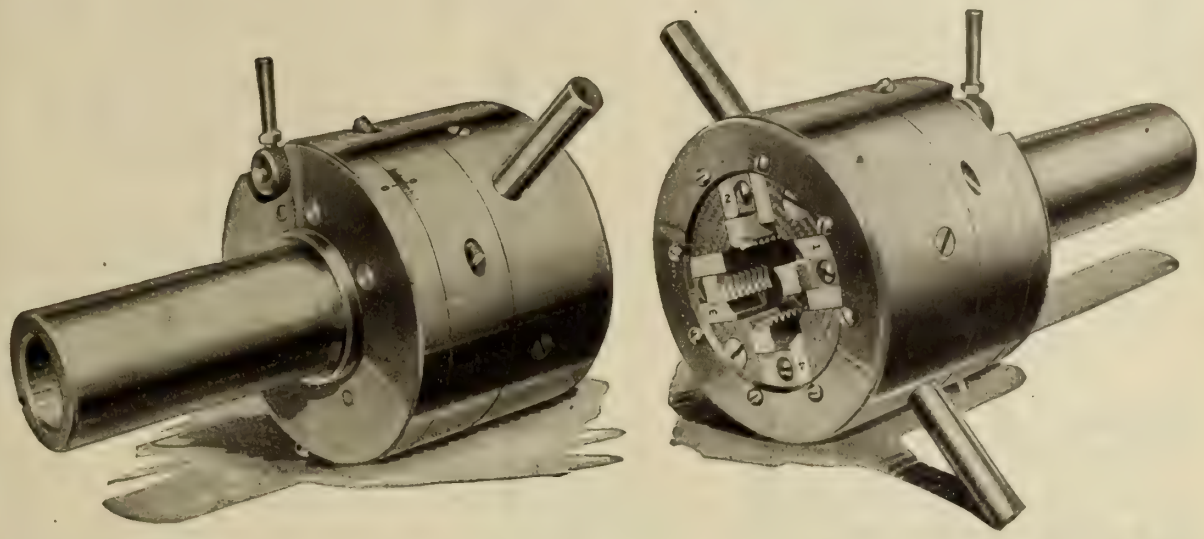
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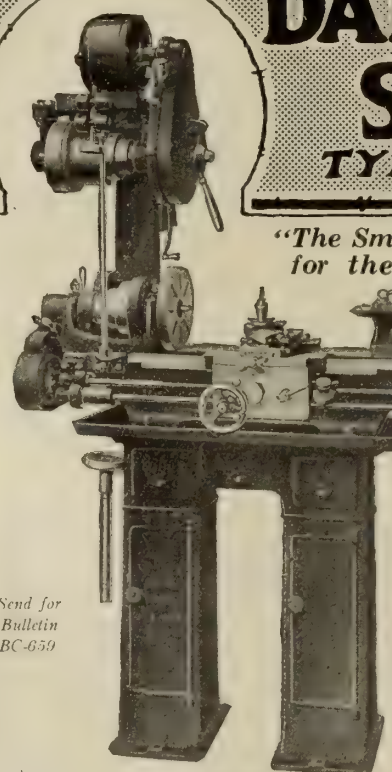
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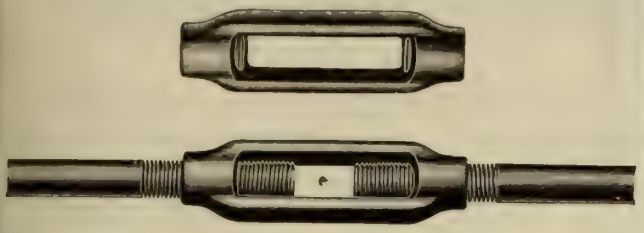
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	Inches
Actual Swing	8¼
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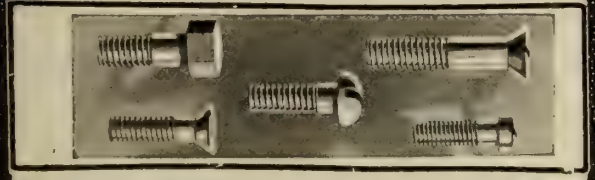
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The progress of photography presented many complicated mechanical problems. The die-casting process helped many manufacturers in the solution of these problems. Franklin Die-Castings are to-day used in cameras both commercial and scientific, helping manufacturers to reduce production costs and increase output.

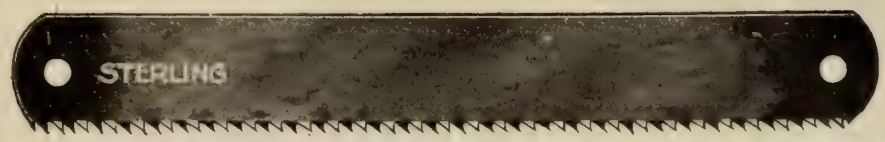
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Guarantee satisfaction. A trial will convince you of their superiority.

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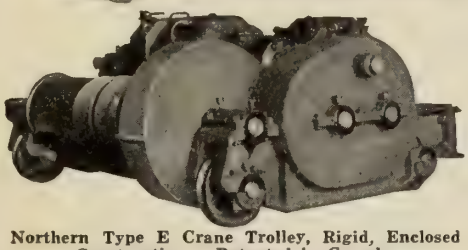
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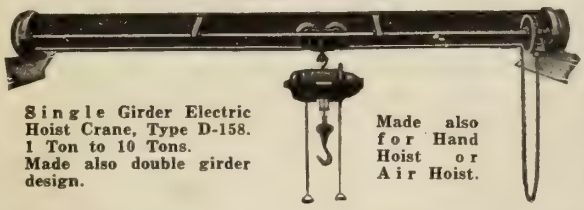


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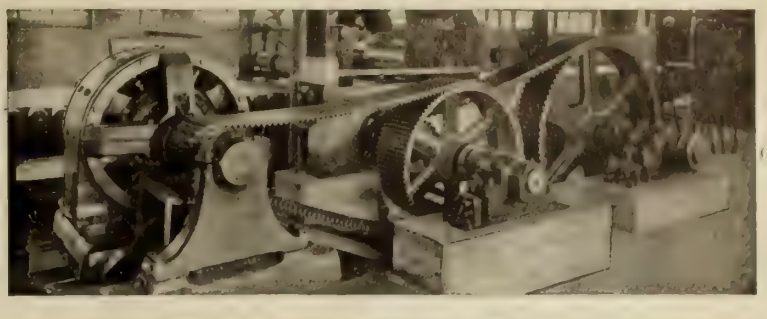
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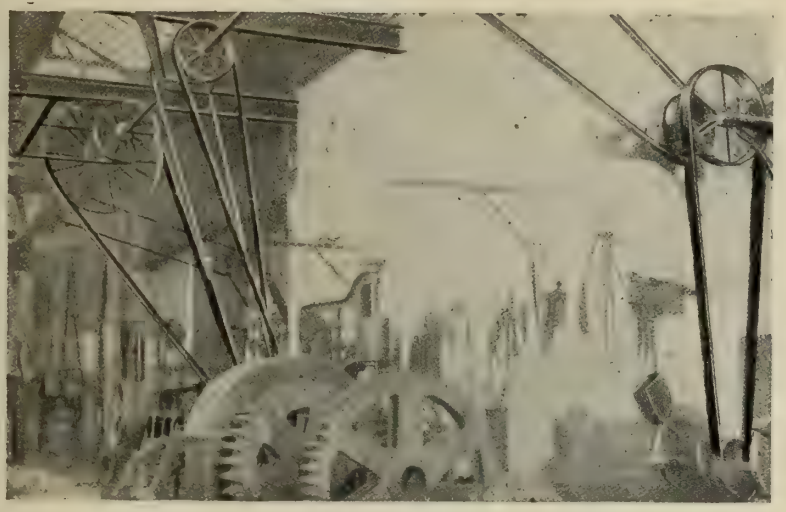
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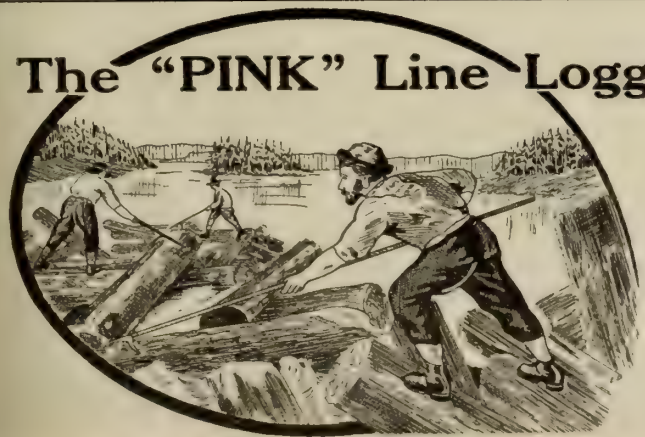
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Boiler cleaner.
Boiler maker.
Boiler repairman.
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Stone cutter.
Stone breaker.
Tank cleaner.
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Tool grinder (street railway).
Turret-lathe operator.

This is the List or occupations for which type No. 2 Goggles are specified in the Pennsylvania State Industrial Board's "Safety Standards" for Head and Eye Protection.

A sample of the ***STOCO*** Safety Goggle will be sent interested responsible people—without charge—on receipt of request on letter-head. The price of the ***STOCO*** Safety Goggle is 90 cents each—$1.15 each with "Celoglas" Shatter-Proof Lenses—f. o. b. Geneva, N. Y. Interesting discounts from those prices are allowed for quantity orders.

THE STANDARD OPTICAL CO. GENEVA N.Y.

"Good tools may not make a machinist—but the lack of them very often *un-makes* him. So I'm telling you, son, make sure that your Starrett Tool outfit is *complete.*

"Don't borrow. It will pay you to go down to the hardware store, and look over the Starrett line, and *buy.*

"You can't help feeling sore at these birds that are always borrowing. Every time you lend 'em something it peeves you and upsets you. And that shows in your work.

"Another thing, it often happens that the lender needs the tool loaned, while the other fellow is still using it. So the man who owns the tool has to wait around for the borrower to get through with it. And of course that looks bad.

"That's why men who borrow tools usually aren't popular; and as a rule when anybody is laid off, they 'get the gate'.

"Myself, I never lend my Starrett Tools to anybody. I think too much of them to pass them out to machinists old enough to have a set of their own. And you can't begin to get 'em too young.

"First thing to do—right *now*—is to write for the Starrett Catalog No. 22.

THE L. S. STARRETT COMPANY
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.





42-196

Use Starrett Tools

Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

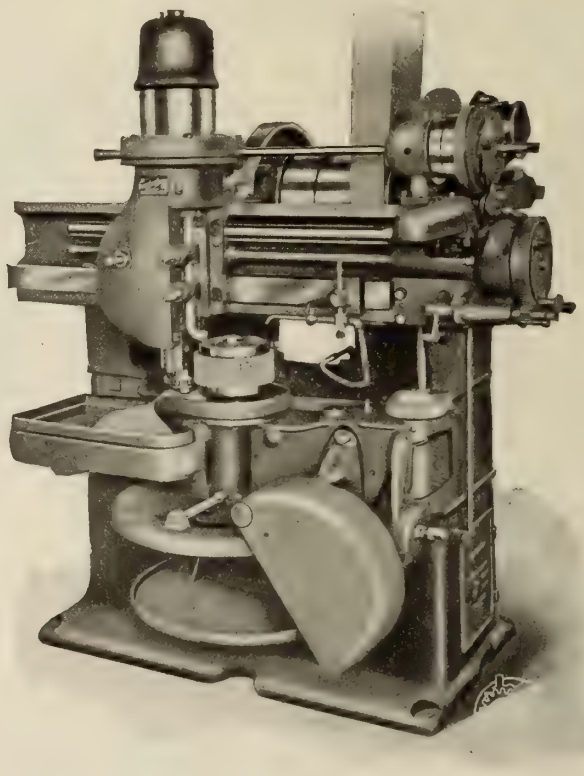
A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this little word "IF."

When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commerical Gear Cutting," which is a treatise on the subject of:—
Gear Cutting with the "IFS" Left Out.

Send for your copy to-day



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

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PIONEERS 1842 LEADERS EVER SINCE



PARKER VICTOR
THE PRODUCT OF MASTER MAKERS

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AIDS TO EFFICIENCY THAT'S US

WHY DO WE SAY IT

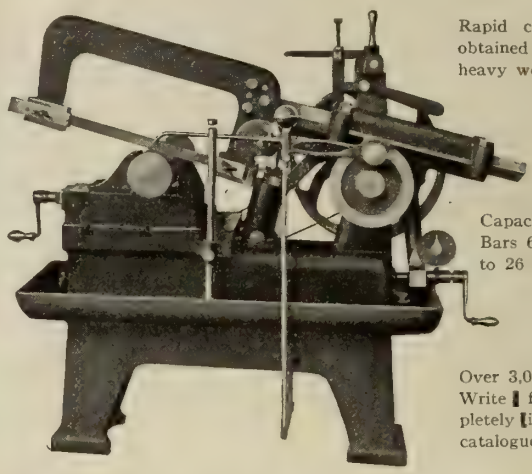
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The Sawing Machine for Power and Fast Cutting Economy

A POWERFUL, rigid construction, simple parts, low upkeep cost, and the ability to cut fast and with little waste make this "Rapid" Saw the right machine for a variety of cutting jobs.



Rapid cutting is obtained without heavy weights.

Capacity — Bars 6 in. up to 26 in.

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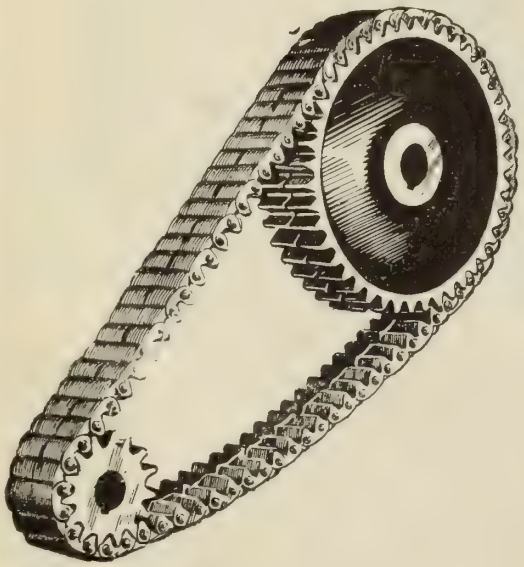
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"Rotex Dust"

Elk Service Means Lower Costs

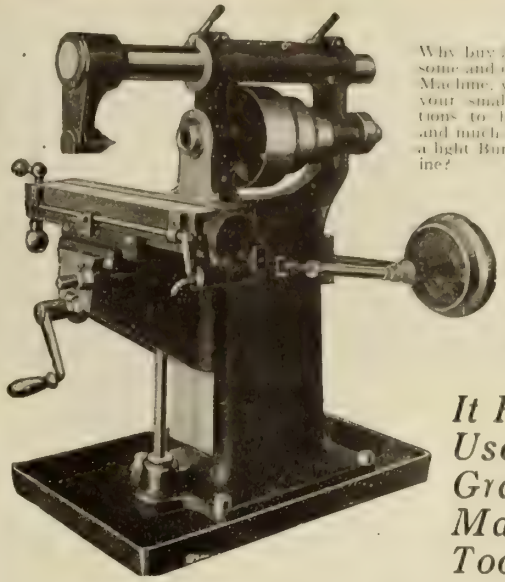
There are two important things to consider in buying firebrick—**price** and **quality**. When you buy ELK BRAND FIREBRICK we take a keen, unprejudicial interest in seeing that you get the class of firebrick you need. If a moderate-priced brick fills the bill we never recommend a brick of higher quality at higher price.

We make bricks in all standard sizes and shapes.

Elk Brands Firebrick are reliable. Specify them in your next order.

Elk Fire Brick Company of Canada
Limited
Sun Life Building, HAMILTON, ONTARIO

This Power Feed Miller $220



Why buy a heavy, cumbersome and expensive Milling Machine, when you can do your small milling operations to better advantage and much more rapidly on a light Burke Milling Machine?

Catalog shows other size of Milling Machines with hand or power feed, with or without overhanging arm either bench or column type.

It Pays to Use High Grade Machine Tools.

THE BURKE MACHINE TOOL CO.
520 Sandusky St., Conneaut, Ohio, U.S.A.

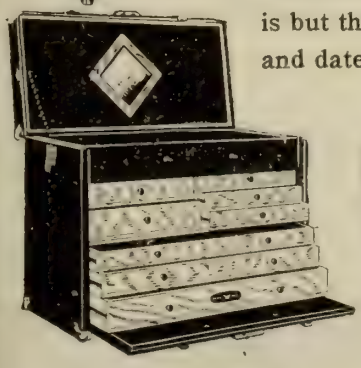
Canadian Dealers:—H. W. Petrie Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeats Machinery Co., Cope & Sons, Geo. F. Foss Machinery & Supply Co.

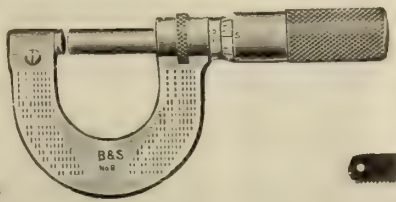


Supplies for Machine Shops, Foundries Factories and Construction Purposes

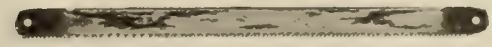
SET SCREWS, Cap Screws, Machine Screws, High Speed and Carbon Drills, Files, and a Complete Line of Machinists' Tools (Starrett, Brown & Sharpe, etc.), Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

The prompt, courteous service and dependable goods for which Rice Lewis is noted, is but the development of a policy commenced 74 years ago. Full particulars, prices and dates of delivery of any of our supplies are yours for the asking.

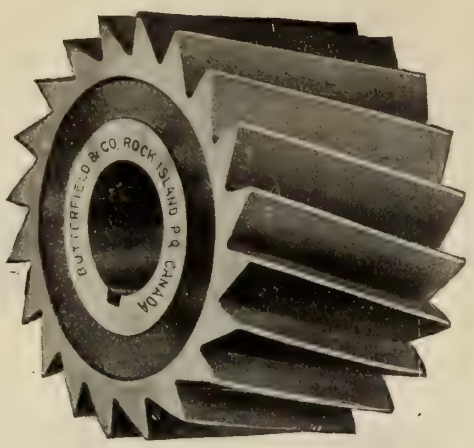




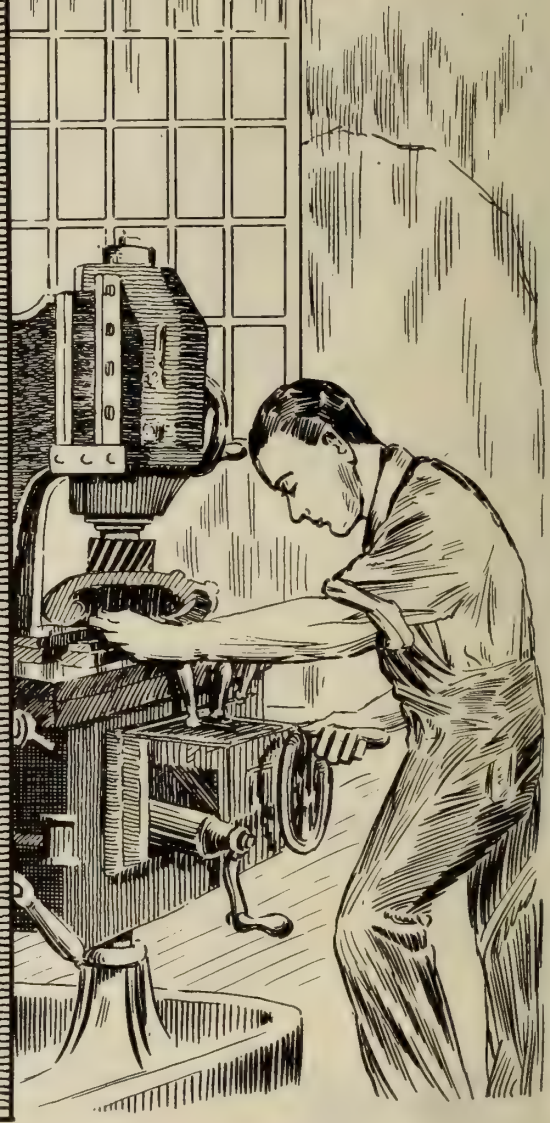




Rice Lewis and Son, Limited, Toronto



"The Tools You Buy Again"



COMPETITION of today demands that you use tools of QUALITY. For your drilling, reaming and milling cutter operations, put your faith in Butterfield Drills, Reamers and Milling Cutters. As compared with any ordinary tool they cut faster, more accurately, require less power, less re-grinding and give longer service—and they cost no more than ordinary tools.

BUTTERFIELD & COMPANY DIVISION
UNION TWIST DRILL CO.
ROCK ISLAND, QUE. - CANADA

STORES:—220 King Street West, Toronto.
131 St. Paul Street, West, Montreal.

AGENTS:—D. Philip, 138 Portage Ave., Winnipeg, Man..
The Triangle Co., Standard Bank Bldgs., Vancouver, B. C.

FOREIGN REPRESENTATIVES:—Great Britain, Geo. H. Alexander, 83-84 Coleshill St., Birmingham, England; France, Italy, Belgium and Switzerland, Fenwick Freres, 8 Rue de Rocroy, Paris; Sweden, Norway and Denmark, Ab Sigfr. Anderson & Co., Malmo; Spain, Casamitjana Hermanos, Barcelona; Japan, Abe-Kobei & Co., Yokohama; Greece, Stephen C. Staphanson, 11 Lycourgan St., Athens; Netherlands, Wynmalen & Hausman, Rotterdam; Australia, H. R. Richardson, 82 Pitt St., Vickery's Chambers, Sydney; South America, Charles Dreyfus, B. Mitre, 735 Buenos Aires, R. A.; South Africa, H. Parker Wood, Cape Town, Durban and Johannesburg.



DRILLS, REAMERS, MILLING CUTTERS, TAPS AND DIES

BUTTERFIELD



Nichrome the Casting Durable

Carbonizing Economy

involves more than cost of equipment. Results in the heat treated parts should get first consideration—if the reason for case-hardening is to be fully justified.

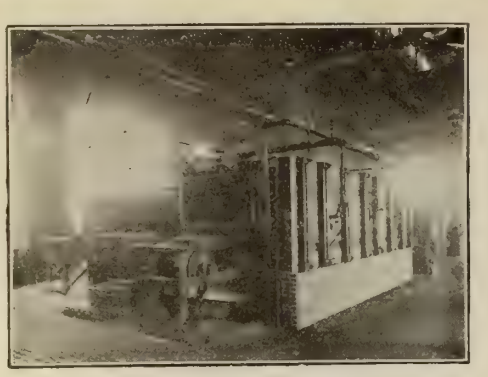
Furnace equipment that makes for uniformly good results at lowest cost not only keeps spoilage of expensive materials to the minimum, but includes long-life CONTAINERS.

The physical characteristics of Cast Nichrome Containers vary so little with repeated heating and cooling that heat penetrates readily and uniformly at all times during the entire guaranteed life of thousands of hours at 1,800° F. These, in brief, are the reasons for the extensive use of Cast Nichrome Containers in hundreds of plants where either economy or uniformly high grade results—or both—are the big consideration. Booklet N-21 gives more details.

Manufactured under HENDERSON Patents by

CANADIAN DRIVER-HARRIS CO.
WALKERVILLE, ONT.
American Office and Works
Chicago-Detroit Harrison, N. J. England-France





Quantity Production of Shafts in Automatic Heat Treatment Furnace.

PRODUCTION MANAGERS

The following advantages are secured by the Continuous Method of Heat-Treatment :

Increased production per unit of floor space.
Reduction in manual labor per unit of production.
Uniformity of product, resulting in decreased scrap, following less dependence upon the human element.
The fuel economy that naturally follows the direct transfer of heat in spent gases to incoming material.
Improvement in working conditions by cooler shop.

In short, the saving in cost of the finished product due to economy in labor, time, fuel, floor space, decreased rejections, etc.

Do these advantages appeal to YOU?

Write nearest branch for Bulletin 217-T and learn whether this method is adaptable to your product and manufacturing conditions.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 CHURCH ST. (Hudson Terminal Bldg.), NEW YORK
WE MAKE INDUSTRIAL HEATING FURNACES
FOR EVERY REQUIREMENT.
COAL—OIL—GAS—ELECTRICITY.
"FURNACE AND FUEL TO SUIT CONDITIONS."

W.S. ROCKWELL CO. INDUSTRIAL ESTABLISHED 1888 FURNACES 50 CHURCH ST. NEW YORK

CANADIAN ATLAS CRUCIBLE STEEL Co. LIMITED

Made in Canada

L-XX HIGH-SPEED
ATLAS TOOL STEELS
ATLAS ALLOY STEELS

for Machine Tools, Automotive Parts, etc.
Noted for their uniformity

Hot Rolled, Forged Blocks and Discs
Cold Drawn Steel and Drill Rod

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QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

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IRON ORE - PIG IRON

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CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
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RAWHIDE OR METAL

P X H IMPERIAL

Increased Output
and
Lower Operating Costs
follow the use of
P.H. and IMPERIAL FILES.

"They Cut Faster and Wear Longer."

Be File-Wise.

INGERSOLL FILE COMPANY, LIMITED.
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Sole Distributors,
Ingersoll, Ontario.

INGERSOLL

WRIGHT HOISTS



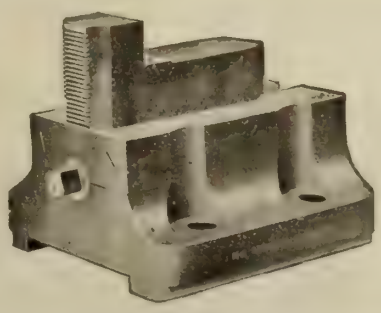
are made in a plant that makes nothing else—a plant where every part is the result of the best thought and effort of specialists.

Try one, then order more.
Ask your Jobber.
Have you our catalog?

Canadian Distribution:
The A. R. Williams Machinery Co.
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Toronto
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WRIGHT MANUFACTURING COMPANY LISBON, OHIO.

SKINNER CHUCKS TRADE MARK



Skinner Boring Mill Jaws

Note the powerful, compact construction of these sturdy jaws. For heavy duty work on boring mills and large lathes these jaws, fitted to the parallel slots in the face plate or table by means of the double rib, insure a most positive grip.

Furnished in iron or steel body—single or double rib as desired.

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN. U. S. A.
Established 1887
New York Office: 94 Reade Street.
San Francisco Office: Rialto Building
Chicago Office: 552 West Washington Blvd.
London Office: 139 Queen Victoria St., E.C. 4.

H.W. PETRIE LIMITED

CANADA'S DEPENDABLE MACHINERY AND SUPPLY HOUSE

H.W. PETRIE LIMITED TORONTO

The "PETRIE" policy represents the standard in high-grade tools and efficiency in service.

MACHINERY and SUPPLIES

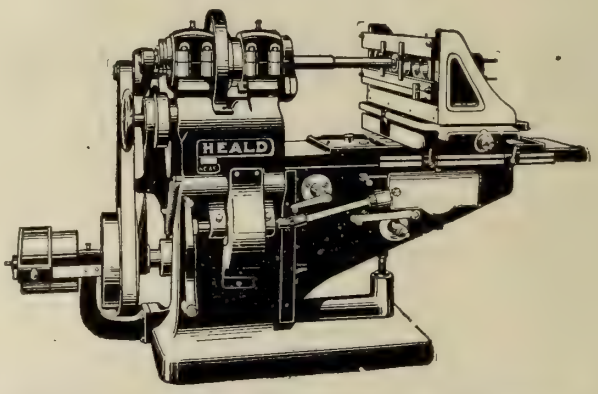
REMEMBER the house of H. W. Petrie, Limited, when in need of anything in the shape of machinery and supplies. A colossal stock of machine tools of every description always on hand from which you are assured of getting the exact tool to suit your requirements. Included in this great array are many used tools. They are in good conditions and warranted to give satisfactory service. If you are seeking an opportunity to buy equipment at rock-bottom price don't fail to see our line of used machines.

SERVICE.—A competent staff of engineers is at your service at all times; submit your problems to them; their advice costs you nothing and it is highly authoritative.

Another factor of importance to remember in dealing with the house of H. W. Petrie, Limited, is this: the quickest of service is always rendered on orders large or small.

Get the Cream of a Profitable Business

Regrinding Cylinders makes used motors better than New



Style No. 55 handles all sizes and shapes of cylinders

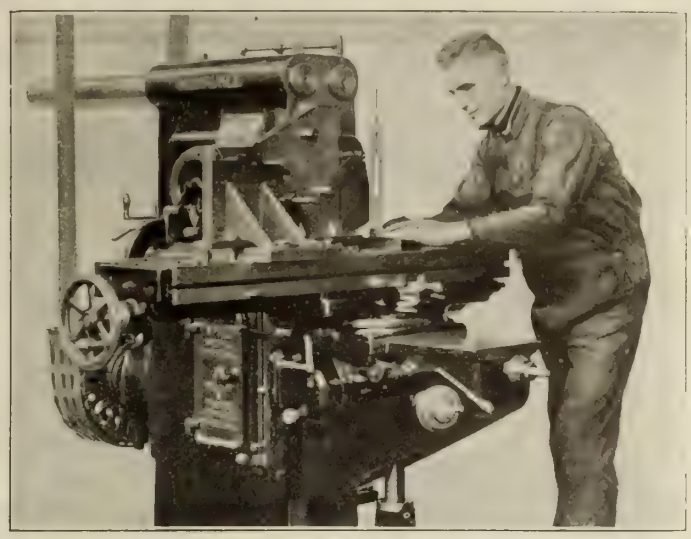
There is no business to-day that has the possibilities and which fits as nicely into a small machine shop, automobile repair shop or a concern doing welding, as the regrinding of worn or scored cylinders. Heald style No. 55 is built expressly for regrinding work. It is simple, moderately priced, self-contained, and has a very large capacity and range, easily taking care of singles, doubles, four and six en bloc cylinders.

Over Half a Century of Unequalled Success

H. W. PETRIE, LIMITED

TORONTO - HAMILTON

MILWAUKEE MILLING MACHINES



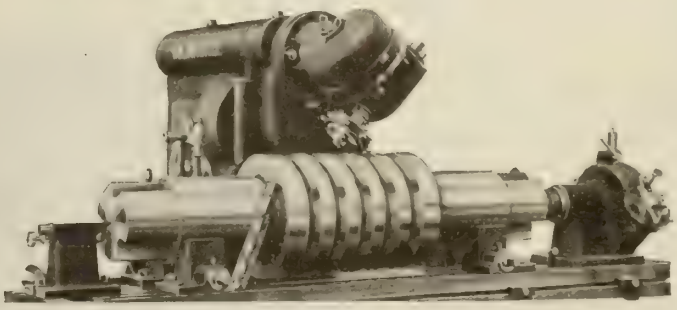
Efficient on Light and Heavy Milling

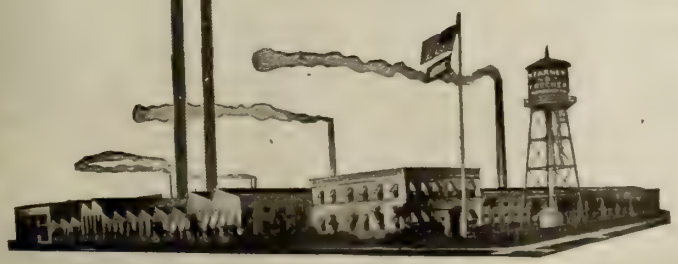
Heavy milling jobs are not unknown to Milwaukee Universal Milling Machines, while delicate and intricate ones are efficiently performed with little effort.

Both light and heavy milling operations are handled with such smoothness and accuracy that the finest results are obtained. Because Milwaukee Universal Milling Machines perform such a wide variety of work, they are particularly well adapted for the tool-room.

The jobs shown in the two illustrations are representative of "Milwaukee" adaptability. The upper illustration shows a jig being bored with a fly cutter. The lower illustrates the milling of a chilled roll with the use of a Universal Milling Attachment.

Write for Catalogue—NOW.





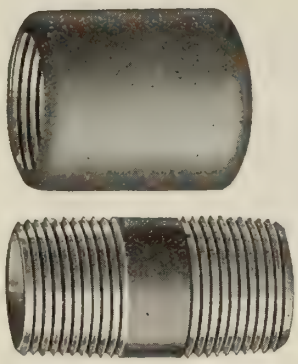
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CORPORATION
MILWAUKEE, WIS., U.S.A.

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COUPLINGS and NIPPLES





Each length of M.R.M. Pipe is tested to withstand a pressure of 600 pounds per square inch.

Supplied in black, or galvanized.

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL

STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
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Western Room 14 Windsor Hotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

Baptizing a fire-box with flame



One reason why the oxy-acetylene process is to-day so widely used in shops and yards for scientific reclamation and manufacture is that

Prest-O-Lite

DISSOLVED ACETYLENE

in readily portable cylinders permits the use of the process both under roof or in road maintenance to the best possible advantage.

A chain of centrally located plants and warehouses makes possible a constant and plentiful supply of this exceptionally good welding and cutting gas.

PREST-O-LITE COMPANY OF CANADA, LIMITED

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Branches at
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Plants at: TORONTO, ONT. MERRITTON, ONT. ST. BONIFACE, MAN. SHAWINIGAN FALLS, P.Q

Right Now, When You Want To Cut Down Your Overhead and Save on Production Cost



Pageant of Progress Exposition at Chicago. $5,000,000 Municipal Pier, July 30 to August 14.

YOU should have an Imperial Oxy-Acetylene Welding Outfit in your plant. In a short time it will save hundreds of dollars. When machinery breaks, tying up whole departments, an Imperial Welding Outfit can make repairs in minutes or hours, instead of days or weeks. We have a record of a saving of over $500 on repairs in one factory in less than nine months—a record easily duplicated by any moderate-sized organization.

Imperial
Automatic
ACETYLENE GENERATOR

Further, there are scores of ways in which oxy-acetylene welding can be used in production to save expensive processes. An Imperial Welding Outfit is not costly—we urge you to look into it. Send for our new catalog, prices, and information on welding.

The Imperial Acetylene Generator saves 2 to 4 cents on every foot of acetylene gas. Can be used with any make of Welding Apparatus.

In your letter give us the name of your distributor through whom you prefer to deal.

The Imperial Brass Mfg. Co.

503 S. Racine Ave., - Chicago, Ill., U.S.A.

MAKERS OF IMPERIAL WELDING, CUTTING, CARBON AND LEAD BURNING EQUIPMENT AND SUPPLIES.

IMPERIAL BRASS PRODUCTS

MADE IN CANADA

Torrington

MACHINE SCREWS

Uniform in Quality and Workmanship

THE reputation of Torrington Machine Screws for dependability is worth consideration when you are placing your orders.

Because the standard of every shipment maintains this reputation we have come to expect a firm when they send us one order to send us others.

For the first time in the history of the machine screw business, there has been a standard of dimension established by us that enables the user to provide the correct style and make of taps to insure uniform fits.

MANUFACTURERS OF STANDARD AND SPECIAL MACHINE SCREWS, RIVETS, THREADED WIRES AND SPECIALTIES IN HEADED WORK.

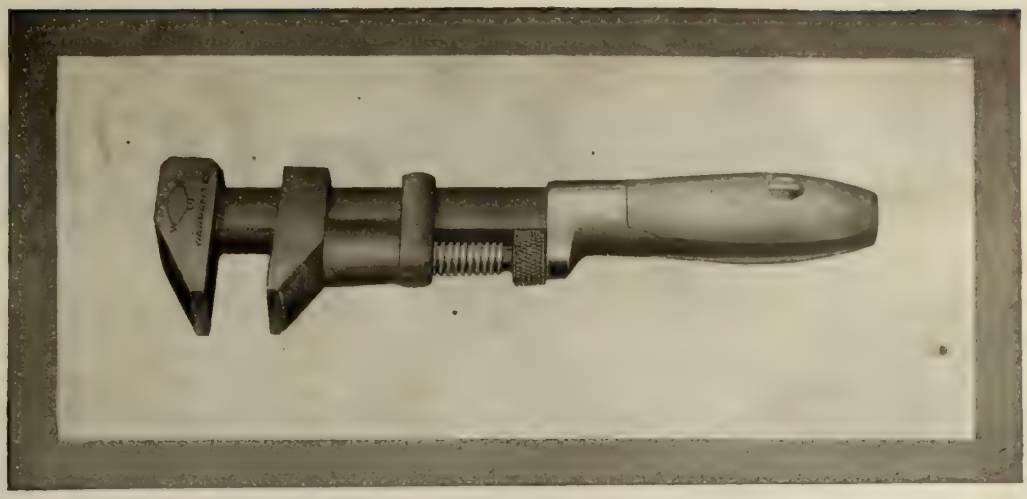


These are but a few of the many styles we have made.

Enquiries Solicited

The Torrington Company, Limited

Upper Bedford, Quebec.



Made in Canada

W

Dependable Wrenches

W & B screw wrenches are dependable *tools* because into each of their *parts* is put the skill and experience gained during half a century of wrench manufacture.

With head and bar drop-forged in one piece, extra heavy jaw and solid adjusting screw turned from wrought steel each part contributes its individual share toward the dependable strength of the complete tool.

Two models—"Knife Handle," with handle sides of selected beech, and "Railroad Special," with indestructible iron handle—are unexcelled for heavy duty. Seven sizes, 6 to 21 inches.

A third model—"Agricultural"—is supplied at a lower price where maximum strength is not necessary. Five sizes, 6 to 15 inches.

Ask your dealer. Screw Wrench Book on request.

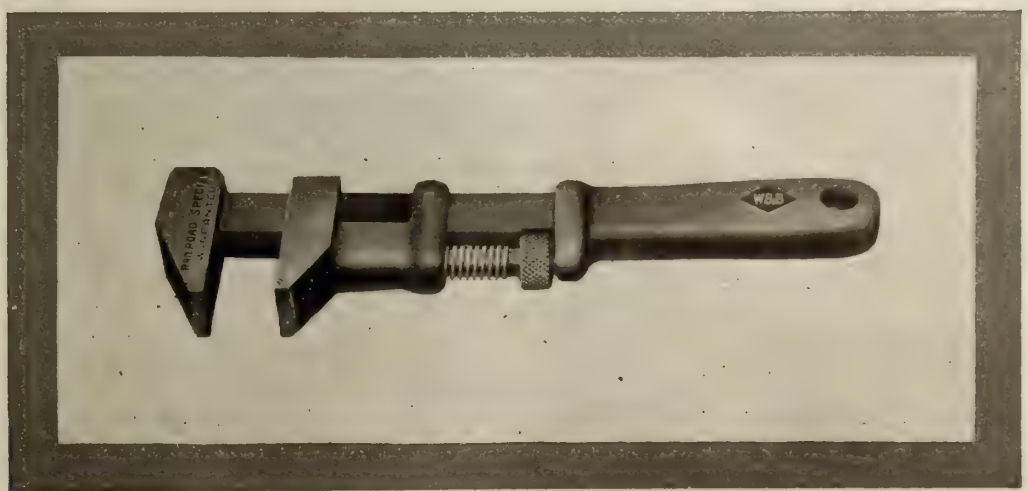
J. H. WILLIAMS & CO., Limited

"THE WRENCH PEOPLE"

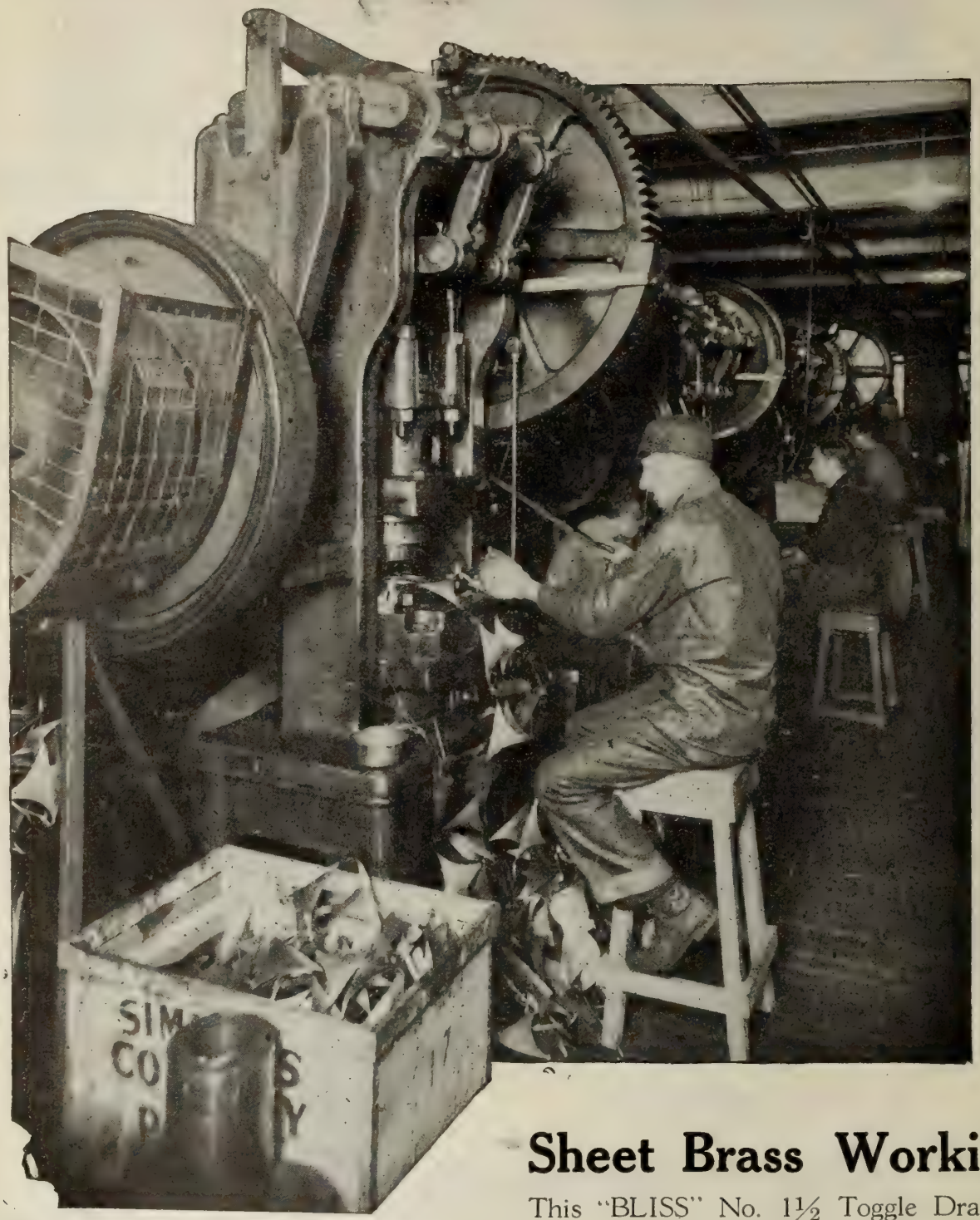
Formerly Canadian Division of
The Whitman & Barnes Mfg. Co.

45 Thorold Road **St. Catharines, Ontario**

W



Made in Canada



Sheet Brass Working

This "BLISS" No. 1½ Toggle Drawing Press is one of the many "BLISS" Presses used by the Simmons Company to achieve fine results in making brass beds. It is shown here blanking and drawing bedpost necks from .035″ strip brass 9″ wide. The shells are 5¾″ diameter x 2¼″ deep.

BLISS 1857

E. W. BLISS COMPANY

BLISS 1921

Main Offices: BROOKLYN, N. Y., U. S. A.

American Factories: BROOKLYN, N.Y.; HASTINGS, MICH.; CLEVELAND, O.; SALEM, O.

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CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURG, Keenan Bldg.

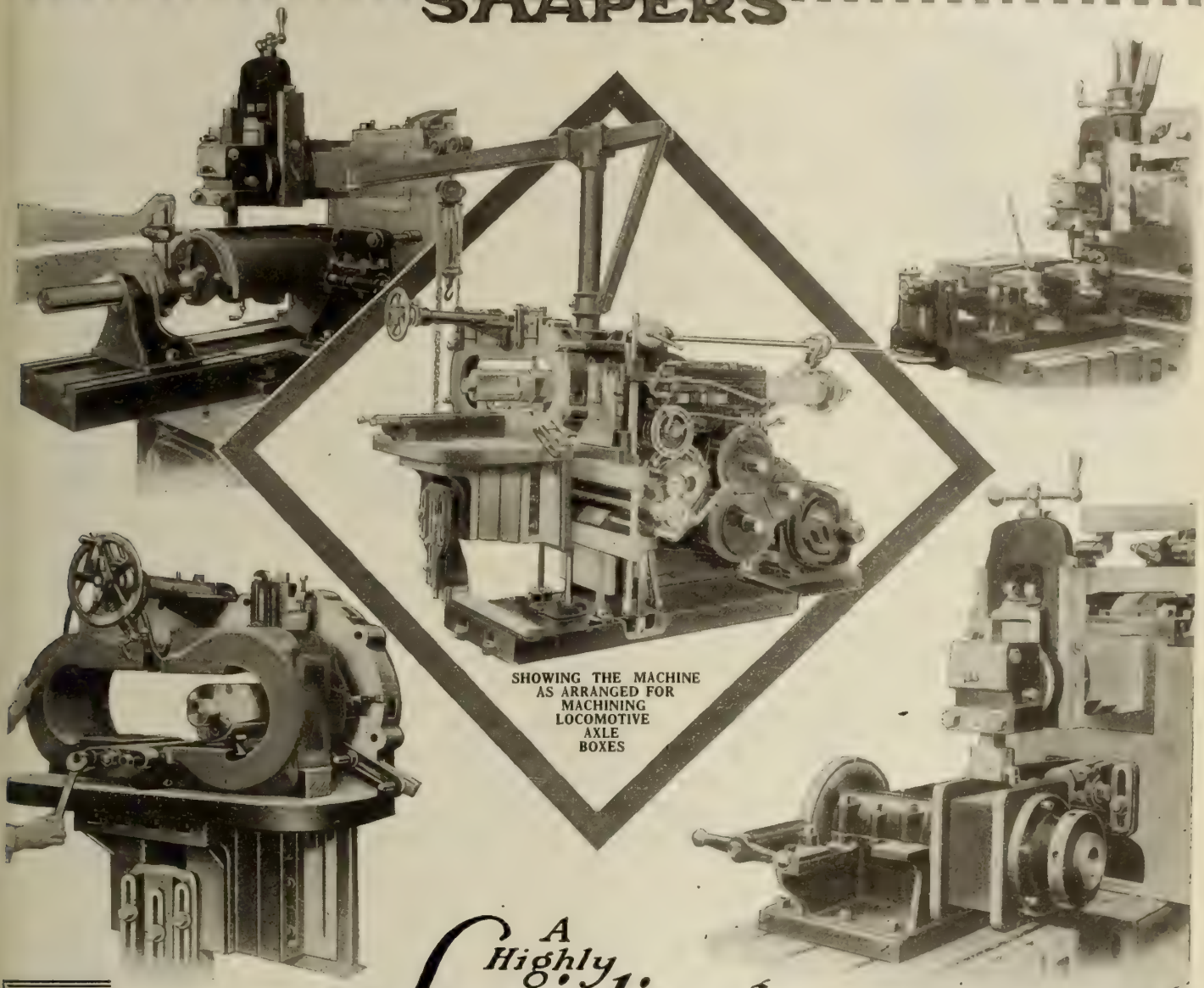
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No. 1

MORTON

HEAVY DUTY RAILROAD SHAPERS



SHOWING THE MACHINE AS ARRANGED FOR MACHINING LOCOMOTIVE AXLE BOXES

A Highly Specialized MULTI-DUTY MACHINE

THIS Morton Heavy-Duty Draw-Cut Railroad Shaper is a specialized tool of exceptional design.

It is a multi-duty machine and the ease and rapidity with which changes are made from one class of work to another are features which make it a highly profitable producer. Fully equipped with the latest time-saving devices! A machine of maximum rigidity! Deep cuts, coarse feeds, and smooth and accurate work make it a tool of outstanding ability.

Send for bulletin 6A—it contains a complete and interesting story of this finely built tool.

MORTON MANUFACTURING CO.

MUSKEGON HEIGHTS, MICHIGAN, U.S.A.

If interested tear out this page and place with letters to be answered.



Production "Cost Cutters"

Specify "Barnes-made" Spring Washers and Stampings, and reduce your cost of production!

In our Stampings Department we have a multitude of special tools and special automatic machines, all "Barnes-made" and designed for cutting washers and stampings. That's why we can save you money.

We make these parts of cold-rolled steel, tempered steel, brass, bronze, copper, German silver—or any required material—according to your needs.

This work is done with the exact same care, skill and accuracy we employ in our spring making. It merits the confidence of manufacturers of even the most delicate and intricate mechanical devices.

Catalogue No. 9 is worth asking for. May we send it?

Springs of steel, brass, phosphor bronze or vanadium —flat, coil, spiral, —compression, extension or torsion. Wire Forming. Spring Washers. Small parts of steel, brass, etc., in any finish. Assemblies. High Carbon Cold-Rolled Steel.

The Wallace Barnes Co.

"Spring Makers for Three Generations"

Main Office and Works
Bristol, Conn.,

Western Sales Office
Book Bl'd'g., Detroit

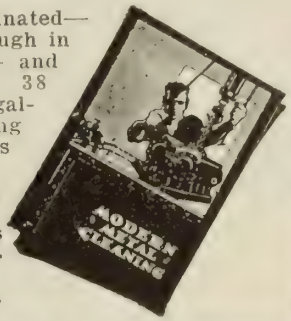
Oakite Cleans Aluminum at 1/20th Former Cost

A MANUFACTURER of engineering instruments uses Oakite materials for cleaning aluminum parts, and improves working conditions at a fraction of former cleaning cost.

The old method of removing polishing oil and emery consisted of hand brushing the parts with high grade gasoline that cost 40 cents a gallon.

Now clean without hand brushing, by washing in a solution made of Oakite materials, cost only 2 cents a gallon.

Fire risk is eliminated—work comes through in perfect shape — and the saving of 38 cents on every gallon of cleaning material reduces production costs.



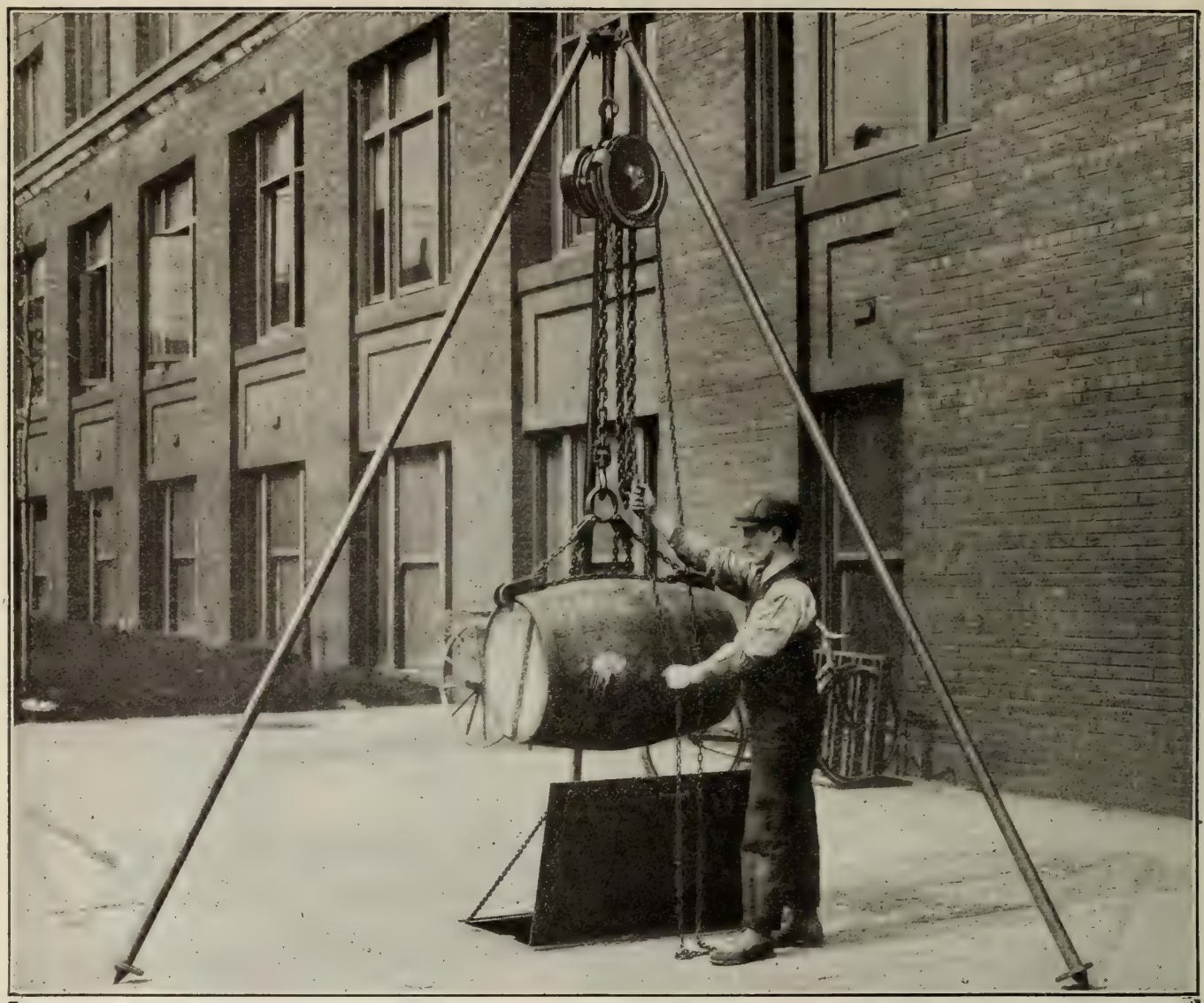
Write for this Booklet — "Modern Meta Cleaning" —free.

OAKITE

MANUFACTURED BY
OAKLEY CHEMICAL CO.
44 THAMES STREET · NEW YORK

Resident Canadian Representatives: Mr. C. P. Murphy, Toronto and Mr. C. Burgin, Montreal

This Advertisement is one of a series based on actual occurrences.



A FOLDING STEEL TRIPOD

Fitted with a Morris Triple Gear or Worm Gear Chain-block and used for setting machinery and making the occasional difficult lifts around your plant, will soon pay for itself and will occupy but little space when not in use.

THE HERBERT MORRIS CRANE & HOIST CO., LIMITED

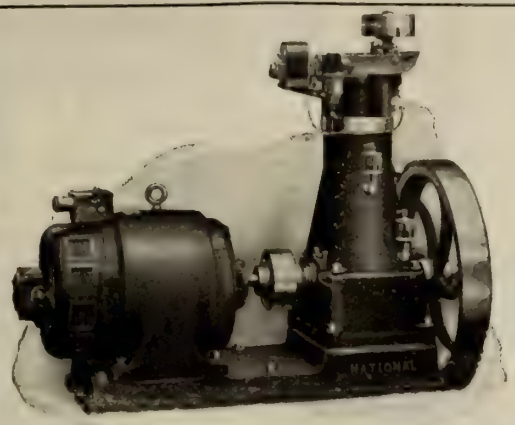
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Specialists in the design, manufacture and application of lifting machinery and material handling equipment.

HERBERT MORRIS

Cranes and Chain Blocks



5 H.P. VERTICAL ENGINE
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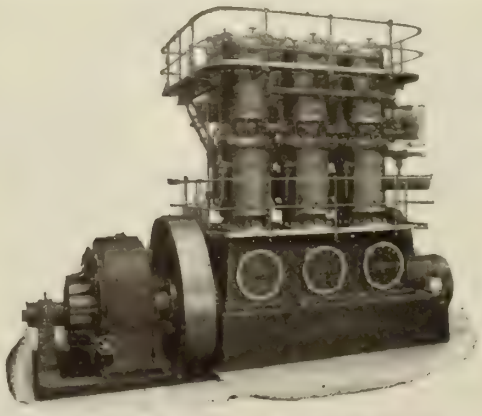
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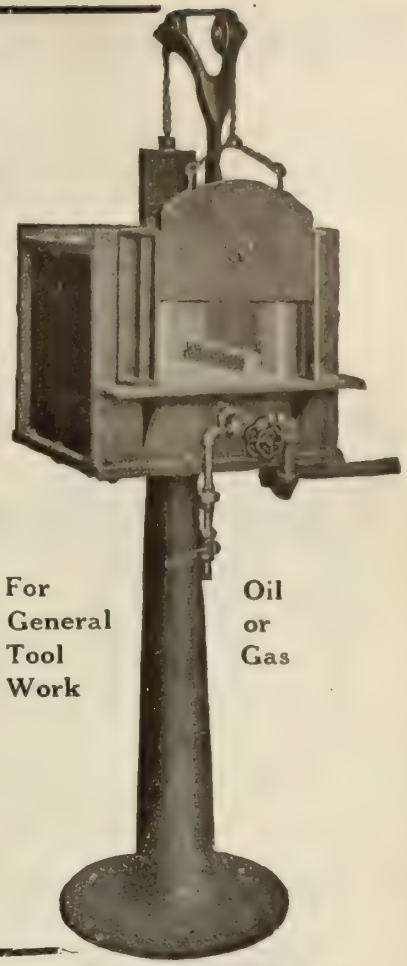
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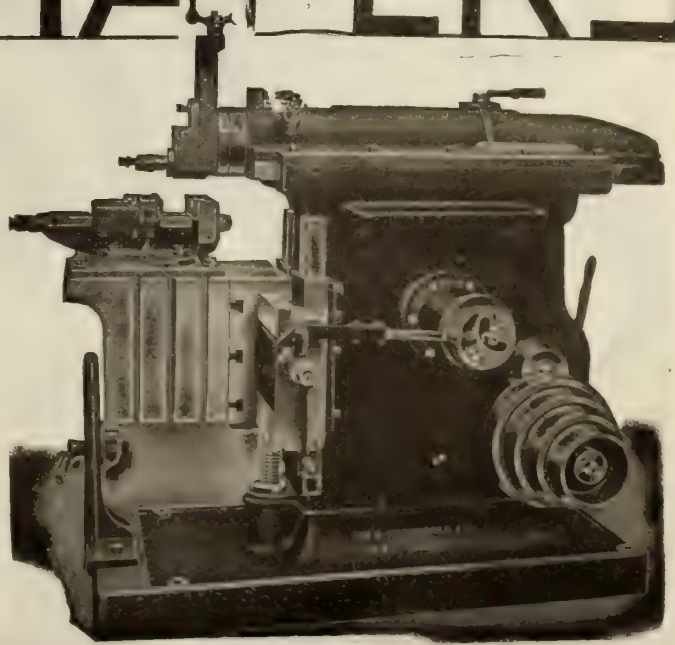
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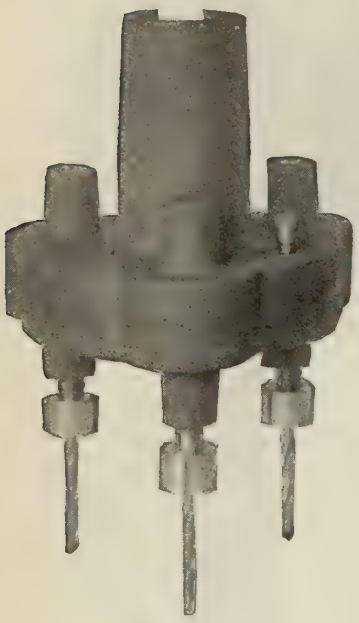
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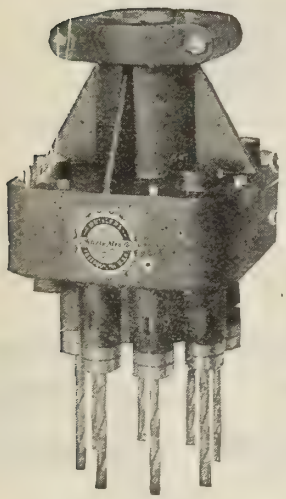
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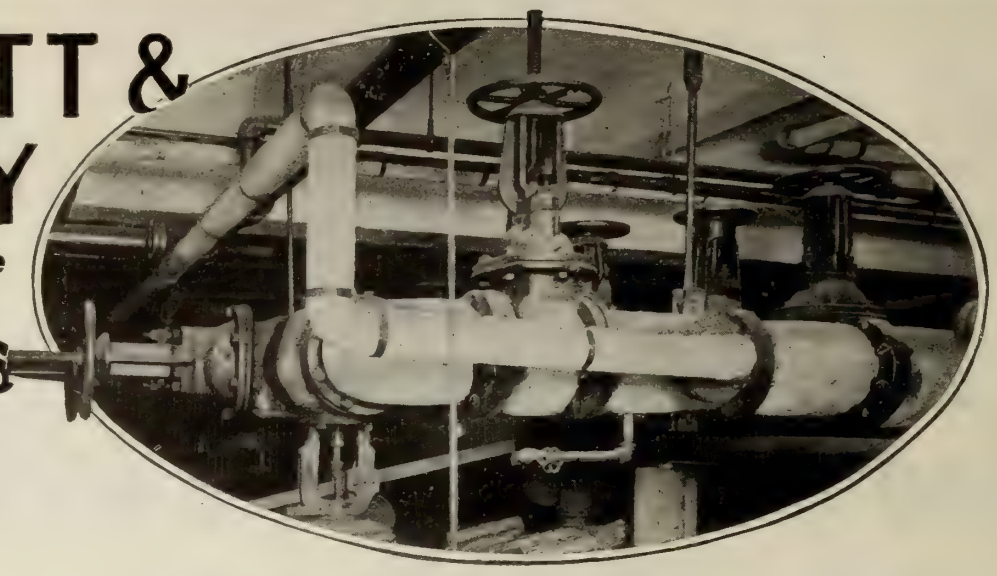
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI. No. 1. July 7, 1921

Milling 7500 Drill Tangs Every Ten Hours

Vertical Milling Practice. Examples of Work Performed, Including Milling Drill Tangs—Monkey Wrenches—Various Shaped Levers—Bearing Caps—Plier Bearing Caps—Plier Bodies—Gear Pump Bodies and other parts.

By J. H. MOORE.

LIKE many other types of machine tools, the vertical miller has made rapid strides in efficient design during the past few years, until at present they have become a manufacturing tool with a very wide field of usefulness. Operations that were previously performed on other machines have been transferred to the vertical miller with splendid success, and in every way this type of miller has lived up to its name, "A Production Tool."

A feature that helped considerably to popularize this style of machine, was the continuous milling attachments that could be placed on top of the regular table. This feature can of course be adapted in some cases to the horizontal type of miller, but the vertical style lends itself very readily to the use of such attachments. This will be readily apparent when readers study the examples of continuous milling shown in the present article. Without entering into the design of such machines, we will proceed to discuss examples of work performed.

Contrary to an erroneous belief, continuous milling fixtures are not always expensive. True, in some cases, where the work is of a particularly intricate character, the cost of the fixture may be more than usual, but in the average case a tool designer will be able to produce a simple fixture that will serve the purpose. For example, the fixture shown at Fig. 1 could not be termed elaborate, yet it holds eight different

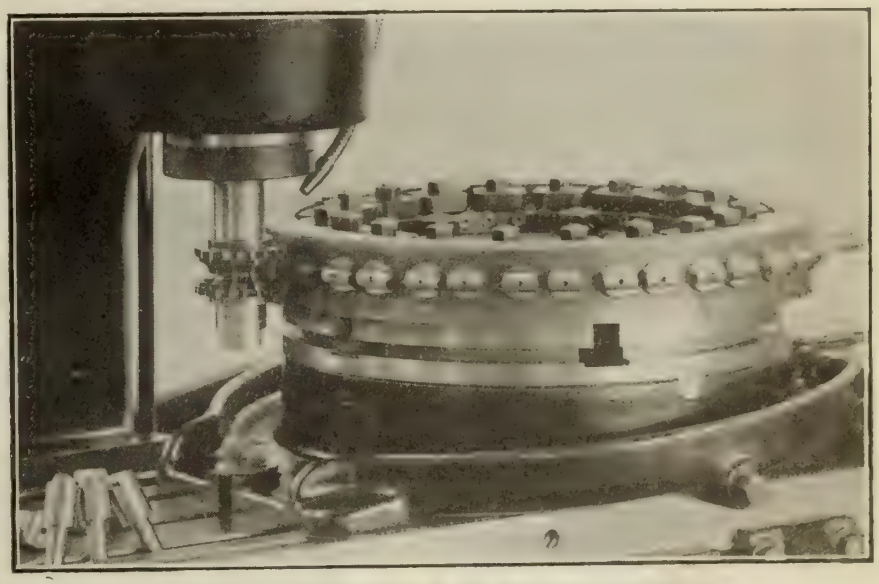


FIG. 5—MILLING RADIUS ON ROLLER PLUNGERS.

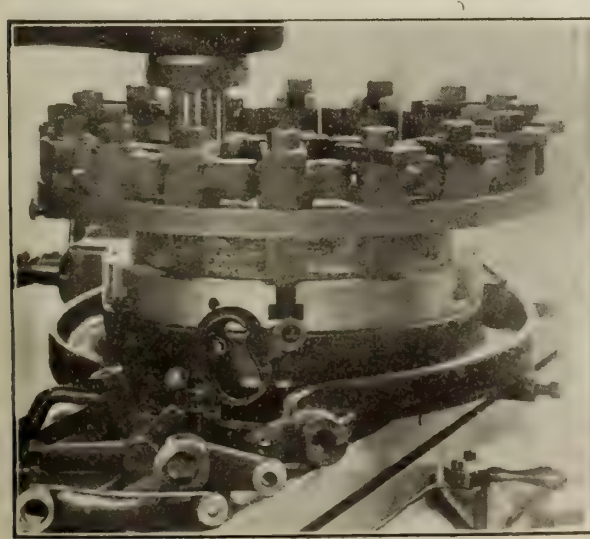


FIG. 1—SIMPLE LEVER MILLING FIXTURE.

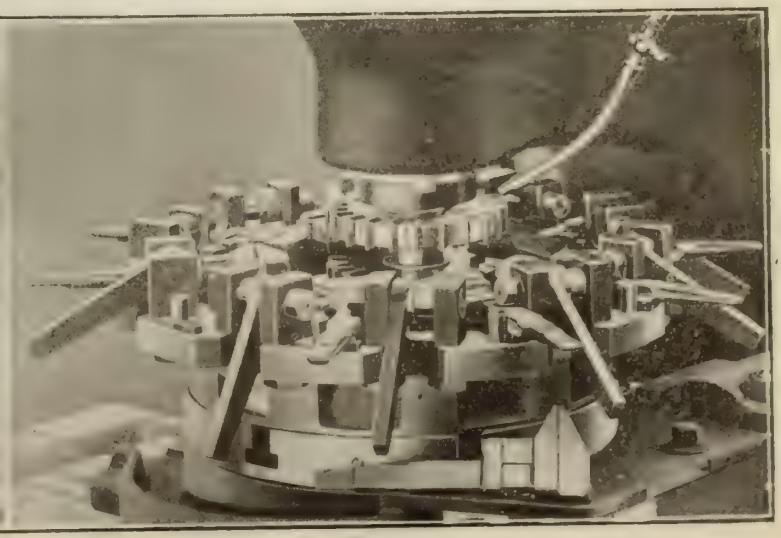


FIG. 2—MILLING MONKEY WRENCH BODIES

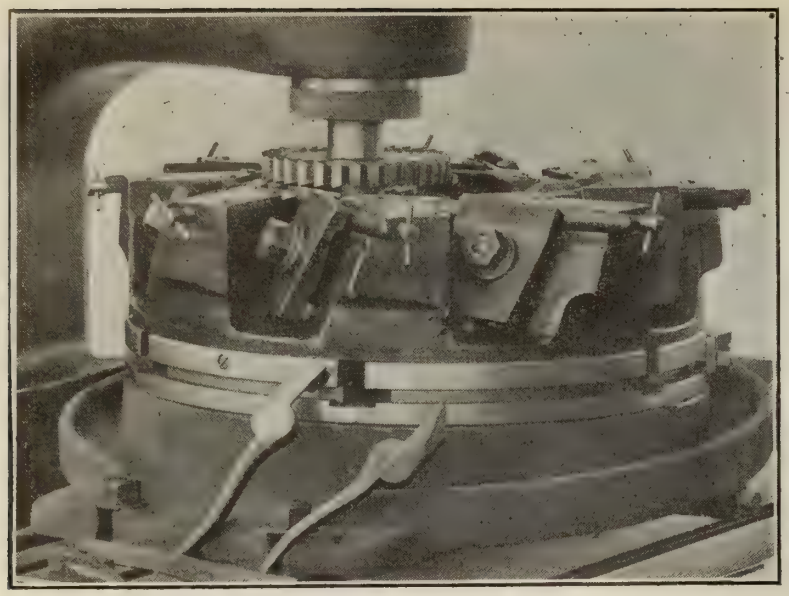


FIG. 6—MILLING THE SIDES OF PLIERS.

styles of levers, all of which are shown resting on the table of the machine. The fixture is of the adjustable type, the holding studs being removable. In the photograph, sixteen levers are being milled on their bosses.

The next illustration. Fig. 2, shows the milling of monkey wrenches at the rate of 3,000 every ten hours. The special fixture depicted is arranged with an eccentric, quick-changing device, this allowing fast removal of the parts, no cutting time being lost while changing. It will be noted that both these fixtures are mounted on the regular rotary table attachment as used on such machines.

Milling Drill Tangs.

Fig. 3 illustrates a very simple fixture, yet one that has saved considerable money for the firm that is using it for milling the tangs on their drills. The fixture is attached to the rotary table as shown, and the drill shanks placed in the double binding clamps, which can be clearly noted in the photograph. On drills having a No. 3 taper shank, 750 per hour were milled, this production being limited to the speed of the operator in changing the drills. There is also considerable saving of time in the setting up of these drills, as they formerly used to set the drills in a row so that six or more tangs could be milled at one time. As the cutters were at that time arranged on a horizontal spindle, it took quite a time to align up these cutters with the holding fixture to get the tangs central, and as the limit allowed was .001" plus or minus, each set of cutters had to be adjusted after each grinding.

This difficulty is overcome by the use of the continuous method, as only one set of cutters have to be aligned. Should the tang not be exactly central, this can be corrected by adjusting through the vertical feed. As stated previously, the drills are held in place by V blocks and clamps, each clamp holding two drills. To keep the tangs uniform in length, a ring gauge is used on the inside of the fixture, the cutter straddling this gauge, but not touching it.

Milling Bearing Caps.

Fig. 4 depicts a continuous milling operation being performed in the Le Roi Co. motor shops. In this case the machine is milling cast iron bearing caps at the rate of 100 per hour, and the cutter used is a 4½" high speed end mill. One man handles this production with ease.

The fixture used, as can be noted, is very simple, but before leaving this particular photograph, we shall, for the benefit of those readers not familiar with the method of driving such rotary tables, discuss the matter briefly. On looking at the photograph closely, it will be noted that a universal joint shaft connects the driving spindle of the rotary table to the feed box of the machine. This of course, allows you to vary the speed of the table at will, just as you would vary any other speed on the miller. The interior design of such tables does not interest us, so we will pass on to the next example, Fig. 5.

In this view we see a very interesting operation. viz., the milling of the radius on the roller plungers as used on the knee of Milwaukee milling machines. A high speed, formed concave cutter is used, and the holding fixture is arranged with clamping bolts as shown, each bolt binding two parts, as can be noted at the back portion of the fixture. The production time on this operation is 120 pieces per hour.

At a later operation, these parts, using the same attachment, are turned around ninety degrees in the fixture, when a slot is cut through the formed portion at the rate of 150 per hour.

The previous examples shown, also the present one, are all performed on

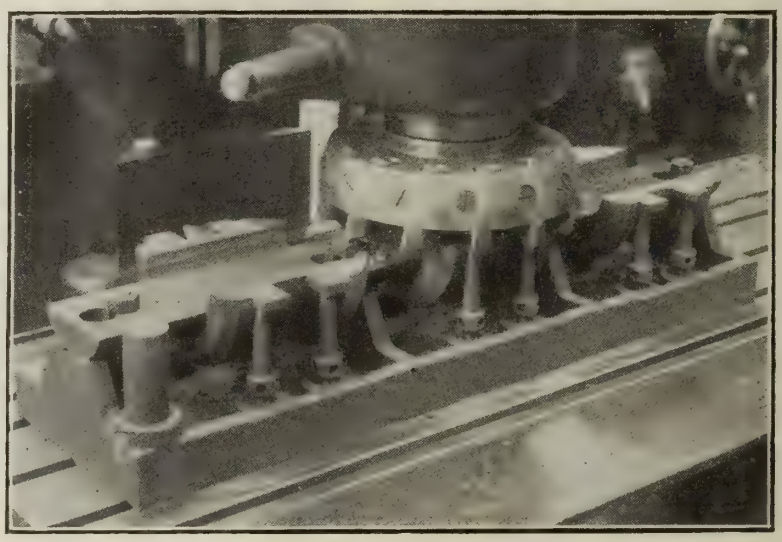


FIG. 7—MILLING HEADSTOCK CAST IRON BEARINGS.

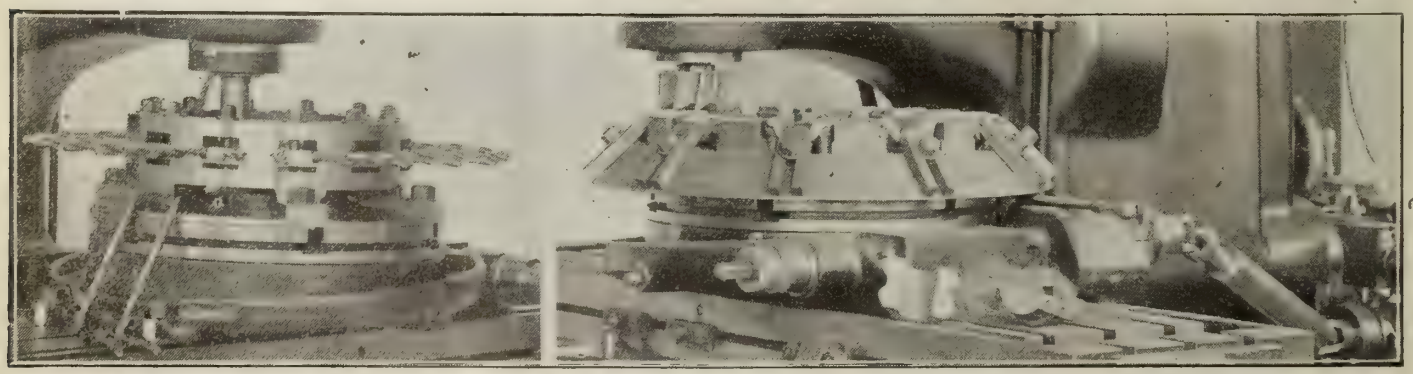


FIG. 3—MILLING TANGS ON DRILLS

FIG. 4—MILLING CAST IRON BEARING CAPS.

*Milwaukee milling machines, and in the case of Fig. 6 we see the method employed at the plant of the Mathias Klein Mfg. Co., Chicago, in milling the sides of pliers. The fixture shown is adjustable, it being possible to mill three different sizes of pliers in the same fixture. On the eight-inch pliers, shown in the photograph, 120 pieces per hour are produced. Formerly this operation was performed on a disc grinder, but due to the extreme toughness of the metal, the disc wheel would not stand up for more than 1,000 or so pliers. This was naturally too expensive, so milling was adopted, and the cutters at present complete over this amount without regrinding.

English Practice.

Next we shall consider a few typical examples performed on †Herbert machines, these being of English design. Fig. 7 depicts the milling of cast iron bearings for headstocks. These castings are later lined with babbitt, and the fixture shown takes three castings. It is adaptable for various sized bearings, the studs and clamping pieces being removable. In the operation shown, an inserted tooth cutter is used, the speed being 25 r.p.m.; the feed 5 3/16" per minute. The work is completed in one cut, the amount removed varies depending on the condition of the castings.

In the previous illustration, also the present one, it will be seen that the fixtures are mounted directly on the regular table, but as these two parts do not lend themselves to continuous milling, the reason for not using a rotary table is self-evident.

The operation at Fig. 8 shows the machining of the base and clamping down tongue on the sole plate of square turrets for capstan lathes. These pieces are drop forgings about 35 to 40 tons tensile strength, and in order to mill the dovetail portion and the base, three types of cutters are necessary, the cutters being changed without removing the work. A 3" inserted tooth face cutter is used for the base, with a feed of 5 3/16" per minute, while for the tenon, an end mill 2" diameter is used at the same feed. For milling the dovetail, an angular cutter is used at a feed of 3 7/16" per minute. Two parts, one partially completed, the other one finished, can be noticed resting on the machine table.

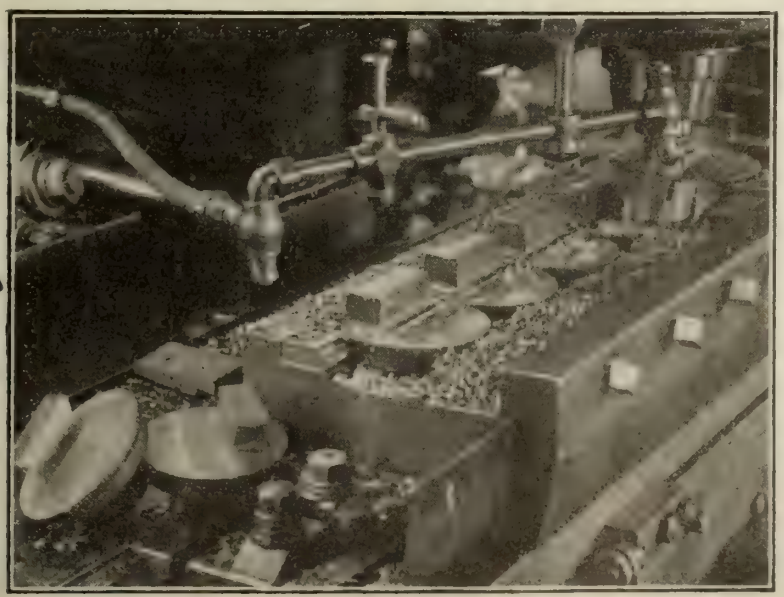


FIG. 8—MACHINING BASE AND CLAMPING DOWN TONGUES.

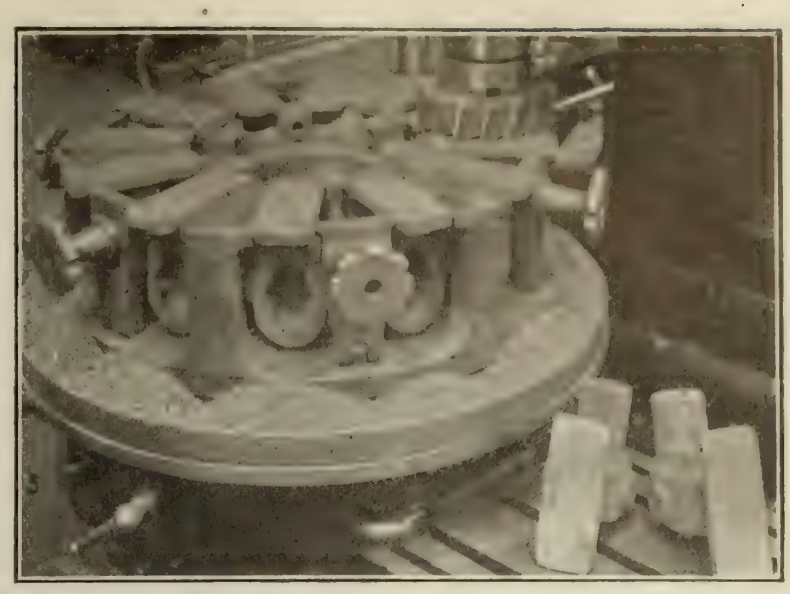


FIG. 9—MILLING BASES ON GEAR PUMP BODIES

Before proceeding to the remaining illustration, here are a few examples of work produced on these machines, but which we have not the space to illustrate.

In one case tee slots on cross slides were milled with a 2" x 5/8" tee slot cutter at a spindle speed of 93 r.p.m., and a feed of 2 3/4" per minute, from 250 to 300 castings being machined between grindings of the cutter.

Two other examples were the milling of stop rod brackets for turrent lathes, and a continuous milling operation on some pump covers. In the former operation, the parts are clamped directly to the table with ordinary clamps, and an inserted tooth cutter 4" diameter is used to mill the work. This cutter runs at 47 r.p.m., the feed per minute being 5 3/8". The latter operation used a 7" cutter running at 30 r.p.m., the output being 40 pieces per hour.

The last illustration, Fig. 9, shows a continuous milling operation, the work being the bases on gear pump bodies. The fixture, which holds ten castings, rotates under a 7" diameter cutter running at 30 r.p.m., and the work is completed at one cut. Of course no time is lost in machining, as loading and unloading takes place while the machine is in operation. The depth of cut varies from 1/16" to 3/32", the output being 40 pieces per hour.

To completely cover the field of usefulness of vertical millers in an article of this nature is impossible, for we can but scrape the surface of its possibilities. Such can be used for machining many types of small parts on various machines, such as sewing machines, typewriters, guns, etc., and in many instances you will find a complete line of vertical millers engaged in different operations on the production of machine tools, and small tool parts generally. The automotive industry has also found the vertical miller a valuable aid in the production of parts for automobiles, and in fact any phase of machine work has had a like experience. Of course this type of miller has its place, just the same as the horizontal type, and their work is independent one of the other, although in some cases work has been taken from a vertical miller to a horizontal type, and vice-versa. It is largely a matter of good judgment on the part of the plant engineer as to what style of machine tool best suits his purpose.

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The Selflock Nut & Bolt Co., Inc., East Syracuse, N. Y., have forwarded some interesting literature on their line of self-locking threads. They state that these threads areequal in strength to other threads and only differ in the shape of their cross sections. The base of the self-locking thread is deflected a few thousandths of an inch. Because of this difference in form, such threads have to be forced into engagement with standard threads, and the resulting friction has to be overcome when they are separated. This is the reason the makers claim they positively lock. These Selflock nuts are made for use on standard threaded screws. They may be used either side down, and if reversed when applied the second and following times, their locking efficiency will remain practically constant. These nuts are said to resist heavy and severe vibration tests, and are made in all grades and finish for every purpose.

Tools Used In Making of Precision Lathe

Interchangiability a Big Feature—Drilling Headstock—Milling Carriage Nut—Drilling Double Ball Cranks—Machining Lead Screw Bracket—Drilling Apron, and Other Operations.

By ROBERT MAWSON

THE making of a precison lathe is by no means an easy task. The very word "Precision" is a guide-post, and as the word implies, the elements that go to make up such a lathe must be made accurately. Interchange-ability is another essential feature, this in turn calling for special jigs, tools, and fixtures. We shall, in the matter to follow consider some of the special fixtures used.

It is highly necessary to show a photograph of the lathe itself, for practically every mechanic knows what a small precision lathe looks like.

The first operation on the tailstock, (on the particular lathe we are describing) is milling the base. The fixture used for this purpose is shown at Fig. 1. The casting is placed in the fixture and forced against the steel vee shaped locating blocks A; this being accomplished by the screws B. The base of the piece is forced into contact with stop C by means of screw D. It has been found that this method of locating and holding is very satisfactory. The fixture is held on the miller table in the usual manner, and a notched face cutter used for milling the faces.

The Headstock.

In drilling the head stock for a tee headed bolt a very simple fixture is used, and in boring out the headstock, the fixture shown at Fig. 2 is adopted. This boring operation is performed on a milling machine, and the piece is placed on the base of the fixture A, which it will be observed is made with similar ways to that used on the lathe for which the head stock is designed. The head is held on the fixture by means of a tee headed bolt which fits into the machined slot C. The two brackets D, also fit on the fixture ways, being held in position with tee headed bolts operated by means of handles, one of which is shown at E.

Bushings are provided in the brackets to guide the boring bar F, so that the hole will be machined parallel, and in correct alignment. It can easily be seen that all elements bored will be interchangeable as similar surfaces are employed to locate them, also the guide bushings are fixed as regards height from the milled face of the base. The hole is then bored out to 2 5/8 inches, leaving .002 of an inch for finish reaming.

The operations followed when machining the tail-stock are similar to those for the head-stock. The casting is first milled on its base using a suitable fixture to hold it. The spindle hole of tailstock is next bored, using the same fixture as shown at Fig. 2, but using different bushings to suit the bar ued.

The advantage of using the same fixture for boring both the head and tail stocks is that the locating surfaces being similar, also the guide bushing holes, the centers of both elements will be in the same height of plane from the lathe bed.

The nut to operate the carriage is made in two parts and the first operation when making this element is milling the base and later machining the joint surfaces. The two pieces are then placed in the jig shown at Fig. 3, the parts being held in the fixture by means of the four screws A, which are placed on a slight angle, and thus forcing the pieces down onto the machined base. The screw B is employed as the fixed locating pin, therefore the element at the left is tightened up first. The strap C is afterwards fastened by means of the nut shown and this assists in holding the sections in the jig.

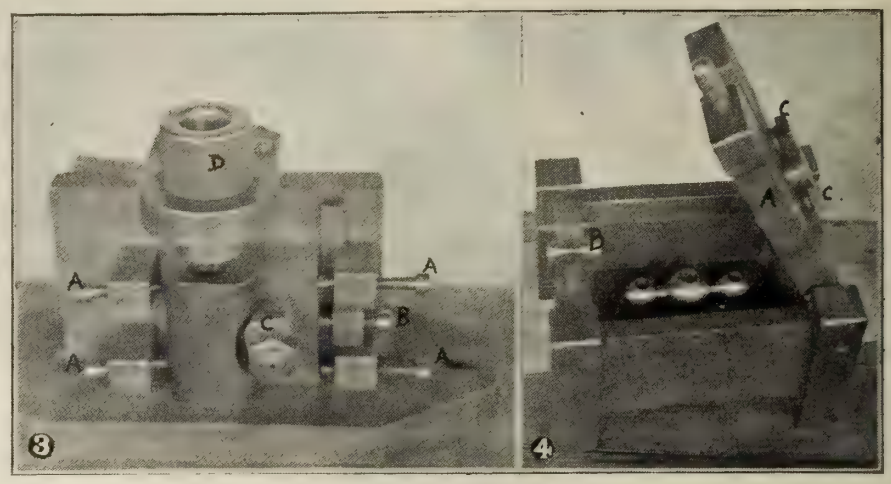


FIG. 3—JIG FOR DRILLING NUT.

FIG. 4—DRILLING DOUBLE BALL CRANKS.

The hole is first bored, the tool being guided in the long bushing D. This machined hole is then tapped with an Acme thread 5/8—8 threads to the inch, the split nut being 2 1/2 inches long. The tap is also guided in the bushing, so that the threads will be true and therefore move the carriage in a straight line.

Drilling Double Ball Cranks.

The illustration, Fig. 4, shows the jig used for drilling the double ball cranks. This piece is first turned to the proper shape and located in the jig by means of two cup bushings in which the two outer balls rest. The cover A is dropped down and fastened with the thumb screw B. The two screws C are next tightened, this action forcing the crank into the cup bushings holding it securely in position. Holes are drilled part way through the screws so that the drill will not come in contact with them during the machining operation.

A 5/16 inch hole is drilled, the drill being guided through the bushing in the cover. The jig is then reversed and two 1/4 inch holes drilled in the outer balls, the drill being guided in bushings placed in the base of the jig.

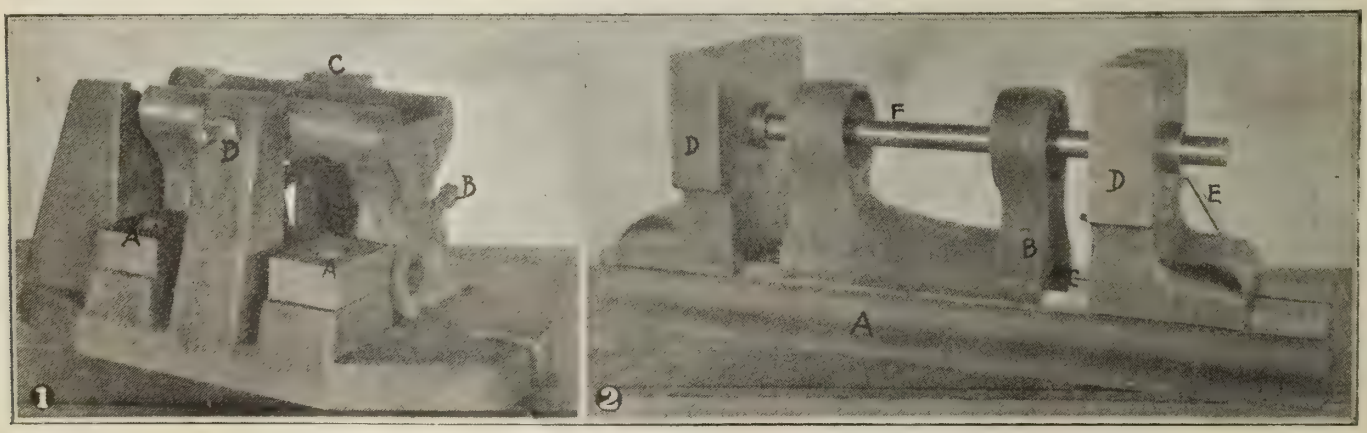


FIG. 1—FIXTURE FOR MILLING BASE.

FIG. 2—METHOD OF BORING HEADSTOCK.

The jig shown in Fig. 5 is used to machine the lead screw bracket. The casting has been previously milled on the joint face which is used to attach it to the lathe bed. The element is located by means of a stop at the left hand end. The screw A is then tightened, this forcing the casting back in the jig against a similar machined contour to that of the part. A 7/16 inch hole is now spot drilled and reamed in the piece, the tools being guided in the bushing B, and a ⅝ inch hole also spot drilled and reamed in the bracket through the bushing C.

It will be seen that this tool is of simple design, but it has the advantage of being almost fool proof as the man can see clearly if the piece is correctly located before commencing the operation. The drilling of the steady rest base follows the operation of milling the bearing surface that rests on the lathe bed, and the fixture employed for the drilling is shown in Fig. 6.

The casting is located by means of the machined base which is placed on a similar finished surface as shown and held in position by means of the bolt B, which fits in a hole which has been previously drilled. Two screws C are next tightened against the bosses of the element. The sliding member of the jig is next revolved on the pin D until the edge of the fixture comes in contact with the stop screw E.

A ½ inch hole is now drilled and reamed in the boss F, which is in a vertical plane. The block and screw E is then removed from the jig and placed into another location, which is hidden in the view shown. The sliding part of the jig is now swung against this new location. This brings the boss G into a vertical position when a similar hole is drilled to that made in the other boss. It will be noticed that this fixture is not provided with guide bushings, the men placing the holes in the centre of each respective boss.

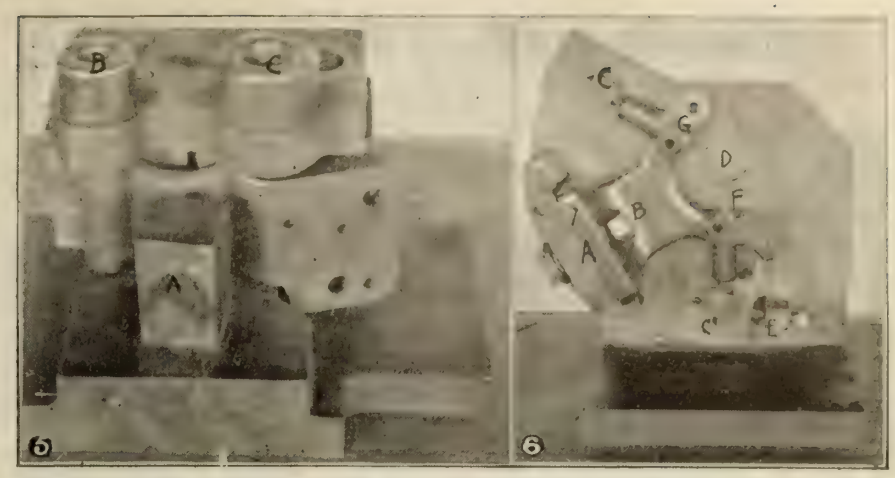


FIG. 5—JIG FOR LEAD SCREW BRACKET. FIG. 6—DRILLING STEADY REST.

Drilling the Apron.

The illustration, Fig. 9, shows the jig used when machining the lathe apron. This casting has been previously milled on its face to the proper outline and is located in the jig by means of the hardened steel block A, which fits accurately a milled recess in the piece. The cover is then dropped down and held with a thumb screw. Two screws are next fastened down on the element to hold it securely. The following holes are then drilled in the casting, each being guided through bushings to obtain the correct alignment:—Two 21/64" holes; one 9/16" spot drill and ream; one ½" spot drill and ream; one 25/32" drill; one 7/16" spot drill and ream, and one 1 9/16" bore, using a bar which is guided in the largest bushing shown. The latter hole s afterwards threaded with a tap 1⅝ inch 16 threads; this tool being also guided in the same bushing to obtain a well directed thread.

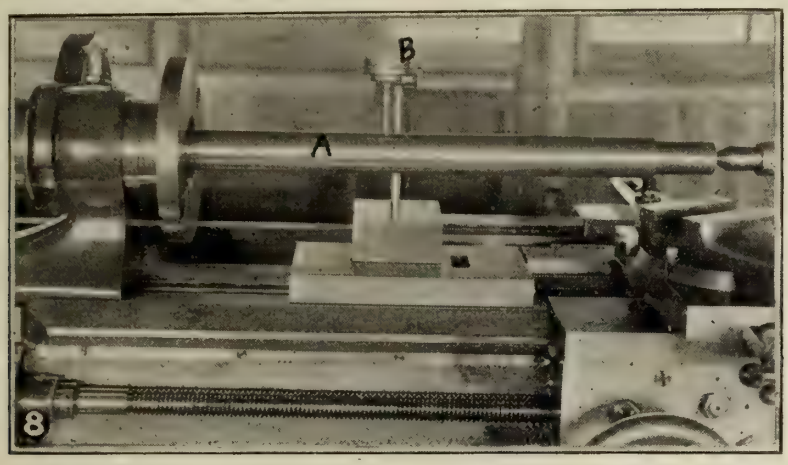


FIG. 8—SHOWING THE ALIGNMENT TEST.

Testing Alignment.

After the lathe has been finally assembled the head and tail stocks are tested to determine if they are in alignment. The method followed for making this test is shown in Fig. 8. The ground arbor A, which is made with the correct taper to fit the head stock, is placed as shown, fitting the head stock, and resting on a center in the tail stock. The arbor is revolved. The inspector moves along the dial indicator B, when he can read on the gauge if the arbor oscillates, which would of course prove that the heads were out of alignment.

Further, the error, if such is in evidence, can be ascertained at the two ends of the arbor, and if this be greater than called for on the specifications, the fault is rectified until the lathe meets the requirements. The advantage of this type of testing device is that the conditions are similar to those employed when the lathe is in operation for turning; fitting in the collet hole of the head stock, and revolving on the ordinary center at the tail stock end.

Other testing gauges used on the lathe are shown in Fig. 9. The block A is the tool used for testing one size

Continued on page 74.

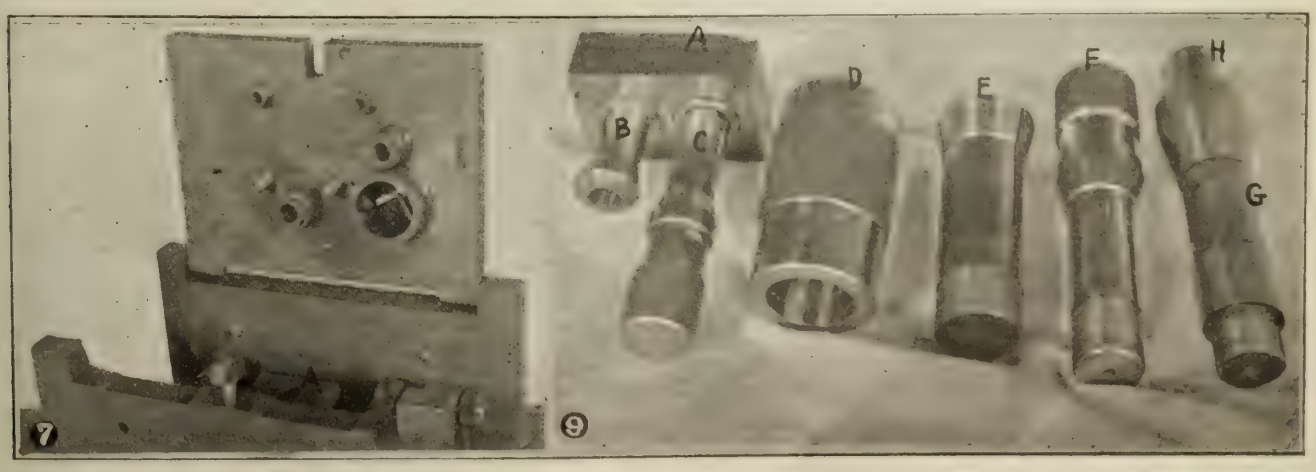


FIG. 7—JIG FOR LATHE APRON. FIG. 9—GROUP OF TESTING GAUGES.

Management Problems of the Small Factory

Comprehensive Plan of Procedure Essential—Factory Planning Should Originate in the Office of the President—The Factory Should Not Prepare the Master Schedule

*By ERNEST CORDEAL

THE difference between success and failure in business, and particularly in manufacturing, is frequently found in the presence or absence of a comprehensive plan of procedure. No one would think of starting to build a house until all of the details of its design had been settled upon and working prints prepared to guide the mason and the carpenter; no one would start upon a hunting trip without figuring in advance what provisions and ammunition would be required; yet only too frequently is a factory operated day after day and year after year with no more plan than is employed by a band of children at their play.

The importance of a plan may be illustrated by an actual example, disguised but not exaggerated, of a condition existing in one factory and fairly representative of the situation in many plants where no thought has been given to panning production. The product of the plant under discussion consisted of but one type of machine built in twelve sizes. A very few of the parts were common to all sizes, a few more were used on two or more sizes, but the majority while identical in design, were of different dimensions for each of the twelve sizes. The yearly and monthly requirements to fill sales orders were very regular and could be predicted months ahead with only a small percentage of error. Practically no finished stock of machines was carried, orders being filled direct from the shop.

Responding to a well executed advertising camaign the demand for the product of this factory was largely increased. The manager, who was a competent executive and salesman but knew nothing of factory practice, called upon the shop for a greatly increased output, at the same time giving the superintendent permission to increase his force to whatever extent he should deem necessary. More men were hired, double shifts were put on all the machines, wholesale orders for rough materials were placed and the foundry was placed on a twenty-four hour basis. The shop soon assumed the appearance of intense activity, every wheel was turning, material crowded the runways, the accountant complained that the inventories were showing enormous increases. But weeks passed and production had not been increased by a single machine.

After two months of more than double expenses, with nothing to show in the way of increased production and orders being cancelled by the score because of delays in delivery, the explanation of the factory failure was discovered. In the store room were found seven hundred finished parts, representing thousands of dollars in labor and overhead, for one type of machine, the demand for which averaged less than two a month. For the most popular size, which constituted more than thirty per cent. of the total sales, three thousand parts of one kind were found but of another part, a drop forging which was furnished by a distant factory, there was not a single one on hand, less than one hundred on order and six weeks required to secure delivery.

With finished parts in the store room sufficient in value to complete more than three months' production it was scarcely possible to furnish to the assembly floor enough material to keep it going a single day. The foundry had been taking off two heats a day for weeks and yet certain castings were entirely out of stock. Every machine had been working to capacity building up great stocks of parts which were not required or could not be used until other parts were finished. In some cases material had not been ordered for parts for which the final assembly department was waiting.

THINGS TO AVOID.

There is nothing which disorganizes a factory so badly, which causes a greater falling off in efficiency or which more surely contributes to losses than a shortage of certain parts or certain materials required in the completion of the product. When the purchasing department fails to keep the factory fully supplied with rough materials, an endless succession of expensive difficulties is started.

There is nothing to be gained by insisting that losses should not occur and by ignoring the possibility in planning the factory work. In planning, account should be taken of all losses which ordinarily occur in parts production and proper allowance made in issuing orders.

Incidentally it might be mentioned that a simple planning system introduced in this factory more than doubled production in less than two months with an actual reduction in the working force.

Where Planning Should Start.

Factory planning should originate in the office of the president in the form of a master schedule prepared several months in advance. This schedule should take into consideration first, factory capacity for the production of the various lines, types and sizes and second, estimates of the sales department as to the probable demand for the several articles.

The practice is sometimes followed of permitting the sales manager to prepare the master schedule, but this ordinarily is an error. The sales department is naturally interested in securing a large production of those articles which are most easily sold. The average sales manager is inclined to measure the efficiency of his department in gross rather than in net income and for that reason sometimes strives for volume without sufficient study of the relative profit realized on the various lines. Again the sales department rarely possesses, nor can it be expected to possess, a comprehensive knowledge of shop operating conditions.

Efficiency in the factory demands that the volume of production of the various lines be kept within certain limits so that machines and departments may be employed to the best advantage and kept as nearly as possible in a state of balance. The sales department, in its desire to increase gross receipts, is all too likely to ignore the effect which an unbalanced production program will have on factory costs.

The Factory and the Master Schedule.

It would be an equally serious mistake to permit the factory to prepare the master schedule. In this case it might be expected that the superintendent would outline a plan which permitted the greatest efficiency in factory operation without regard to the possibility of disposing of the product. Fortunately in most manufacturing organizations there is an official who is above and not directly connected with either the selling or the factory departments and he is the person who is in the proper position to tell the sales department what they shall plan to dispose of and the shop what they shall prepare to produce.

With the information which every executive should have at hand there should be no great difficulty in preparing months, or preferably a full year in advance, a schedule of production divided into weekly or monthly periods. In making such a schedule the wise executive will call in his sales manager and his superintendent and take advantage of their detail knowledge of conditions as well as secure their best cooperation in the carrying out of the plan by making them parties to its preparation. The minor executive who has expressed his opinion as to the feasibility of producing certain results will make a far greater effort to attain them than he will to follow out a program about which he has not been consulted. Such is human nature.

With a master plan before him the sales manager may proceed to outline his advertising and selling compaigns. He will, of course, endeavor to better the estimate of sales which the master schedule contains but in doing so he will, as nearly as possible, direct the energies of his force toward selling the items upon which the factory can make the greatest profit and toward keeping the sales closely in balance with the capacity of the factory for the various classes of product.

The factory superintendent, as soon as he has been provided with a copy of the master schedule, can proceed to line up the work of his entire shop. If the product is a complicated one requiring a large number of parts and sub-assemblies he will find it expedient to prepare shop and foundry schedules in complete detail. If, however, the product is one of comparatively simple units, containing few parts and requiring no long and complicated operations, a very simple schedule covering the daily or weekly output of the various departments may prove sufficient.

Ask for Bids Early and Avoid Delays.

If a separate purchasing department

* From *Industrial Management.*

is maintained it also will find it necessary to go over carefully the master schedule and to ask for bids on the material which will be required and place orders in ample time to avoid any possibility of delays to the factory. Not the least merit of the planning system is that, if properly followed out, it permits the utmost economy in the purchasing and carrying of materials. When no plan is prepared in advance the task of the purchasing agent is indeed a difficult one. He must either order materials in sufficient quantities to protect all possible requirements, in which case he is very likely to be criticized because of heavy inventories of rough material, or he must take chances of seriously delaying the work of the factory, and when that happens he is sure to find himself in trouble.

The actual procedure followed in planning will depend entirely upon the facilities which the factory offers in the way of records and reports unless it is considered worth while, as it will usually be, to introduce whatever additional system is necessary to complete production control. In a plant where a complete system of production orders and a perpetual inventory is in use planning in the shop is simply a matter of making use of the information at hand as to parts in stock and in process as a guide in the issue of orders to the several departments. With the master schedule as a basis a weekly or monthly chart may be prepared showing the number of parts or sub-assemblies of each kind required to complete the production for the period. The number of parts required less the number on hand and in process leaves the balance for which orders must be placed in the parts production departments. All production orders under a planning scheme are dated as to require time of completion.

Best Procedure for Small Factory.

Ordinarily in the small factory it should not be necessary to carry the planning beyond the point of giving to each department a detailed list of the work to be completed during a given period, preferably not exceeding a week. Where production orders are issued to all departments from a central office the placing of the dates required on the orders serves the purpose of a schedule for the several foremen. The effective plan will, of course, make proper allowance for the completion of parts and sub-assemblies in advance of the time when final assembly operations are scheduled to start.

Where a foundry is operated in connection with the factory the schedule for that department will obviously have to be dated several weeks ahead of the machine shop and perhaps a month or more ahead of the assembly floor. The purchasing schedule will also have to be made well in advance of the production schedule and in times when material is difficult to get or when deliveries are uncertain it may be advisable to put out purchase orders several months in advance of required dates. There is nothing which disorganizes a factory so badly, which causes a greater falling off in efficiency or which more surely contributes to losses than a shortage of certain parts or certain materials required in the completion of the product. When the purchasing department fails to keep the factory fully supplied with rough materials an endless succession of expensive difficulties is started.

Introducing a Planning System.

The factory which has not perfected its production order system will find it advantageous to do so when introducing a planning system. It may be feasible in some factories to operate effectively without the production order, depending upon a department schedule and the assignment of work by the foreman, but ordinarily the use of the production order to cover every job which goes into the shop is the only effective method of directing factory work. The production order system should, however, be as simple as it can be made.

FACTORY PLANNING.

Factory planning should originate in the office of the president in the form of a master schedule prepared several months in advance. This schedule should take into consideration first, factory capacity for the production of the various lines, types and sizes, and second, estimates of the sales department as to the probable demand for the several articles.

The actual procedure followed in planning will depend entirely upon the facilities which the factory offers in the way of records and report unless it is considered worth while, as it will usually be, to introduce whatever additional system is necessary to complete production control.

There is no necessity, except in the very largest plants, for an elaborate assortment of forms to be used for the different classes of work, nor is it necessary that the production order carry a mass of information which is a matter of common shop knowledge. In the very large plants it may be often advisable for production orders to carry complete instructions as to the operations to be performed and as to the tools and jigs to be used, but in the shops of moderate size where the work is largely a repetition day after day of the same operations there is no possible advantage to be gained by employing additional clerical help to put information which is perfectly well known to foremen and workmen alike on production orders.

Schedule of Output Affects Production.

The value of the schedule of expected output in guiding the preparation of production orders will be readily understood. When a central office, either that of the superintendent or a special production department, issues all the orders for the factory general supervision is greatly simplified and control of production is rendered more easily effective. The entire factory is of course, run for the benefit of the final assembly department and with the production system under central control the balancing of the work of all departments so as to bring together at the proper time and in the proper number all of the parts required for the completion of the scheduled product is made easily possible.

The perpetual inventory, if complete and accurate, is of the greatest assistance in conducting a planning system. If the material records show correctly and at all times just what quantities of parts are on hand in a finished state, in process and in the rough the process of planning parts production is made very easy. With such records it is only necessary to compare schedule requirements with stocks on hand and to prepare orders on the shop or foundry or on the purchasing agent for the additional materials either rough or finished which will be required.

It must be admitted with regret, however, that very few perpetual inventory systems function with sufficient accuracy to make them of any use in connection with planning. If the perpetual inventory is not absolutely dependable it should not be permitted to endanger the proper working of the planning scheme but rather should be disregarded in the preparation of schedules. If the perpetual inventory is not available then it is necessary at each period when a new schedule is worked out for coming months to make a complete check of stock to ascertain whether or not the necessary quantities of rough material are on hand, what number of finished parts are available and what quantities are in process.

Planning and scheduling production would be extremely simple if only it were possible to eliminate all uncertain factors from factory operation. As this is not possible, even under the best conditions, allowances must be made for irregularities which are of constant occurrence and certain factors of safety must be established and observed. In building a bridge or a steam boiler no engineer would attempt to follow a design which called for materials of only sufficient strength to withstand the computed stresses and strains.

Not All Losses Can be Eliminated.

It is undoubtedly true, theoretically, that all losses in the factory, through defective materials, poor workmanship, machine breakdowns and innumerable other causes should be susceptible to elimination, but even in the best managed plants this ideal is far from realization. There is nothing to be gained by insisting that losses should not occur and by ignoring the possibility in planning the factory work. Every foundry turns out some bad castings, the best mechanic occasionally spoils a job and there are various other causes why parts started through the shop do not reach the assembly floor in proper condition to be used or do not arrive there at all. In planning, account should be taken of all losses which ordinarily occur in parts production and proper allowance made in issuing orders. Many a good planning system has fallen into disrepute because no consideration was given to possible losses.

It is not at all uncommon, even in fairly well managed factories, for losses of as high as twenty-five or thirty per cent. to occur in the finishing of parts, particularly those made from castings. Few managers, except those who have a complete follow up system and use it, realize how high the percentage of loss in manufacturing operations is. Accurate records of losses should be kept as the first step in their minimization and incidentally to assist in keeping the parts production schedule in balance. Some factories observe the practice of filling out all orders to the full number at the final operation by running additional parts for those spoiled at any point in process. This is a good system when practical but in the small shop where every machine must perform various operations on a number of parts it is rarely possible to make up losses which occur after the first or second operation. The best system in such factories is to compute for each part the usual percentage of loss and to start each order with a sufficient

additional number over those required to make up the difference.

A factory turning out a product for which they also furnish repair parts has an additional problem in planning. It is not usually possible, except in the largest plants, to assign the furnishing of repair parts to a separate department but it is possible and should be made a practice to keep repair part orders separate from orders covering regular production. It is a very easy matter to determine from sales department records, provided the product has been on the market several years, about what quantity of each part will be required for repairs and orders can be placed in the shop at intervals to take care of such needs.

The actual procedure in the preparation of the production plan is a simple mathematical process. The master schedule obviously becomes the plan to which the final assembly department is expected to work. This schedule calls for the completion of a certain number of units of each kind during a given period. The superintendent in making his schedule for the shop starts at the assembly floor and works backward to the foundry or the rough material department.

Get the Assembly Schedule Uniform.

A practice which seems to be so common as to be almost universal is that of permitting the assembly floor to drag during the first part of the week or month and to crowd the greater proportion of the production into the last few days before the end of the accounting period. Such a method of operation should be discouraged by all means as it is obviously inefficient and as the hurry at the end of the period is unavoidably connected with a deterioration in the quality of the product. If an assembly schedule, assigning to each day its proper share of the production for the period, is prepared and adhered to it will be found that efficiency is automatically increased and quality of output bettered.

Theoretically a parts production schedule would be merely a list of all the parts required multiplied by the total number of units of finished product called for by the master schedule. In practice there must be some variation from this procedure. It is not always economical to run parts in so small numbers as would be needed to complete production for a single week or month. In the manufacture of parts on automatic or semi-automatic machines the time required to set up the job is frequently equal to that required to complete hundreds or even thousands of parts after everything is ready. In such cases it is obviously good practice to run several months, or years, supply of parts at one time provided, of course, that heavy carrying charges would not offset the saving in production cost and further that there is no danger of the design of the part being changed. Again the difference in the time required to complete the operations on the various parts makes it necessary to start parts of some kinds through the shop days or even weeks before other parts which go in the same assemblies need be scheduled.

The scheduling of work in detail, as is the practice in well managed large factories, is a desirable refinement of planning which may be employed to advantage in many factories of smaller size where the product consists of a complicated assembly, but in the average factory it is hardly necessary to go beyond the department schedule. The mistake should never be made of introducing any more system into a factory than is necessary to secure the desired results. Every form which a workman or foreman is required to make out should have its definite use, and that use should be thoroughly understood.

In the small factory the planning of the shop work can usually be handled by the superintendent himself or by a special assistant and it will be found that the duties and worries of supervising the shop will be minimized by the employment of a comprehensive schedule to cover the work expected from all departments. The ordinary factory fails of a high degree of efficiency mainly because of a lack of coordination between individuals and departments It matters little how diligently and intelligently each member of the factory force performs his particular task so long as the collective effort of all is not gathered as an effective whole into the completion of a product of good quality and economical cost. By means of planning the efforts of every member of the organization, from the sales manager and the superintendent to the man at the machine and the bench, may be made to contribute with full force to the desired result, more product and greater sales at less cost.

PROTECTING ALUMINUM

To protect aluminium and aluminium alloys from corrosion, L. von Grotthus has tried browning the metal electrolytically. The aluminium is suspended in an electrolyte consisting of a sulphur compound of molybdenum with a zinc anode at a temperature of 60° to 65° C. The aluminium is soon covered with a dark-brown coating, and may be bent or rolled without cracking the coating. Aluminium thus treated was immersed in a salt solution for two months without showing the slightest trace of corrosion.

DUST EXPLOSIONS.

Writing on the subject of dust explosions, in the Engineering News Record, Mr. David J. Price suggests that, in order to prevent high pressures from being built up within heavy concrete wall construction, consideration might be given to the use of a thin wall offering little resistance to the great volume of gases produced by the ignition of the dust. In such a building all the working stresses would be placed upon the concrete columns and beams, the walls serving only as a filler or curtain. Large window area, or the daylight type of building construction, affords another means of preventing high interior pressures. Recent explosions in two different lines of industry were localized as a result of this type of construction. Windows of the steel sash type, self-supporting and extending from the ceiling to the floor, would be preferable. Steel curtain doors have been used on the working floors of grain elevators. They can be opened during the day, providing good ventilation to the working floor and a vent for any explosion on that floor.

CIRCLE

Finding Diameter from Broken Section

It is often required to find the radius or the diameter of a circle from a broken section, or where only a portion of the circumference is available. It is a rule of proportion that the height of a sector is to half the chord as half the chord is to the diameter of the circle, minus the height of the chord.

Using the cut here shown this would be, in formula form:—

C D : C B = C B : C E

Case 1———15″ : 18″ = 18″ : C E

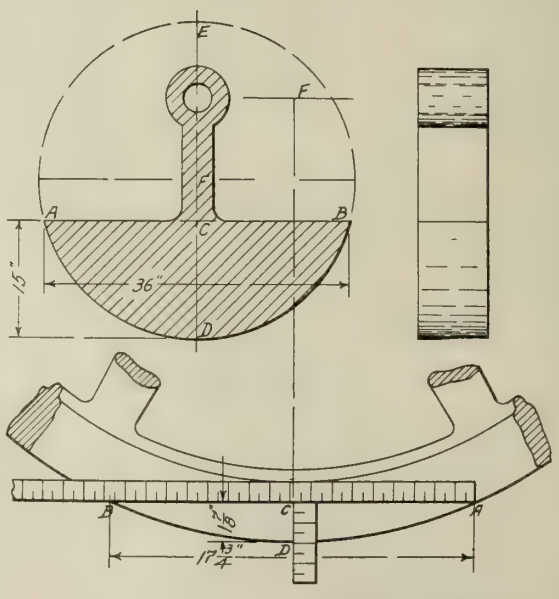
$$C\,E = \frac{18'' \times 18''}{15''} = 21.6 \text{ inches.}$$

Diameter = C E + C D = 21.6 +15 = 36.6 inches.

Radius F D = 36.6 ÷ 2 = 18.3 inches.

Case 2———1.875″ : 8.875″ = 8.875″ : C E

$$C\,E = \frac{8.875'' \times 8.875''}{1.875''} = 42.01 \text{ inches}$$



Canadian Machinery



WHAT OUR READERS THINK AND DO



PUNCH AND FORM DIE.

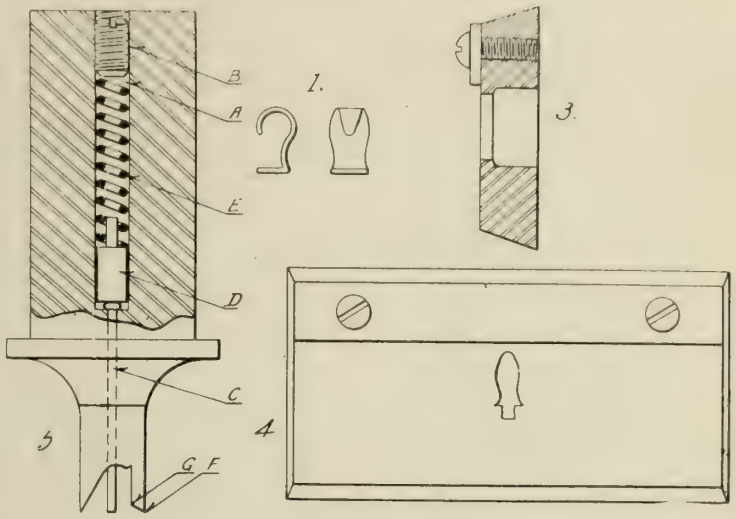
By C. E. H.

A very simple and efficient punching and forming die for making small metal parts at one operation, may be of interest to the readers of "Canadian Machinery," as the principles involved may be applied to various other shapes, and if a roll feed is used on the press the output is enormous.

The form shown in Fig. 1 is a cheap form of brooch catch and the number used of various sizes runs into tens of thousands, so that an economical means of production is an absolute necessity.

The die is of the shape shown at Fig. 2, and is made with 1" clearance out of about ½" material. The back of the die is cleared away to within about 3/32" from the face, Fig. 3. This is to insure each piece going clear through the die, as if one remained, the next would crowd on top of it instead of forming. This also facilitates the filling of the die, as very little metal is left for the die-walls.

The punch was made of 1¼" round annealed stock of the shape shown at Fig. 4. A ¼" hole was bored about 2" deep down the center of the shank (A), and tapped for about 1" down for a 5/16 grub screw (B). A smaller hole, as large as the formed portion of the punch will allow, is drilled from the other end to meet the large hole. This is for a stripper pin of drill rod (C) with a small head peened over to keep it from falling out. On top of this head is a small block (D) about ⅜" long, made to slide loosely in the larger hole, and a spiral spring of music wire (E) is placed behind it and the tension regulated by the grub screw (B).



SHOWNG HOW THE PUNCH AND DIE WAS MADE.

As the punch descends, the two outer edges begin to cut the metal and the inclined portion curls the piece being cut into the desired loop. The other leg cuts from F to G and then bends the work to a right angle, forming the base of the catch, and when the punch fully enters the die the whole is cut from the plate, and the stripper pin which has been depressed is released and pushes the catch clear of the die and so leaves room for the next to curl properly.

Several sizes of this type of die have been in operation in one shop for a number of years and have given constant satisfaction.

AUTOMATIC DEVICES NOT ALWAYS PROFITABLE.

(By L. George.)

In these days of mass production on repetition work the tool designer is frequently requested to make the fixture as near automatic as possible, so as to eliminate as much of the human element in its manipulation as it is advisable to do so. When this policy is carried to the extreme it is not surprising to see cases where time and money has been expended on tools and fixtures that are unnecessarily complicated. Some fundamental condition may have been ig-

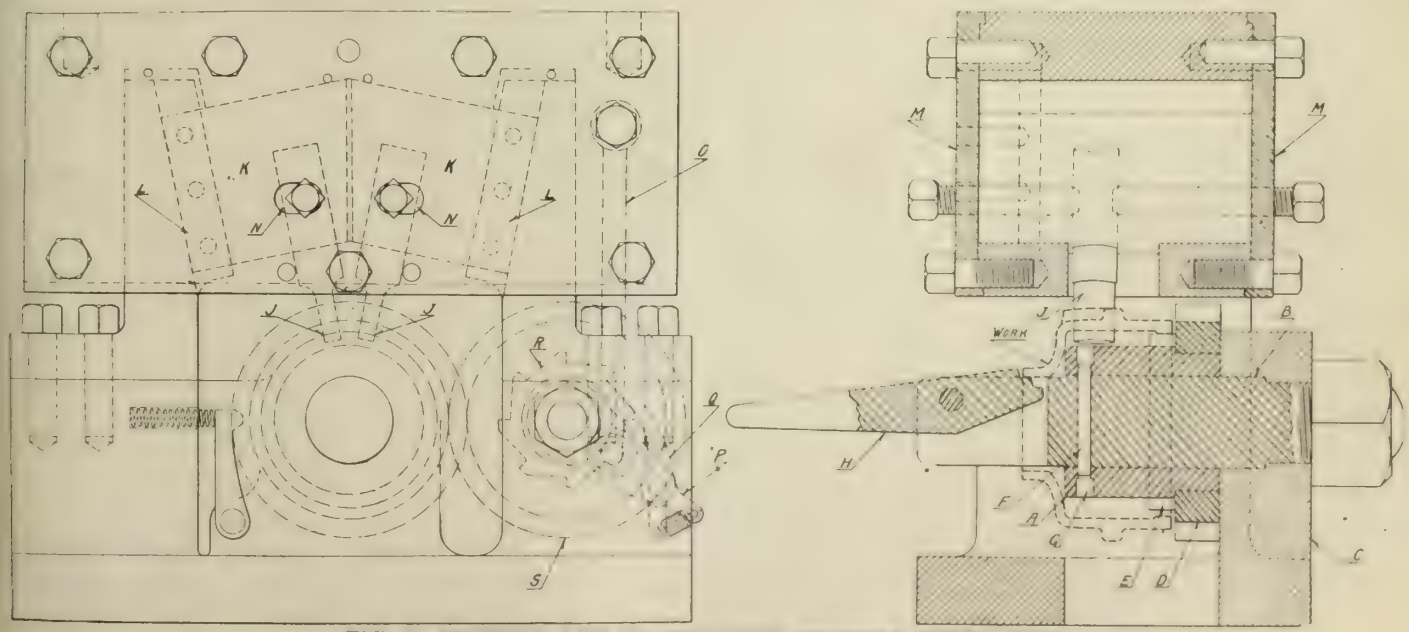


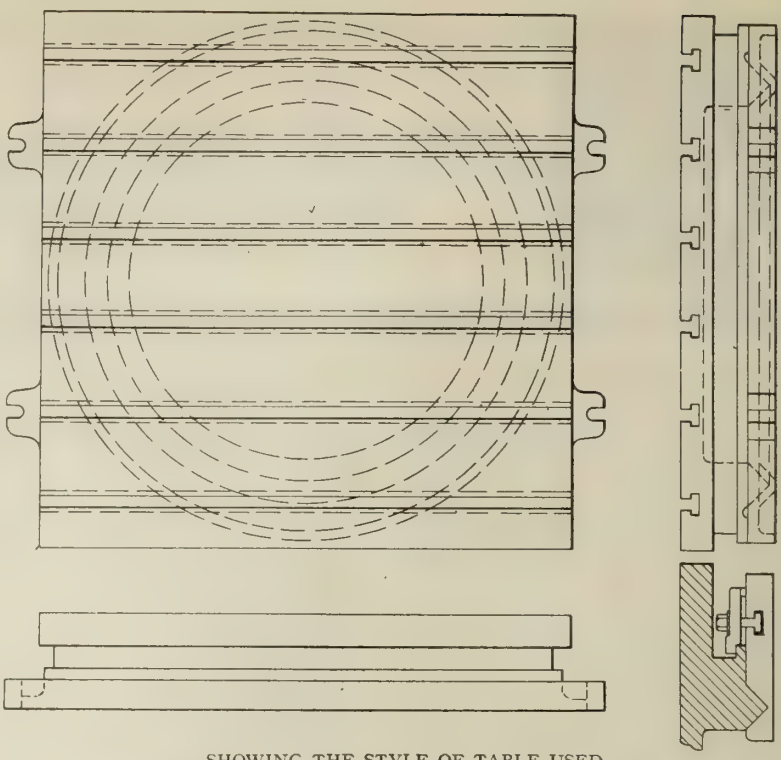
FIG. 1—SHOWING THE COMPLICATED FIXTURE FIRST USED.

nored and the designer overshoots the mark with too intricate an idea.

The accompanying article describes an instance in point. The operation was the broaching of spoke holes in a malleable iron hub. The piece, shown in Fig. 1., is slipped over the sleeve A, which can revolve on the center pin B secured in the bolster C. The sleeve carries a gear wheel D, the teeth of which is a multiple of the spoke holes, and which has projections E to engage with those of the hub. A pin F retains the sleeve in position by engaging with the internal groove G. A lever H in the slot of the horizontal pin keeps the hub in place and helps in its release.

Two radial holes are to be broached at each stroke. The punches J are held in separate blocks K, the latter being retained by means of dovetails in the inclined ways L of the bolster, so that the movement of the punches is radial to the axis of the hub. Cover plates M attached to the upper bolster have slotted holes N to permit of horizontal movement to the screws securing the punches. At the rear a rod O, attached to the upper portion, gives motion to an oscillating arm or lever P and pawl Q, which at each up stroke turns the ratchet wheel R and gear S, thereby rotating the sleeves and the work through twice the angular pitch of the spoke holes. A blunt catch engaging with the gear teeth holds the work ready for the down stroke. As can be seen from the sketch, the device was designed for the punching of two holes at the one stroke of the press, but owing to the pitch of the different holes varying to an uncertain degree, the fixture did not prove satisfactory, resulting in many broken punches and other difficulties.

The complicated fixture was subsequently discarded and replaced by one similar to that shown in Fig. 2. This does not represent the identical fixture but illustrates the idea which proves successful. Here the hub is placed on the pin ,rotated by hand, one hole being broached at a time. The machine may be run continuously and broaching and unloading is performed quicker than in the previous fixture, and the cost of the latter device was only a fraction of that of the first mentioned.



SHOWING THE STYLE OF TABLE USED

AUXILIARY TABLE.

(By John Homewood).

A very useful auxiliary table to be used on a planer for light work that would be difficult to reset when cutting a surface square with the first cut. The revolving part can be elaborated by graduating the cylindrical surface so that angular cuts can be taken. The drawing does not show in detail the stud that retains the parts together. In conjunction with an angle plate this revolving table can be used to great advantage in shops doing a general line of work where variety is predominant.

MAKING PRECISION LATHE

Continued from page 69.

of collet B, and the male gauge C is used for testing the hole in the head stock, both holes in the block being interchangeable. If the collet and gauge fit both, also the lathe, the desired conditions have been met. The ring gauge D is used for testing the collet E and is made a perfect counterpart of this element. The gauge F is for testing the hole in the headstock machined to suit the collet in question.

The concentricity of the machined hole in the headstock is also tested as a separate unit and the tool employed is shown at G. This is made with a ground surface that fits accurately the collet hole in the head, and after it has been placed into position the inspector tests by means of a dial indicator resting on the protruding end H, if the head stock revolves without oscillation, or in other words, if the hole is concentric.

Other gauges and testing methods are employed on the various elements but those described will show the reader the care exercised to not only obtain, but ensure an accurate precision lathe.

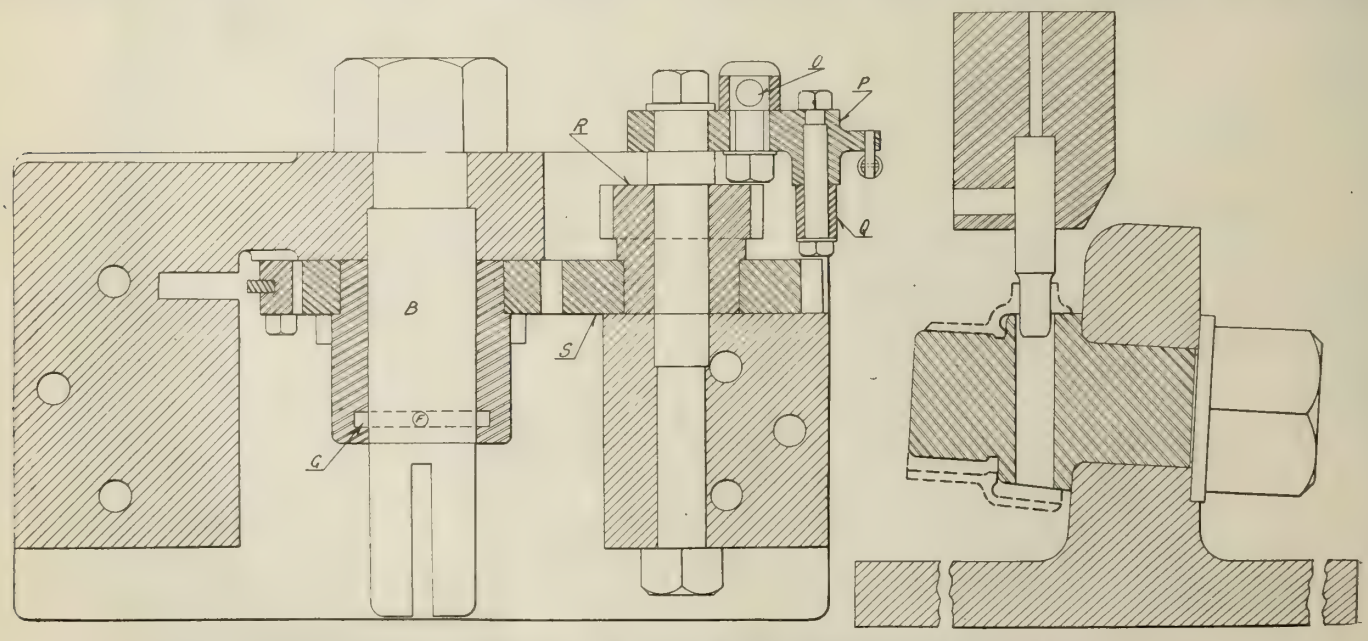


FIG. 2—A SIMPLE TYPE OF FIXTURE WHICH IS MUCH BETTER THAN THAT SHOWN AT FIG. 1.

The Brinell Testing Machine.—Some of Its Uses

By CHIEF CHEMIST ALFRED HERBERT CO., COVENTRY, ENGLAND.

THE Brinell method for testing the hardness of metals was introduced in 1900, and is now accepted by many as the most accurate and reliable hardness test for all classes of steels, and for most of the non-ferrous alloys. Apart from its laboratory uses, it is essentially a workshop machine and there are very few progressive firms dealing with the heat-treatment or extensive machining of metals which have not one of these instruments installed in the works. It is simple to work and when used with a knowledge of its capabilities it can control the heat-treatment of steels in particular more efficiently and more rapidly and economically to my mind than the older method of tensile testing.

The particular machine with which we are dealing has several distinct advantages. It is purely automatic and practically foolproof, giving absolute accuracy without requiring any exertion in applying the pressure. Being operated on the weight system, it has no oil leakages or gauge defects to guard against and attention has been paid to details which affect the output of the machine.

It is an established fact that the Brinell hardness numbers follow very closely the tensile strength of the same types of steel, whether the steel be heat-treated or otherwise. It is therefore particularly applicable to the rapid testing of parts for which it would be impracticable to take regular tensile tests, such as the majority of forgings and stampings, heavy shafts, etc. Where large quantities of steels are used in repitition work; charts may be made for each steel showing its various properties, so that the Brinell test after heat-treatment gives all the information required. This applies particularly to alloy steel which are generally heat-treated to give either hardness as the first essential or the maximum combined strength and toughness. In the first case, after quenching in oil from 800° to 850° C., the article is tempered at 200° C. This should give a Brinell number of over 400, and the steel is not machineable. The value of such a machine is evident, for, although 400 or over will be satisfactory for gears and parts subject to wear, 375 will be decidedly too soft.

In the second case, tempering is usually between 550° and 650° C., depending to some extent on the size and thickness of the parts. The qualities desired for shafts and parts subject to shock and torsional stresses are obtained when the Brinell is about 250 to 270, and in this state the steel is comparatively easy to machine. When the hardness number reaches 285, machining becomes difficult, and while the metal may still be cut at 300-320 Brinell, at a slow speed, this should never be necessary. A chart is usually built up from the properties of a bar 1-in. diameter, so that bars 8-in. or 10-in. diameter will not give quite the same results, particularly towards the centre. In a case of this kind, if the properties shown at 255 Brinell are required, it may be necessary to use a lower tempering heat which would give possibly 285 in the 1-in. bar. If much of this work has to be done, however, it is a simple matter to plot the tempering heat against the size of the bar, to give the approximate Brinell number required.

A Wise Plan.

Very often stampings are received by the user, which have to be machined at the first operation. In certain cases it is advisable to Brinell these to remove not only those that are too hard to machine, but also to detect any great difference in composition, and so prevent machining parts which would ultimately be scrap. When the stampings are to be heat-treated before machining there is no necessity to do this, but it is very important to test them after heat-treatment, and so ensure a uniform product passing into the machine shop.

The installation of such a machine has many indirect uses. Very soon each class of steel is given certain limits. When trouble is experienced it leads to the furnace temperature being more accurately recorded, or the composition of the steel is more closely specified. Any well-designed furnace, when properly used, will give a uniform heat, and this is easily indicated or recorded.

The carbon content of a steel when carefully made and allowing for slight segregation, need never vary more than .04 per cent. from the figure aimed at. The other important elements such as nickel, chromium, vanadium and manganese, which do not segregate to any extent, should come within quite narrow limits.

Once the steel is consistent and heat-treated within the correct temperature limits, the Brinell test is the only one necessary, and to my mind the only satisfactory hardness test for commercial work. The results are soon shown in the machine shop where maximum speeds can be used without danger of sudden stoppages, due to tool failures, and the number of complaints, valid and otherwise, as to difficulty of machining are very much reduced.

Necessity of Heat Treatment.

It is not only alloy steel which should be heat-treated. All carbon steel with over 0.25 to 0.30 per cent. carbon, are greatly improved after hardening and tempering, and in this condition can very often replace the more expensive alloy steels for parts not required with exceptionally high properties, and where the untreated carbon steel does not give a sufficient margin of safety.

It might be thought that for very soft steels used for casehardening, the Brinell test is of no value. This is by no means true, although a machine of this type is of no use for testing the hardened case, due to the core yielding under pressure, the "small ball" machine being more suitable. On the other hand it is very often most useful in detecting a steel not suitable for a certain machining operation. It may be taken that the softer the steel the more liable it is to rip and tear on machining, and that broaching is a worse operation for ripping, than milling, and milling worse than turning, especially if the cut be taken with the grain. So much depends upon the particular machine shop practice, the speed of machining and the condition of the tool, that figures can only be given with hesitation, but as a rule a steel will tear on broaching when the Brinell number is less than 120, and on milling about 100, or under. The elements on which ripping chiefly depends in very soft steels are carbon, manganese and phosphorus.

Phosphorus is intentionally kept in steel up to about 0.12 per cent. where the carbon and manganese are low, which has to be screwed or machined at a high speed, and where the parts are not subject to any great shock or strain. It has the same effect in cutting as a small amount of lead in brass or bronze. For steels for general casehardening work, the carbon and manganese are the most important elements, and, if only for machining, these should not be less than .14 per cent. and 0.60 per cent. and 0.80 per cent. A steel with the minimum figures specified by the Air Board S .14, with carbon 0.12 per cent. and manganese 0.50 per cent., especially if it has been normalized (heated to 850°/900° C., and allowed to cool in the air) or if the rolling has been finished at much over 800° C., will almost certainly give trouble in machining.

This applies more strongly to specifications for softer casehardening steels such as Air Board S. 13, where the carbon may be as low as 0.08 per cent. The Brinell machine, to my mind, is the only mechanical test of any assistance with these very soft steels, and if much trouble is experienced it can very often be overcome by its use alone. Where ripping is met with in higher carbon steels, it is usually caused by over annealing, either directly, or by piling at the rolling mills, and can generally be removed by suitable heat-treatment.

Casehardening Steels.

In the case of fractures of casehardened steel or parts broken say in straightening after hardening, a Brinell test on the core will always differentiate between a steel suitable for casehardening and a steel which is not. The Brinell number of the core of water-hardened bars 1-in. diameter and of the following carbon content is as follows:

Carbon per cent	Brinell No.
.10	107
.15	170
.20	228
.25	285

It will be observed that if the hardness of the core (when the part is 1-in. or more in thickness) exceeds about 250 Brinell, the steel may be looked upon with suspicion.

For non-ferrous alloys, the Brinell test is equally useful. Copper alloys harden severely when mechanically worked either hot or cold. In certain cases this hardness is removed by cooling from the forging temperature, but annealing is nearly always necessary. For example 60/40 brass stampings are usually annealed to give not over 80/90 Brinell, and in the annealed state the test gives an idea of the composition, as it varies inversely with the proportion of copper. So also in rolling 70/30 brass. This after cold rolling may be as hard at 160/170 Brinell, yet with

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The Influence War Had On Lathe Practice

Little Lasting Impression Has Been Made on Machine Tool Practice—Revolutionary Advance Occurred in Gauging, Inspection and Interchangeability. Continuous Production Ultimate Goal

By RALPH E. FLANDERS *

WITHIN the memory of the author, the design of machine tools has been deeply affected by a number of influences. The first of these was the bicycle craze of the nineties. An important result was the development of the hand screw machine in the direction of heavier drive and feeds and stiffer structure to meet the demand of work like hub forming. Another line of improvement lay in the design of highly specialized machinery for the making of a single part. Such machinery had been almost unknown up to that time, as the bicycle gave the first opportunity since Civil war days for continuous production on work of moderate size. Machines of this new type were applied to spoke and nipple making, hub drilling, chain-link manufacture, sprocket and gear cutting, etc.

The second great influence was the invention and development of high-speed steel by Mr. Taylor and his associates. The effect of this invention began to be strongly felt in the first five years of this century, and was the chief factor in a continuous policy of redesigning for cutting power and rigidity which has been going on until the present time.

Cutter Versus Machine.

Meantime the high-speed tools themselves have been improved, while the ability to treat them and, still more, the courage to use them to the limit, have been steadily developing. As a consequence there has been a contest between the machine and the high-speed cutting tool much like the classic rivalry between the projectile and the armor plate. As soon as a machine was designed to use high-speed tools to the limit, better tools were provided and speeds and feeds were demanded which were beyond the capacity of any known machine.

The last important influence was that of the automobile. This statement is made advisedly, as the war, so far-reaching in its effect on human life and history, made really little lasting impression on machine tool practice. A few special processes were fostered, such as thread milling and form grinding. A really revolutionary advance was made in gauging, inspection, and interchangeability in general. This was induced by the necessity for assembling together parts made in widely scattered factories. But the effect on machine tools themselves and their actual operation now appears to have been negligible.

If we study the influence of the automobile on machine-shop practice, we can see why this is so. The industry, long before the war, developed to the point where parts were made in such quantities that most of the operations could be made continuous, one machine or many being set up and tooled for a single operation on a single piece, remaining on this operation hour after hour, day after day, and month after month. In spite of the immense amount of machine shop work involved in the activities of the war, only a minor percentage attained to this standard condition of automobile manufacture. For the most part it was ammunition and small arms only that were made in continuous production.

Continuity of Production.

Now this condition of continuous production is the ultimate goal of manufacturing development. It demands and employs every last possibility in cutting qualities of steel, power and accuracy in machines; and particularly in skill in the design of fixtures, tool outfits, and methods of machining. The fact that this goal was reached so early in American automobile manufacturing explains why the war did not stimulate new developments in machine tool practice. but rather acted as a retarding factor on the whole.

The influences just described have affected all varieties of machine tools, but this paper is limited to a discussion of the lathe practice as affected by the automobile. By lathe practice is meant not only engine lathes, but turret lathes, automatic lathes, automatic screw machines, and other machines in which cutting tools act on rotating work.

For the moment, at least, machines of the best design are more than adequate to the demands of the best high-speed steel now available. Development has therefore taken entirely new directions, and this is a most favorable moment to examine carefully its progress.

Present progress in lathe practice is in two radically different and, to some extent at least, opposed directions. The one relates to the expanding of the machine by giving it a number of spindles with a corresponding number of tool positions. This is best seen in the multiple-spindle automatic screw machine, now used almost exclusively for standard bolts, screws and studs, and for other parts made in large quantities. It is more costly than the single-spindle automatic, but not much more complicated, the cost arising principally from the extreme accuracy necessary in the indexing and spacing of the spindles. The difficulty of obtaining this accuracy is the limiting feature of the machine, but its scope is constantly increasing.

As applied to larger machines for chuck work on castings, forgings, etc., the machine becomes more elaborate, approaching the conditions of a number of separate machines united on one base. This results in considerable complication and cost, but spectacular producing capacity in many cases. There is the further advantage that the tooling—being spread broadly over the different positions—is simple, open and easily adjusted to suit individual needs.

The second line of progress is in the direction of providing machines having a large surplus of driving and feeding power and of rigidity. The limitation on output and accuracy now becomes an entirely new one. Instead of asking, "What will the machine stand?" or "What will the tool stand?" we ask "What will the work stand without springing, breaking, chattering, or tearing from the chuck?" The engineering problem thus becomes one of operation sequence, support for the work, tool design, and—in some cases—design of the work itself. This second development may be described as the intensive, single-spindle method.

*The author, who is manager of Jones & Lamson Machine Co., Springfield, Vt., presented this matter before the recent meeting of the American Society of Mechanical Engineers at Chicago.

BRINELL MACHINE

Continued from page 75

suitable annealing this will drop to 40/50.

Copper again is a most ductile material and when fully annealed has a Brinell of 40-45. For machining or screwing long lengths this softness is sometimes a disadvantage, so that the metal is slightly hardened by the addition of a small amount of arsenic, silicon, zinc, etc. In the case of copper for electrical work, this is not possible, on account of the great reduction in conductivity, so that the metal is not fully annealed, but partly annealed to give say 90 or 100 Brinell. In this state it has the required rigidity without materially affecting its other useful properties. A Brinell machine is absolutely necessary for this kind of work, and there are many instances where it gives valuable information to the user, who, as a rule, quickly adapts it to his own requirements and if necessary makes his own hardness limits for the particular class of material in which he is interested.

It is only necessary to add that the output of a testing mahine is much greater if a small grinder is at hand to remove scale instead of using a file, and when suitable holders are made for parts of irregular section. The impression should be made where the strain set up does not weaken or damage the article. As a rule, the width of the impression should not be greater than the distance from its edge to the edge of the part under test, and it should be made where it is least visible on the finished product.

NEW PAMPHLETS.

The Brown & Sharpe Mfg. Co., Providence, R. I., have issued various instruction pamphlets, these covering the method of reading the micrometer caliper, both in English and Metric measure, also the methods of adjustment and care of these tools.

Another pamphlet describes the method of reading English measure verniers with 20 or 25 graduations. Either of these pamphlets are obtainable at no cost.

WOULD LIKE CATALOGUES.

Messrs. Menary & Wetherell have opened up a machine shop at Wetaskiwin, Alta. They have purchased the business of the Wetaskiwin Welding Works, and both partners have had a varied experience in American machine shops. They state that they would like to receive catalogues or offers of lathes, etc., from Canadian firms.



Paint as a Profit Getter

PAINT is one of the things that can add greatly, not only to the permanence of the building, but to its better operation. The illuminating engineer, the plant oculist, the painter, and the power-plant engineer all work toward the same end. A little white paint works wonders in extending the lighting area of every light source, and in throwing the light everywhere, including corners otherwise difficult to reach.

A machine placed in a dark corner of the room, near the end wall, and yet where the row of windows in the side wall ceases, was difficult to operate in safety and with good production. A lamp which hung near the machine toward the central aisle did not do a great deal of good. But when the side walls near the machine were painted white, the machine suddenly lost its distinction as the darkest in the room.

White paint, throwing light upon the darker machines, continues "Factory," means faster work by the operatives, less discontent at being assigned to unfavorable machines and better health of the operatives.

Light should be not only fairly bright, but should be equally distributed. Sometimes equal distribution is interfered with by the line of belts or cumbersome machines. In one factory room the design provides for excellent lighting from the windows, both in the side wall and the end wall, but a section of apparatus run by overhead motors and belts obstructs the light from the windows in the side wall. As men constantly have to come and go to these machines, a dark spot behind this apparatus was illuminated with the result that the work progressed better.

Sawtooth windows give the best illumination in many cases. But here again a little white paint helps spread the light more evenly. Painting white the surface of all posts and the ceiling, still further diffuses the light so that all parts of machines are evenly lighted.

Improving Old Buildings.

It is not generally realized that paint may be applied effectively to galvanized iron as well as other kinds of pipes. Heating pipes have their life prolonged by being painted, and the white paint also gives an appreciable extra percentage of diffusion of light as compared with the gray galvanized iron surface. Heating boilers and other boilers should also be painted white.

This practice is becoming quite general now, whereas several years ago nobody would have considered applying white paint to a black boiler or low-temperature furnace.

Large machines are also painted in many modern shops. In some cases white paint is used. In one shop a light tone of gray is applied to most of the machines, and certain depressions such as the central webs of pulleys are painted a dark red, which gives a pleasing contrast with the light gray. The difference in the illumination of the room is at once evident after even one or two of the neighboring machines have been so painted.

The most economic means of increasing the effectiveness of the central part of the room in an old building is by careful painting so that the center of the room shall be as well lighted as the other parts.

The aisle which runs down the center of the average factory department has any things along it which should be well lighted. The aisle itself is the line of traffic; collisions, or even scraping of trucks against one another as they pass should be avoided.

Tunnels for piping between buildings should be painted white, unless they are of fairly smooth concrete. This keeps pipe tunnels clean so that a repair man finds it easier to locate any and also makes it easier to work there. The pipes in the tunnel should also be painted, excepting, of course, the ones that are covered with asbestos. These colors should correspond to any color code that may be used throughout the factory to distinguish water, steam, drinking and sprinkler lines.

Concrete, iron, and wood may all have the same paint applied to them, for the mill-white paint now has been scientifically determined so as to be effective on all these surfaces.

White paint reflects the greatest percentage of light striking at any angles and from all sources.

It Pays to Keep Posted

TO preclude purchase difficulties and to keep myself in touch with the greatest number of developments in trade laws, transportation rulings and laws and conditions affecting purchases in this city and in others in which we are likely to have dealings," says L. Herzog in a recent issue of System, "I have my secretary keep a scrap book of news items which bear upon these subjects.

All the newspapers and journals, including foreign publications which are likely to contain information which should be brought to my attention, come directly to this office. After a few months' training I find it possible to leave the selections of the valuable news items entirely to my secretary She clips the items, puts them in the scrap book and indexes them under headings, such as "Loading," "Tariff," "Lighterage Rates."

In addition to these news reports, we include in the scrap book all reports, concerning market conditions and rate exchanges received from our agents in this city and in other parts of the world where the basic deals affecting our business are made.

There may be months at a time when no one uses this scrap book, but whenever there is the slightest doubt about any condition surrounding a purchase, reference to this scrap book has usually been found a help in clearing up the difficulty. Its value at just such times as this is sufficient to justify a great deal more expense than is required to keep the book up to date.

Bushing a Loose Pulley

MANY of us have had and are having trouble with the loose pulley. We neglect to oil it because it needs so much attention. It usually means that we must find a ladder and do some climbing and risk our fingers. This is all wasted effort it seems.

The other day, while visiting a garage, continues W. T. Elzinga in American Machinist, I saw a dry grinder with a tight and loose pulley on the spindle, driven direct from the lineshaft. It was rattling merrily at the rate of some 1,500 r.p.m. and without attention, except perhaps once a week or even less. The pulley was worn at least 1/32 in. large and would soon need a bushing. The dealer selling this grinder said that the price being low no provision for a good oiling system could be made.

Having received permission to make an improvement we took the spindle to our school shop, bored the pulley about 5/16 in. larger and turned a cast-iron bushing to a sliding fit for both pulley and spindle. We next drilled about a dozen ¼-in. holes in it, so spaced that they were not in line with the oil hole in the hub, filed several helical oil grooves between the holes, filled the holes with plugs of felt (we keep an assortment of old hats for such purposes), tapped the oil hole in the hub for an oilcup, assembled the spindle and put it to work again. It has been running now for several weeks and the owner is happy because its noise does not distract him any more and he can forget about oiling it.

We have in our school shop a dozen or so pulleys with bushings from 1¼ to 3 in. in diameter so treated and they are certainly a great improvement over the old style. We have eliminated several counters on account of this kink. It seems that this bushing slips around in the hub and turns about half the speed of the pulley, distributing the wear over pulley, bushing and spindle.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Readers no doubt missed the contest in June 30th issue, but the omission was unavoidable. Following are those with correct lists for June 9th issue: J. E. McCloskey, R.R. No. 2, Fredericton, N. B.; G. O. Nobes, Milton, N. S.; J. H. Wood, Toronto, Ont.; and T. Hurst, Brantford, Ont. Mr. McCloskey won in the elimination test. In the June 16th issue the following forwarded correct lists: A. Dickworth, car foreman C. P. R., St. Thomas, Ont.; F. E. Regan, and B. Back, both of P. B. Yates Machine Co., Ltd.; H. T. Osborn, Ottawa; and B. J. Murphy, Can. Link Belt Co. Mr. Dickworth was the lucky paper to be picked out. One reader asks if we ever use our own advertisements in the contest. Sometimes we do, but not as a general rule.

CONTEST FOR JULY 7TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something that works in a Brass Sleeve.
2—A machine that indexes accurately.
3—Something which is effecting trade relations.
4—How to decrease operating costs.
5—Something being done for convenience of customers.
6—A case where it makes no difference what you need.
7—Something that is said to have set a new standard.
8—How to reduce costs ⅓ to ½.
9—A case where three seconds is sufficient.
10—Something that can be used wet or dry.
11—A case where a small amount of money can be spent wisely.
12—Something packed with wisdom and knowledge.

These are Correct Answers for List from June 16th Issue:

1—Dodge Mfg. Co. of Canada, Ltd.
2—Alfred Herbert Ltd.
3—Can. Ingersoll Rand Co., Ltd.
4—Hull Iron & Steel Foundries, Ltd.
5—The Walton Co.
6—Cleveland Pneumatic Tool Co. of Canada, Ltd.
7—Ford-Smith Machine Co, Ltd.
8—Brown & Boggs Co., Ltd.
9—Canadian Link Belt Co., Ltd.
10—Murchey Machine & Tool Co.
11—Canada Metal Co., Ltd.
12—L. S. Starrett Co.

Closing Date for This Contest is July 28th



DEVELOPMENTS IN SHOP EQUIPMENT



LARGE TURRET LATHE.

The Alfred Herbert Co., Ltd., with Canadian offices at 1 to 3 Jarvis St., Toronto, Canada, have placed on the market their No. 20 combination turret lathe. To enter into detail regarding this large machine is impossible in the space at our command, but here are a few important points worthy of consideration. Those particularly interested can secure further data in the regular manner.

This lathe is very large, having a spindle capacity of 7 in. The turret is provided with power traverse in both directions, and all levers and handwheels are of ample proportions being conveniently located. Oiling facilities, wherever possible, are automatic, and the coolant system has received close attention.

In the headstock all the gears are of steel, the main spindle gear being of high carbon steel, and the sliding gears are made from chrome nickel steel. All shafts run on ball bearings. The head forms an oil bath for automatically lubricating the gears, and there are 16 spindle speeds forward, and a like number on the reverse. Each headstock is put through a special running test before being used.

An 18" pulley, running on ball bearings and driven by a 5-in. belt is employed for driving, this pulley running at 400 r.p.m. Special suggestions are made for individual motor drive if desired.

No countershaft is required with this machine, and the headstock has a positive friction clutch drive. These clutches are of the expanding toggle friction type. In addition to this drive, the machine is provided with a positive drive which is intended to be brought into action when taking heavy cuts on large diameters. This drive factor consists of two hardened steel teeth let into the face of the right hand and heavy drive steel spindle gear.

The distance from the flange of the spindle to the face of the turret is 72½ in.; so that quite lengthy work can be handled. This machine has many other features which we cannot discuss at length, but sufficient to say that every detail has been carefully watched, even to the guarding of moving parts. Some idea of the machine's general proportions can be gleaned from the fact that the 25 in. chuck used, weighs 560 lbs.

HIGH SPEED SAW.

The W. Robertson Machine & Foundry Co., Buffalo, N.Y., have placed on the market a portable hack saw that is intended for either hand or power-drive. It can be used as a general utility saw in the shop when fitted up with two standard legs, while by removing the front leg it is suitable as a rail saw for use on street railways, where the current is taken from overhead. The electric current is ordinarily taken from a lamp socket, but where it is not available, the machine may be driven by hand by means of the lever shown lying in front of the saw, after connecting the lever to pins on the crank disc and on the frame.

The machine has a maximum capacity of 8 in. and uses 17-in. blades. The motor is mounted on a bracket supported on the bed and drives the crank disk through worm gears running in oil. Gravity feed is used, and a lever engaging a stud is provided for holding up the saw while clamping the work.

The latest model of the No. 2 power saw has a draw cut capacity of 6 x 6 in., and the machine has been equipped with an oil lift of the type employed on larger machines made by the concern and intended for relieving the teeth of the blade from the work on the idle stroke.

The oil-lift device consists of a two-cylinder pump submerged in oil contained in the tank shown removed and placed beneath the machine. One plunger is timed with the crankshaft, the other being connected to the saw frame. At the end of the cutting stroke the plunger connected to the crankshaft is on the down stroke, which forces the oil under the plunger connected with the frame, thus raising the saw from the work. At the beginning of the cutting stroke, the pump timed with the crankshaft has just passed a port allowing the oil to escape, thus allowing the frame to lower while on the cutting stroke. It is said that the lift greatly decreases saw breakage. The machine is equipped with a swivel vise for cutting angles up to 45 deg. It is driven through a friction clutch and stops automatically when the cut is completed.

CRANK PLANER.

The Woodward & Powell Planer Co., Worcester, Mass., have placed on the market a crank planer said to be particularly adapted to forge and railroad shop work such as die blocks, rod straps, cross heads and slide valves.

The machine has a short rapid stroke, and it is adjustable for length by a removable crank operating a screw in the crank disc. Any length of stroke up to 24½ inches can be taken over any portion of the table, the position of the stroke being adjusted by means of a shaft on the front end of the table. This adjustment can be made while the table is in motion.

For angular planing the head can be swiveled to either side for angular planing and is graduated in degrees. Feeds for cross, vertical and angular travel are operated automatically by power or by hand. The machine can be operated by one pulley connected to a 4-speed gear box or the pulley may be replaced by a gear driven by a motor mounted on top of the gear box. The handle for operating the starting and stopping clutch also operates a brake for stopping the table when the clutch is thrown out.

PORTABLE GRINDER.

The Black & Decker Co., Baltimore, M. D., have placed on the market a portable electric grinder that is said to give the operator entire control over the tool.

While this grinder is essentially a portable electric tool, it is supplied with detachable base and adjustable tool rest so it can be used with equal facility as a bench grinder. Besides the base the equipment also includes two 5" x 1" grinding wheels, one fine and one coarse, a wire brush wheel, and a rag buffing wheel.

This machine has grease lubrication throughout, forced air cooling, chrome nickel steel gears and shafts and aluminum alloy housing. The entire mechanism is protected from dust and other foreign matter. A desirable feature is the fact that these grinders can be operated on either direct or alternating current at will.

NEW DRILLING AND TAPPING MACHINE.

The Cinicinnati Hy-Speed Machine Co., Cincinnati, Ohio, have introduced to the market an automatic drilling and tapping machine. The machine is of the unit type construction, the clutch, brake and initial driving gear being a separate unit supported by the top bracket. Power is supplied from a single-pulley direct overhead drive and a dry plate clutch operating with an external clamping adjustable air-cooled brake. By a single handle directly in front of the operator, the machine is started and stopped. Spindle speeds are controlled by a handle on the side of the column. All pulleys are of aluminum.

ADJUSTABLE DIE HEAD.

The Geometric Tool Co., New Haven, Conn., have produced a new style self-opening adjustable die head. These heads were designed primarily for B. & S. automatic screw machines. but are quite as well adapted to other automatics.

This style die head does not depend on the turret feed, but floats to suit the thread being cut. This feature is said to prevent stripping and shaving of the threads, making the usual close camming of machines unnecessary.

A lever trip reduces the force of tripping the die head, and buffer springs allow the head to yield slightly when the chasers come in contact with the work, this insuring a good smooth thread from the start. Two check nuts at the side of head provide adjustment of the point of tripping.

No face plate is necessary, this making it possible to use projecting chasers where required for cutting close to a shoulder. A closing attachment is located in a convenient position to strike

a stop on the machine, this automatically closing the die head when the turret revolves.

The chasers are supported by hardened keys which are said to prevent tilting and consequent cutting of taper threads. Four chasers are used. The die heads can be fitted with suitable shanks to fit the machine they are to be used on.

UNIVERSAL MACHINE SHOP RULE.

The rule, termed a "Universal Machine Shop Rule," has recently been placed on the market by R. Poliakoff, 709 Sixth Avenue, New York City, who is also the designer and copyrightee of same. The purpose of the rule is to enable any shopman, machinist, foreman, draftsman, designer, estimator, etc., to determine quickly and accurately, without making any calculations, the different elements in his problems relating to machining a bar in a lathe or grinding it in a grinder. The rule is very simple and it is said to take only a few minutes to learn how to use it. The following problems can be solved with its aid, using only one side of the rule for the corresponding problem.

1. Given diameter of bar and cutting or grinding speed; to find the number of revolutions. 2. Given diameter of bar and number of revolutions; to find cutting or grinding speed.

3. Given speed in feet per minute and number of revolutions; to find diameter (in inches) that can be turned or ground. 4. Given length of bar in inches, feed in inches per revolution, and number of revolutions per minute; to find time (in miutes) required to turn (or grind) the bar.

5. Given depth of cut in inches, feed in inches and speed in feet per minute; to find volume of metal removed. 6. Given speed in feet per minute and feed in inches; to find the area machined.

NEW CATALOGUE AND NEW TOOLS.

A new small tools catalogue, No. 28, issued by the Brown & Sharpe Co., has just reached our desk. This book has been improved considerably over former editions and in it are shown some new tools and improvements to machinists' tools, all of which will no doubt interest machinists and tool makers alike.

Here are a few of the improvements. The tempered hook rules, No. 320, and the narrow hook rules, No. 325, now have a hook of a new design. The hook is reversible, small, and is provided with a shoulder to assist in setting calipers and dividers. It is held squarely and firmly on the rule by a screw and cannot pull off, and yet is easily removed to permit use of rule alone. There are no loose parts to be lost. These rules are very convenient for measuring flanges or circular pieces, through the hubs of pulleys, setting calipers, dividers and work of similar character.

An improvement has also been incorporated in the combination squares and sets furnished with the centre head. The centre heads are now ground so that both arms are of equal length and the extreme points are both equidistant from the edge of the scale. This permits the use of these centre heads with work of very large diameter.

The Vernier calipers, No. 570, and 571, have also been improved. These calipers, either in English or in Metric Measure, read direct, that is, outside measurements are taken from a Vernier one side of the measuring bar and inside measurements from a Vernier on the other side. No additions or deductions are required. This also applies to the 10" Vernier height gauge, No. 585. Points are placed on bars and slides of the Vernier calipers for setting dividers, etc. These calipers are also obtainable with an English measure Vernier on one side of the measuring bar and a Metric measure Vernier on the other side, in No. 572.

New Vernier height gauges, No. 585, are also shown. The base of this gauge is proportioned to give rigidity without undue weight and extends beyond the back of the bar which gives additional stability. The gauges are made in two sizes. The 10" size can be furnished in either English or Metric measure to take inside and outside measurements. It is also made as a combination gauge reading to English measure on the front and to Metric measure on the back. The 18" gauge takes measurements outside the jaws. The bar is graduated to read, by means of a Vernier, to thousandths of an inch or fiftieths of a millimetre as the case may be, the graduations in each case being carried far enough along the bar to allow measurements to the full rated capacity being made. The readings with the English measure of Metric measure gauge are direct.

A new Thickness Gauge, No. 644, with blades longer than those on the regular line of thickness gauges also appears in this new catalogue. This gauge consists of nine blades, 3" long and ½" wide, of the following thicknesses: .0015", .002", .003", .004", .006", .008", .010", .012", and .015".

A new vise for toolmakers and mechanics is also shown. This vise is claimed to be a handy tool for use in drilling, fitting and laying out work on surface plates. It is case-hardened and the base is ground. It is also said to be light and convenient to handle, being frequently held in the hand during operations.

No. 753, toolmakers' vise clamp, is also a new tool shown in the catalogue, obtainable now from stock for the first time. It is similar in appearance to the other vise just mentioned, but it is not provided with the V groove in the base or the tongue on the jaw and corresponding slot. These vise clamps are said to be very convenient for holding work to be drilled, etc., and are often used in pairs.

CLAMPING DOGS.

The Cincinnati Engineering Tool Co., Cincinnati, Ohio, have placed on the market a line of special dogs for use on first operation fixtures. Some of these dogs are adjustable, while others are of the stationary type. The adjustable style are made of case-hardened machine steel, while the stationary dogs are made of hardened alloy steel.

The advantages of the method of holding the work by means of the dogs are said to be as follows: The fixture can usually be designed and built very cheaply, due to the simple pattern and small amount of machining. The fixture is easily cleaned, as there are no projecting walls which hold chips in it. The work can be clamped close to the finished surface, which is especially advantageous when work has a large rounding and is difficult to hold in any other way. The ajustable dog positively clamps work down on the locating points, and does not cause the trouble incident to the use of a setscrew on which the point is slightly eccentric; that is, lifting the work from the locating points instead of clamping it down.

A SAW SET.

H. Hedstrom, who is car foreman for the C. P. R., at North Bend, B. C., has forwarded to us for inspection a model of an improved saw set which he hopes to soon patent and place on the market.

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Canadian Banks Can Do Much To Assist Exporters

Importance of Adequate Banking Facilities—Methods of Financing Usually Classified Under Four Heads—Risk of Discounts—Question of Currency—Services Banks Can Render, and Other Points of Importance

"NO country is fully organized for export trade unless it possesses adequate banking facilities." These significant words, with their far-reaching meaning, were spoken by G. F. Towers, Superintendent Foreign Trade Dept. Royal Bank of Canada, in an address before the Canadian National Export Club at their recent organization meeting in Toronto.

"The methods of financing exports," he continued, "are usually classified under four heads: There is first the buyer who sends his remittance with his order. I am speaking purely from theory here, for I do not know of any such buyers, and I have never heard of any of them addressing mail to Montreal. There is next the buyer who obtains his goods on open account. This is mainly the case between buyers and sellers whose organizations are in some way connected. It may also be the case between people who have long done business with each other. I will not say any more about this method, because it is new business rather that we are all considering at the present time. We next come to purchases which are financed by the buyer establishing a confirmed letter of credit in favor of the seller."

"Now this is a very satisfactory method of doing business for any exporter. He is assured of receiving payment and knows if he conforms in detail to the requirements outlined in the letter of credit, that he will receive his money, and the transaction will be closed. Drafts drawn under confirmed letters of credit are cashed by the negotiating bank without recourse to the maker, who is thus relieved from all worry. The definiteness and unassailability of confirmed credits have received unmixed support from various high courts in the United States in recent cases, where buyers have endeavored to escape their obligations.

Normal Times Returning.

"Unfortunately in the normal times to which we are returning, only a proportion—probably a small proportion—of business is financed by means of these safe and attractive letters of credit. The financial end of the majority of export transactions is covered by drafts of the seller on the buyer, which the seller places with his bank on a collection or discount basis. Here we come right into the centre of the bank's functions in export trade.

"The main financial support given to exporters by the banks is through the medium of this discounting of the exporter's drafts on buyers in foreign countries. A certain proportion of drafts are sent through on a collection basis, but this involves the tying up of capital for some considerable period—a thing which most exporters do not want and cannot afford to do. If export business could only develop on that basis, then much export business would have to go by the board. We are taking stock at the present time of our facilities not only for keeping but for gaining new business during the years to come. What will Canadian banks do on the subject of discounts? What financial assistance are they prepared to give?

"I feel very strongly that the general ideas on this subject are not clear enough, and that everyone has not the necessary grasp of the principles which govern discounts—stamping one man's requests reasonable, another's unreasonable.

"Much trouble can come out of this. I know of one case where a Canadian manufacturer who had hitherto not undertaken any export business received a good order from a Latin firm in the South. Every bank report spoke favorably of this firm. The Canadian firm, therefore, accepted the order, and consented to draw at thirty days' sight. The goods required special manufacture. This was gone ahead with. Now we come to the unfortunate point in this transaction. The Canadian firm had not discussed the matter with its banker, who, when he was approached, was found to be unwilling to discount their draft. The Canadian firm could not understand it. They had read endless articles urging Canadians to develop export trade. They understood, and quite rightly, that the extension of moderate credit to buyers in other countries is necessary, and when their banker refused them his support, it seemed to them that one branch of our Canadian organization had failed them, and had left them in an exceedingly bad position. The answer is that the Canadian firm had overestimated their resources. Their domestic business was as large as they were entitled by their capital resources to conduct. And if, owing to their inexperience, or to the troubles which may arise in any transaction with a far distant country, the goods were refused, and the draft left unaccepted, the bank which had discounted it would have found itself in an unenviable position. True, the merchandise would have been under its control—but far off, and realizable on only at a loss which might degenerate into a sacrifice. And unless its recourse to the maker of the draft was productive of satisfactory results, this bank would find itself as creditor in a slow loan, instead of the possessor of a quickly liquidating security. It would be indeed lucky to come out of the transaction without a loss.

"Under whatever conditions discounts are made, some risk attaches to them. I do not care whether the bills are clean or documentary—whether the goods evidenced by documentary bills are staple merchandise or high-priced articles of luxury—the risk is there, though it naturally varies greatly. A bank will discount a client's documentary bills where it would not take his clean bills. It will discount his documentary bills covering wheat, where it would not discount them if they covered aigrettes or perishable foodstuffs. But it will never discount any draft unless the capital of the drawer warrants the assumption that he is able to stand any loss which might arise out of the transaction. There might be cases where a bank would not discount drafts to the full value of the goods, but would discount them if they represented only a certain percentage of the invoice value. This eliminates a certain amount of the risk. A bank discounts short term drafts more readily than long term drafts, for every day taken from the term of the draft lessens the chance of the occurrence of some unforseen event which would be productive of loss. A bank will discount drafts on good houses more readily than it will on those of less assured standing.

"But wherever we go, and whatever variations we find in the attractiveness of drafts from the discounting banker's point of view, we come back in the end to the fact that the client's resources are the bank's main security. Banks are trustees of their depositors' funds, and unless they are satisfied that they are incurring no undue risks they cannot let go of their money. I seem to have made a great many qualifications and reserves, but they are made for the sake of the clear understanding which is so necessary, and they should not obscure the fact that to the full extent of their powers Canadian banks are ready and willing to assist foreign business. I believe that the banking facilities that we enjoy in Canada in this respect are equal to any in the world. We have not the open money markets of New York or London, nor the rediscount facilities that some countries enjoy, but we have instead a centralized banking system which ensures that such funds as the country possesses

shall be available at the point where they are needed. And up to the present these funds have been adequate for our purposes. That being so, I do not think we have needed an open money market, one of whose chief virtues is that it attracts surplus funds from all over the country; in the case of the London market, from all over the world. No money market, however, will give up its funds for paper which does not bear the name of a firm with adequate resources. And anyone who could not discount his drafts with his bankers in Canada would find himself in no better position if he tried to sell his paper in New York.

"Misunderstandings are liable to arise on the subject of discounts, because opinions vary on the question of what legitimate requirements consist of. For that reason it is advisable for anyone who contemplates exporting, and who knows he will want to discount his drafts, to have a clear arrangement to that effect with his banker beforehand. Though this may seem obvious, the incident I have referred to a few minutes ago is witness to the fact that this procedure is not followed in all cases.

The Question of Currency.

"A rather controversial subject that I would like to mention is that of the currency in which drafts should be drawn. Many of our export transactions have been phrased in American dollars, and this has given rise to a certain amount of dissatisfaction among our customers. Certain importers abroad are familiar with the fact that a premium exists on United States funds in Canada and have a feeling that when they pay for a Canadian shipment in U. S. funds, the premium is an addition, and a considerable addition, to the profit of the seller. I believe that receiving quotations in American dollars is an advantage for them, and that if they clearly understood the situation they would not complain. England and the United States do a far larger business all over the world than we do, and sterling, and to a lesser extent United States dollars, are widely quoted and dealt in on all the exchange markets of the world. In any market where business is done on such a scale, you get quotations down to a very fine point. Now, if a drawee in a far-off country comes to cover a draft drawn in Canadian dollars, he is going to find, if he goes into the thing thoroughly, that the exchange rate which the bank will name is less fine than it could have given for sterling or U. S. dollars. The bank does not receive the up-to-the-minute quotations on Canadian exchange which it does on the others. Payment in one of the well-known currencies is entirely to the advantage of the buyer, and this fact should be emphasized.

"As far as the British West Indies and British Guiana are concerned, what I have just said does not apply, because Canadian bank branches in those places are naturally in an excellent position to sell Canadian exchange. To these places, then, our exporters should certainly send quotations in Canadian funds. The establishment of shipping connections between Canada and many countries of the world now makes it possible for our exporters to quote c.i.f. I am sure it is superfluous for me to point out how much more attractive it is for a prospective buyer to receive quotations c.i.f. his home port, rather than one f.o.b. some place or port in Canada. If he receives two reasonable offers, one c.i.f., the other f.o.b., it is ten to one that he will take the former, since he knows exactly what that is going to cost him, and does not have to waste time in figuring out the cost, insurance and freight from Canada to his country.

Services Banks Can Render Exporters.

"The next branch of the subject I have in mind is the service which banks can render exporters. First and foremost is the service of effecting collections. There is as much difference between good and bad collection service as there is between black and white. An exporter who entrusts his documentary drafts to a bank wants to know that they will be instantly forwarded to destination, and promptly presented for acceptance or payment; and especially he wants to feel that, if the draft is unaccepted or unpaid, the bank will deal with the goods intelligently according to his instructions, or cable for instructions where none have been given. If good service is not given in these cases, an exporter is liable to hear, some weeks after, that his draft is unaccepted, his shipment refused, and his goods lying on the dock incurring charges. I do not think Canadian exporters are liable to have things like this happen to them. Where Canadian banks have no branches they usually have excellent correspondents. I feel I must refer especially here to the British Empire. In every country of the Empire, Canadian banks either have branches or they have as correspondents the strongest and most prominent banks of the country concerned. This is important, because we are probably looking more to the wide fields of the British Empire for new markets than we are to any other territory.

"Another and very important service rendered by banks is the provision of credit information on foreign firms. No export shipment which calls for any extension of credit can be made to an unknown house. And it is undoubtedly most satisfactory to have the report on the prospective buyer come from a source which can be looked on as reliable, and whose views on strength and security can be regarded as conservative and coinciding with our own. The Canadian banks which have foreign branches abroad are naturally in a peculiarly good position to render credit information service covering the countries in which they are established. I do not want to stress any one bank too much, but I have to refer here to the information that the Royal Bank has on firms in the British West Indies and British Guiana, territories with whom this country has concluded a broad preferential agreement, and with whom we are conducting a steadily growing trade. In the Royal Bank we have reports on the vast majority of these firms already in our files, and it needs only a request to have us obtain full information on others. The Bank of Montreal, through its affiliation with the Colonial Bank, and the Bank of Nova Scotia, and Canadian Bank of Commerce through their branches, are also in a position to give Canadian exporters service in this respect. In general, your banks can obtain good credit information for you in regard to most firms in the world.

Information Department.

"The last branch of service I want to discuss is a more or less recent development. I refer to the establishment by the leading banks of special departments of information and service. In the United States and England they are very strong on these, and have found them exceedingly useful. Their advertised functions vary. For some you will see that they can supply the names of buyers in foreign countries, can give data on foreign markets, tariffs and conditions, and do various other things. I am of course prejudiced, but I think the best system is the one which avoids as far as possible giving lists of names, but tries instead to place sellers only in touch with buyers who would be interested in hearing from them. If a firm comes to us and says that it wants to sell such and such a thing in the British West Indies, or South America, for example, we give them our opinion on the possibilities, and we have our manager in the South get in touch with firms there, not to make any definite arrangements—for that is impossible—but to find out if the local firms are interested in hearing from the Canadian firm. If the matter is an urgent one, we can usually suggest some names without writing South, but anyone who is seriously thinking of commencing export business can usually afford to wait the few weeks which a letter and reply require. In general, we are prepared to render any reasonable service and fulfill any request. When I say reasonable, I mean almost anything, because we have not yet found that anyone has asked us something which

Continued on page 97

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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B. G. NEWTON, Manager
A. R.. KENNEDY, Managing Editor
J. H. MOORE, Technical Editor
T. H. FENNER, Associate Editor
J. H. RODGERS, Montreal Editor



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The Adolescent Attendance Act

THE Adolescent School Attendance Act is something which interests, or should interest, every Canadian manufacturer. Those responsible for the enforcement of the act have shown good judgment, for it will be brought into force by stages, and not at one wild jump.

Speaking on Section 3 of the act, which comes into operation on Sept. 1st, 1921, and which provides for the attendance at school of adolescents between "14 and 16 years of age," the minister announces that in conformity with this Section of the Act, pupils are expected to remain in full time attendance at school until they are sixteen years of age, unless employed on the authority of a home permit or an employment certificate as provided for by the Act, but that it is not his intention to instruct Attendance Officers to make the Act retroactive by endeavoring to compel young persons between 14 and 16 years of age who have been engaged in regular employment to return to school. School authorities, accordingly, will in the beginning be charged with providing only for the continued instruction of those who are at present at school, and not for the numbers who might be forced to return to school by the strictest interpretation of the Act. At the same time, he expects that the Act will be made fully effective to the extent that attendance officers will be appointed according to law and their Departments organized to ensure: 1.—That all young persons between 14 and 16 years of age shall be either at school or at work; 2.—That all those who are at work either at home or in gainful employments shall hold the permits or certificates required by law.

Section 9 which provides for the establishment and maintenance of part-time courses of instruction for young persons at work comes into operation on September 1st, 1922. The Minister expects that boards will be prepared to make this section effective on that date.

The enforcement of this Act, should without question, raise the standard of the young manhood leaving our public schools. The period between 14 and 16 is an extremely dangerous one, and with the influence of good leadership, our boys should leave the various halls of learning in a much better educated state at 16 than could possibly occur two years earlier. There may be a few who consider the terms of the act too strict, but these are sure to be in the minority.

Management Problems

THE difference between success and failure in business, especially in manufacturing, is often found in the presence or absence of some comprehensive plan of management. One would hardly start on a trip to the North Pole, unless many advance plans had been made regarding suitable clothing, provisions, etc., etc. It is a long jump from the North Pole to the manufacturing field, but the same condition holds good. If you want to produce some article successfully, and at a good profit, you must first lay your plans. Every operation must be studied out ahead of time. You must visualize the product passing through the plant, and wherever possible eliminate wasted effort. Even the routing of the part must receive careful consideration, for when a product is moved willy nilly all over a plant, the trucking expense mounts accordingly.

Standardization is perhaps the most important of all factors, for many dollars can be saved by designing the parts in such a way as to use them on various machines which you may be turning out. Then again, a part may be designed in such a manner that it can be produced on a disc grinder instead of a miller or planer, this relieving the larger and more expensive machines.

Shortage of certain parts must also be avoided. Nothing causes a drop in efficiency so quickly as a shortage of work. The operators instinctively slacken their efforts, and production drops.

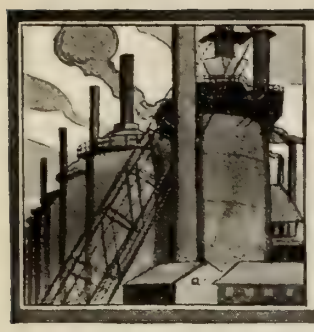
A master schedule should be prepared, and this followed out as near as possible. True, there may be slight deviations from the original, but no schedule made was yet perfect. The routing from the raw material entering the plant to the assembled product should be watched carefully, and if the plan has been mapped out intelligently, profits should show a decided increase.

A writer recently stated that to his mind such a master schedule as we speak of should be prepared in the office of the president, and where the gentleman holding this position is a practical man, we believe the idea an excellent one. Should the president however, be a business man only, he should see to it that the heads of his various mechanical departments are called in for consultation on the preparation of the schedule.

Aeroplane as Business Help

THE Aeroplane as a business help is becoming more common every day. At first, a few firms, after some sensational publicity, used an aeroplane to deliver spare parts for some machine or automobile in a hurry, but at best these incidents could be considered stunts.

A few days ago a contractor in Vancouver arrived at his office to find that he had until noon of that day to submit figures to be in the running for a big building contract. These figures, or at least the majority of them were in the hands of his partner, who was quite a distance from Vancouver, in fact was 68 miles north of Squamish, a place with no telephone communication. An aeroplane was brought into service; he got to his partner and returned with the figures before noon, incidentally receiving the contract. This may have been a stunt idea too, although it does not look like it, but in any case the usefulness of the aeroplane as a speed factor in business is clearly proven.



MARKET DEVELOPMENTS



Market Has Reached Bottom. Improvement Expected

When Things Get So Bad That They Cannot Get Any Worse—Well, Improvement Is Bound To Come. Orders Are For Small Amounts—Fewer Mills Have Closed Entirely Than Was Expected.

THE market has reached the stage where it is impossible to report any fresh dullness. July, as a rule, is one of the dullest months of the year in the steel market, but conditions during the past three months have been so poor that things cannot get any worse. The trade is rather glad that bottom has been reached, for when things cannot get any worse there is always a hope for improvement.

The Steel Corporation is operating at about 30 per cent., but it is impossible to give a close estimate on the independents, as each producing company is in a class by itself. Plant operations vary greatly from week to week. The best guess for the independents seems to be between 10 and 15 per cent.

Fewer mills have closed entirely than was expected. Most plants would lose less were they to cease work, but luckily the desire seems to be to give workmen as much employment as can be found for them. The plants that are entirely closed are chiefly small plants, having no orders at all.

A small lot of basic pig iron was sold by one steel interest to another at $20.00 furnace. Bessemer remains at $22.50 valley, a price established on single carloads. Inquiry for a larger lot would no doubt bring out a lower quotation. Foundry iron has dropped another 50 cents, being now quoted at $21.00 valley. Foundry coke is $4.25 to $5.00, depending on brand. Sales at the latter price are rare.

PITTSBURGH FEELS THAT BUSINESS HAVING REACHED BOTTOM WILL NOW IMPROVE

PITTSBURGH, July 7.—July and August are normally by far the dullest months of the year in the steel market. Now July comes without bringing any fresh dullness. Every week for two or three months past has brought reports of greater and greater inactivity, but now the trend seems to be broken. Of course one might rejoin that the steel market had grown so dull it could not get any duller, but that was just the condition the trade was hoping would develop, or when things cannot get any worse they are likely to begin getting better.

As to mill operations, moreover, it is doubtful whether they have grown any leaner. The Steel Corporation is said to be operating at about 30 per cent., and the corporation had such a rate early in June, there being afterwards a slight improvement. It is impossible to estimate very closely the rate of operation by independents as each producing company is in a class by itself, while at a given plant operations vary somewhat from day to day and greatly from week to week, so that it is difficult to strike an average even for a single plant. The best guess for the independents seems to be between 10 and 15 per cent., not that many plants actually operate at such a rate at a given time, but that there is complete idleness at times to balance operations at other plants or at other times at 20 or 30 per cent. This would give an operation for the whole industry of about 20 per cent., wihch would mean a rate of steel ingot production of about 10,000,000 tons a year. It does not look as though the rate will go below this.

Fewer mills have closed entirely than was expected. Most plants would experience less loss in closing entirely than in operating at present low rates, but it is desired to give the workmen such employment as can be found for them. Plants that are closed entirely are chiefly small plants, having no orders at all. Operating plants may close for a week or two at a time, as the supply of orders dictates.

Steel Prices.

The trade takes less interest in prices that may be going at the moment than in prospects for the future. Everywhere it is recognized that within a short time the market on an average will be well below the April price schedule, and it is thought that this is going to be the final shake-out in prices, at least for a few months or until there is a further and material reduction in costs. Prices made now are of interest chiefly by way of the possible suggestion they contain as to prices in future.

Naturally the Steel Corporation is the subject of rumors, as to what the corporation will do at this time or that. A favorite prediction lately has been that the corporation would reduce prices and wages about July 15. This may prove correct, but the prediction fails to take account of one very distinct possibility, that the Steel Corporation may for a time have not set prices at all, and if it has no set prices it has nothing to announce. There have been short periods in the past when the corporation had no regular prices, but made a quotation on each inquiry as it appeared, suiting the price to the desirability of the order.

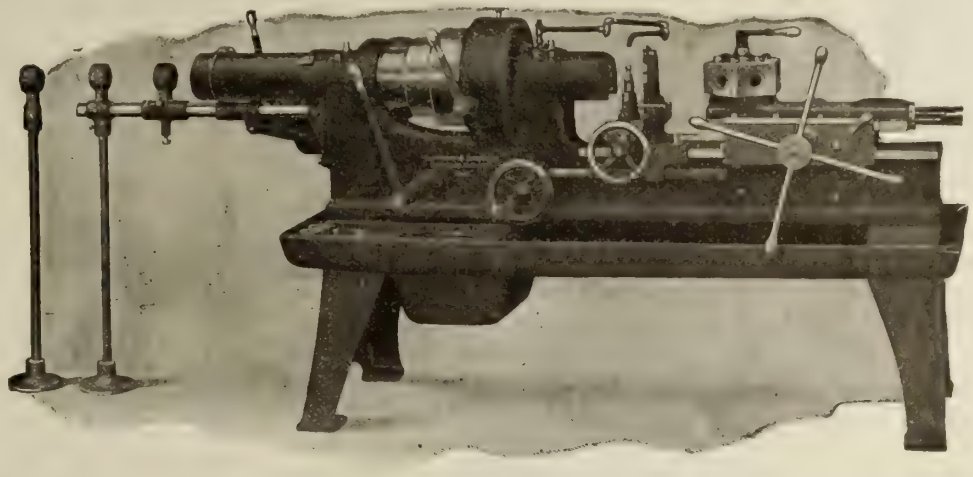
As a matter of fact, it is a question whether as to certain products the Steel Corporation has regular and rigidly maintained prices at the present time. The reduction in wire products of $5 a ton over a month ago and the reduction of the same amount in sheets a fortnight ago were not announced as specifically establishing the new quotations as regular prices.

Independents have been doing more shading in the past week, some of the low quotations being made only against specific inquiries, not representing re-

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For large output and close limits—If you are figuring on screw machine work you can depend on W. & S. machines being right for the job.

We can supply you from stock immediately.



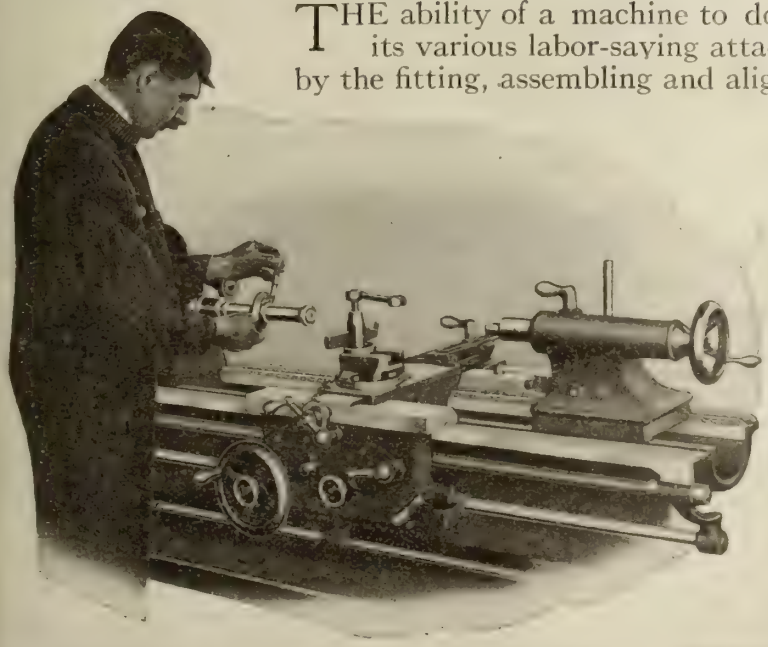
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WINNIPEG, VANCOUVER

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64 Front Street West
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HENDEY



THE ability of a machine to do its work well depends upon more than its various labor-saying attachments. It is governed to a large degree by the fitting, assembling and aligning of the various parts.

A careful and well rounded series of tests is made on each Hendey Machine before it is passed for shipment.

One of these tests — testing alignment of spindle with ways of bed on a Hendey Lathe—is shown on the left. A limit of variation of .0005 is allowed; but very seldom reached, between collar at nose and the one at outer end, and it must show large at outer end to offset possible spring of bar away from tool, and to favor hole in any boring operation running small at spindle end.

THE HENDEY MACHINE CO.

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Canadian Agents:

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LATHES—MILLERS—SHAPERS AND CENTERING MACHINES

ductions that the maker would apply to all inquiries. There is a report, which may be correct, that the Inland Steel Company took 7,000 tons of plates for tanks for the Sinclair Oil Company at 1.85c Chicago, when the April price was 2.20c, Pittsburgh, and the carload market of late has been quoted at 2.00c, Pittsburgh. Some of the low quotations made lately have perhaps been by way of experiment, to see if much additional business could be brought out by lower prices. The Steel producers have been claiming that price reductions would not stimulate business, in conditions such as have obtained, but that at some time a disposition to buy would develop, and then price reductions would help.

After occasional sales of galvanized sheets had been made at 4.50c, when the recent reduction put the price at 4.75c, one mill announced 4.50c as its regular quotation, and others have been following. This leaves black at 3.75c, making a spread of 75 cents per 100 lbs., the lowest spread on record, but zinc is at a lower price than at any time since 1908.

Soon after the reduction of $5 a ton in wire products, making plain wire 2.75c and wire nails $3, base, the spread for galvanizing was reduced from 70 cents to 50 cents, so that galvanized wire is now 3.25c, while with painted barb wire at 3.15c galvanized barb wire is 3.65c. Woven wire fence has been reduced 2½ points, equal to about $5 a ton, the new discount on carload and larger lots being 65½ per cent.

A steel interest in the valleys has sold a small lot of basic pig iron to another steel interest at $20, furnace, or 50 cents under the previous sale, and the market is now quotable at $20. Bessemer remains quotable at $22.50, valley, a price established on single carloads. Inquiry for a larger lot would no doubt bring out a lower quotation. Foundry iron has slid off another 50 cents, being now quotable at $21, valley.

Sales of Connellsville furnace coke to blast furnaces have been rare. Recently the market declined from $3.10 to $3, on sales of single carloads to miscellaneous consumers. Since then a sale of about 3,500 tons has been made at $3. This was to a furnace that had shut off shipments on a contract but desired to run another week before blowing out. Foundry coke is $4.25 to $5, depending on brand, sales of the brands held at $5 being very rare.

TRADE GOSSIP

The Ontario Legislature has voted $1,000,000 to provide for the erection of a provincial cement plant. According to F. C. Biggs, Minister of Public Works, it is intended to proceed with the erection of a one-unit plant having a capacity of 300,000 barrels a year. The object is to supply cement at cost for municipal development, but if the municipalities for any reason fail to place their orders with the Government, the provincial works would be capable of absorbing the total output of the factory, since it requires this amount each year to resurface roads. It is estimated that the municipalities outside of Toronto require from 200,000 to 300,000 barrels of cement a year, while in the city from 50,000 to 60,000 barrels are used annually. If the demand justifies it, the new cement plant can be extended into a two-unit one with a production of 700,000 barrels a year.

It is not the intention of the Government to enter into competiion with private concerns on the open market, but it desires to provide a reliable source of supply for municipal and provincial needs. The location of the plant has not yet been settled.

POINTS IN WEEK'S MARKETING NOTES

No fresh dullness can be reported, and as things have hit the bottom, improvement is looked for by the trade generally.

The Steel Corporation is running at about 30 per cent., while the independents are more around the 10 to 15 per cent. mark, although these latter figures cannot be quoted as authoritative because conditions in the various companies vary so much from week to week.

Fewer mills have closed entirely than was expected. Although most plants would experience less loss in closing, than in operating at present low rates, there is a desire to give the men as much employment as possible.

There is a rumor that the Steel Corporation will reduce prices and wages about July 15th. So far this is only a rumor and certain important factors have not been taken into consideration.

Sheets are dropping, black being 3.75c. Zinc is at a lower price than at any time since 1908.

A small lot of basic pig iron has been sold for $20.00 furnace. Bessemer remains at $22.50 valley, this price being established on single carloads. It is thought that a larger enquiry would bring out a lower price than this.

The market for Connellsville furnace coke has dropped from $3.10 to $3. Foundry coke is $4.25 to $5.00, the sales on the latter being very few and far between.

Big cuts in British iron and steel prices are announced. Scottish malleable iron has been reduced three pounds a ton but a comparison with the Belgian price shows that the British ore is sixteen pounds against £9 15s., while other continental and American steel makers are quoting pounds lower a ton than the British. It is expected that there will be another drop in the British price now that the coal strike has been settled.

Kingston Public Utilities Commission is going after the firm of Davis and Farnum, Waltham, Mass., in the United States courts to recover about $7,000 which the local commission through an error overpaid the American gas tank contractors on a big job done at Kingston last year. The company admitted the overpayment but has presented a revised bill, and offers $1,600 in settlement, which the commission refuses to accept.

The Northern Aluminum Company, Shawinigan Falls, Que., have received an order for seven hundred miles of three-quarter-inch aluminum steel reinforced cable, from the Victoria (Australia) State Electricity Commission, according to the weekly bulletin of the Department of Trade and Commerce. The line comprises six separate wires, hence the large amount required. It is anticipated that the whole quantity will be delivered in Melbourne by the end of the year.

Mr. A. J. Hollis, managing director, Bevan, Churchill Co., Ltd., merchants and bankers, London, England, says that his company are anxious to get in touch with Canadian manufacturers of agricultural implements with a view to representing them in Europe. This concern has a branch office in the Bank of Nova Scotia Building, St. James St., Montreal, and those interested should write Mr. F. M. Raphael, who is manager at this Canadian office.

The Canadian Association of Stationary Engineers concluded their 32nd annual convention at Ottawa on June 30th. The following officers were elected for the ensuing year:—Past President, R. O. Leach, Toronto; President, F. Harper, Kingston; Vice-President, H. Wright, Montreal; Secretary-Treasurer, L. J. Ellis, Hamilton; Conductor, G. F. Galloway, London; Doorkeeper, R. E. Rodney, Ottawa.

At a special meeting of the Canadian Consolidated Rubber Company, Limited, approval was given to an increase in the number of directors from fifteen to sixteen and some changes were made in the personnel of the board. R. E. Jamieson retired from the board at his own request and was succeeded by J. A. Connor who will be director in charge of sales.

The additional place on the board was filled by the election of George W. Charles as director in charge of manufacturing. The two new directors have both been connected with the company for some years.

The Dominion Government has placed an order with the Algoma Steel Corporation, Ltd., for 50,000 tons of rails, which will be used on the Canadian National Railways. The plant at Sault Ste. Marie is busy at work, two thousand hands being employed. It is estimated that the work will take about two months to complete.

Right on the Lead

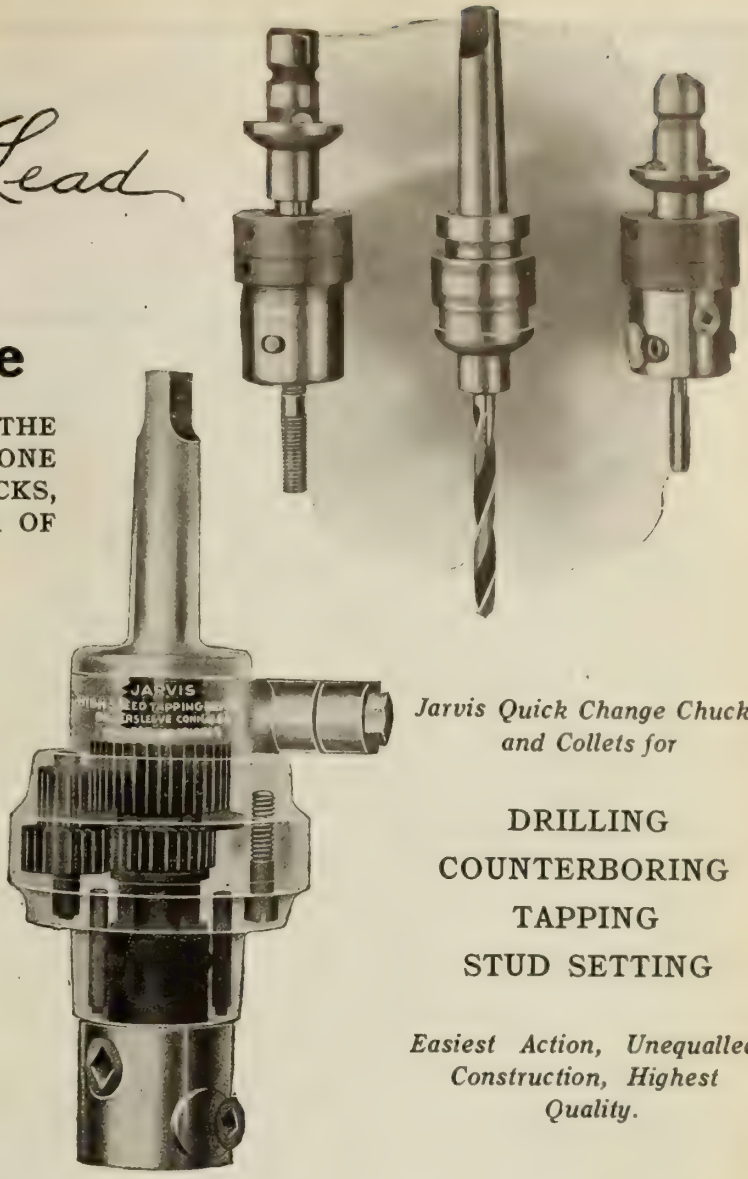
Make a Turret Lathe of Your Engine Lathe

JARVIS COLLETS CONVERT AN ENGINE LATHE INTO A TURRET LATHE BY SIMPLY USING ONE OF THE JARVIS QUICK CHANGE CHUCKS, WHICH ALLOWS THE USE OF ANY NUMBER OF DIFFERENT TOOLS.

Acquaint yourself now with Jarvis High Speed Tapping Devices and Quick Change Chucks and Collets

The booklet will be a worthy addition to your Mechanical Library—It is interesting—It is free—It is yours for the asking—

The Jarvis High Speed Tapping Device is superior to any other. It has a ball drive and ball reverse, making easiest action, with no clinching or binding. Reverse motion faster than the drive. Specially designed Chucks make special taps unnecessary. Tap breakage reduced to the minimum. It makes no difference whether the tap is forced against the work in a Drilling Machine, or the piece is pushed towards the tap in a Speed Lathe. Two Styles of Chucks. Seven Sizes of Tappers. Range of Tapping from 0 to 2″ inclusive.



Jarvis Quick Change Chucks and Collets for

DRILLING
COUNTERBORING
TAPPING
STUD SETTING

Easiest Action, Unequalled Construction, Highest Quality.

Jarvis Tappers and Quick Change Chucks and Collets are Developed to such a degree of perfection that the Geometric Tool Company recommends and furnishes them as a fitting adjunct to their line of Threading Tools.

Where one hole is drilled, reamed, counterbored, tapped and a stud set, or any two of these operations are done with one spindle, the Jarvis Quick Change Chucks pay for themselves in a very short time. Changes are made without stopping the Drilling Machine or Lathe.

There is no burring from constant use to interfere with the easy entrance or operation of the Collet.

Jarvis Quick Change Chucks and Collets consist of a chuck or locking member and a sufficient assortment of Collets for any job. Any Standard Drill Chuck can be fitted to the Morse Taper Collets.

Combination Tapping Device and Quick Change Chuck

In place of the regular chuck, the Tapping Device is equipped with a Quick Change Chuck, forming a Combination Tapping Device and Quick Change Chuck. This is the combination much in demand.

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NEW HAVEN CONNECTICUT

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



METRIC SYSTEM NOT IN FAVOR

Introduction and Adoption of System a Different Matter. Not the Success Some Advocates of the System Would Have You Believe.

"Commerce Reports" as far back as June 29th, 1920, printed a report from Constantinople by Consul General Randal on the "Use of the Metric System in Turkey."

In view of the present agitation for the compulsory use of this system of measurement, some parts of the report are of timely interest to both manufacturers and machinists. According to figures the Turkish Government adopted the metric system as the official standard in 1915. The date is significant, for at that time German influence was paramount in Constantinople.

Evidently it was the desire of the Government to make this the exclusive system of weights and measures, but so far, outside of official circles, the metric unit is little used. In fact, in the interior, the system is practically unknown, and it is doubtful if it will be popularly accepted for many years to come, if at all. The people find the new system very much simpler from a mathematical point of view, but its units are meaningless to them until converted into the units of the old system, for the decimal system as applied to potatoes or sugar cannot be kept constantly before the mind as can the decimal system as applied to money. It is therefore infinitely more difficult to learn and the attempt to introduce it has been productive of no little confusion.

The question may be asked: How can the people find the new system much simpler if to them the new units are meaningless? It is noteworthy that the "adoption" of a new system is by no means equivalent to its "introduction." Emphasis is laid on a long transition period; the words "if at all" sound rather hopeless. The difficulty of becoming sufficiently familiar with the system, in order to use it, is brought out and the "confusion" caused by the use of two systems is emphasized.

INTENSIVE SELLING CAMPAIGN PLANNED

A significant step after business has been taken by the formation of a so-called "Sell Now League." This campaign is in the interest of intensive selling and it is hoped to enlist every manufacturer and merchant in the U. S. for the purpose of spreading the doctrine of selling as an economic aid at the present time. The committee includes Francis H. Sisson, vice-president of the Guaranty Trust Company; Senator Nathan Straus, Jr., Joseph P. Day, Jules Bache, Senator Arthur Capper, John Willys, president of the Willys-Overland company; E. C. Patterson, president of the National Cash Register Company; B. C. Forbes and J. Mitchell Thorson, chairman.

Here is an idea that could well be adopted by Canadian manufacturers in general.

GERMANY CAN UNDERBID CANADA

Machine Tools Can be Made in Germany For Less Than in Canada, Britain, or United States. Reasons are Shown.

It is now a recognized fact that Germany is underselling both Britain, Canada, and the United States in outside markets, notably in machinery. How can they do it?

The First Federal Foreign Banking Association points out that in the five chief elements in the price of a manufactured product Germany has the best of its competitors. These are:—Raw materials; labor; capital; management; overheads, and profits.

The following tables, which were based on conditions in Germany last fall, tells the story. The figures are given in marks, converted into gold on the basis of dollar exchange.

	Wages Per Week.* Marks.		Dollars.	
	1913.	1920.	1913.	1920.
Cabinetmakers ..	43.30	336.00	10.29	5.37
Patternmakers ...	39.00	228.00	9.28	3.64
Carpenters	44.28	216.00	10.58	3.45
Electricians	39.15	204.00	9.32	3.26
Plumbers	40.50	220.00	9.64	3.52
Bricklayers	44.28	216.00	10.58	3.45
Clerks	40.00	190.00	9.52	3.04
Stenographers ...	40.00	190.00	9.52	3.04
Female shop help.	18.00	155.00	4.28	2.48
Living Costs.				
Meat, per lb.....	1.00	24.00	.24	.38
Eggs, dozen.....	.65	21.00	.16	.34
Bread, 4-lb. loaf..	.45	4.50	.11	.07
Butter, lb.....	1.25	17.00	.30	.27
Potatoes, 10 lbs..	.30	4.00	.07	.06
Men's suits.....	80.00	2,000.00	19.05	32.00
Shoes	12.50	300.00	2.97	4.80
Five-room ap't...	125.00	150.00	29.75	2.40
Theatre ticket....	1.50	8.00	.36	.13
Coal, per cwt.....	1.00	23.50	.24	.38

*Nine-hour day in 1913; eight-hour day in 1920.

The German Government controls prices, and has a bureau in which is combined the control of exports and imports, with the control of exchange. The mark in domestic exchange is kept upon a basis of its own, and the foreign trade value of the money is negotiated on a different basis. It is plainly apparent that Germany is employing a subtle, new kind of protectionism in her foreign trade.

The Germans, individually and as a national unit, seem to be capable of self- discipline to an extent unapproached by any of Germany's trade rivals. German laborers, both before the war and now, were willing to work for less, and German capitalists were willing and are willing to take less by way of profits, than are either British, Canadian, or United States manufacturers.

A SUGGESTION WELL WORTH WHILE

A member of the Canadian Manufacturers' Association deserves considerable credit for an excellent suggestion with regard to long distance telephone serice. It is to the effect that all business establishments should print their telephone number conspicuously on all letterheads and advertising matter going out through the mails. In making long distance calls an extra expense is entailed if the telephone number of the party called is not given, so that it is apparent that a saving of time and money would be effected were the practice generally adopted of printing numbers on letter paper. Some firms already do this but many do not and it would be a helpful thing if all would adopt the suggestion.

EXPORTS FROM CANADA TO BRITAIN INCREASE

Outgoing Trade for May Greater by $3,000,000 Than for Same Period in 1920.

According to the weekly bulletin of the Department of Trade and Commerce, Canada's exports to the United Kingdom exceeded by $3,000,000 those of May, 1920.

They point out that, while Canada is experiencing, with other countries, the excessive reaction in business, still her export trade has not diminished in nearly the same proportion as her imports. Furthermore, in considering the declines from 1920 figures, the bulletin states that it is necessary to remember that the value of the dollar is considerably higher in purchasing power to-day than this time last year, so that the slump is not so ominous as it appears at first sight.

The returns of the United Kingdom and the United States tell the same story—a period of reaction after the extravagant buying in the months succeeding the war.

ERRATA.

On Page 41 of the June 2nd issue there was an article referring to a twist drill grinder. It was stated that this machine was brought out by Wilmarth & Mormon. This latter word should have been Norman, not Mormon.

BENDING WITH THE AID OF THE

ATKINS
METAL CUTTING SAWS



Solve your Metal Cutting problems, easily, quickly and economically, by adopting the products made by

ATKINS

We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.

"A Better Saw for Every Use"

E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT. *Branch:* VANCOUVER, B.C

STANDARDS CONFERENCE

Unofficial Meeting in Regard to International Standardization of all Engineering Products.

A conference, which although unofficial in character, should have a far-reaching effect was held recently in London, England. The secretaries of the various standardizing organizations got together with the permission of the main committee of the British Engineering Standards Association, and the object of their meeting was the exchange of ideas, looking towards the establishment of closer relationship.

Each secretary gave a brief report of the general organization of the work in his own country, the methods adopted in arriving at the standards, and also the principles followed to ensure their adoption when issued. It is interesting to note that in most countries it is becoming more and more recognized that industrial standardization, whether of quality or dimensions, to be really useful must be arrived at through a process of unifying the needs of industry rather than by attempting to set up an ideal. It also appears that whereas engineers are everywhere giving freely of their time and experience to this important work, its value to commence generally is far too little appreciated, and is therefore not being supported financially to the extent that it should be.

"Some enthusiasts," says R. G. Durley, who represented Canada at the conference, "are rother apt to think that the time has arrived to attempt to create an international organization for standardizing all engineering products, but the conference took a much more modest view, and seeing the almost insuperable difficulties in the way, preferred to see international standardization develop along national lines and sectionally, as in the case of the now well established International Electrotechnical Commission.

The conference had no executive functions whatever, but each secretary will in due course submit to his respective organization the suggestions of the conference on the various points discussed.

The secretaries were entertained by the British Engineering Standards Association during their four-day conference.

"The human factor enters so largely into all questions of standardization," says Mr. Durley, "that for the secretaries of these important bodies to meet and become personally acquainted and thus have an opportunity of comparing notes in this informal way, is bound to be of no small advantage in the future, and materially assist in guiding international intercourse on this complex question along right lines."

STEEL BUSINESS VERY QUIET AT PRESENT

Roy M. Wolvin, president of the British Empire Steel Corporation, just back from a two months visit to England, stated recently that until such time as the world demand improved to such an extent as greatly to exceed the export surplus of Germany and Belgium, the steel export business of other countries would be negligible.

In regard to the British Empire Steel Corporation, he said results of operations for the second quarter of the year would show material improvement over the first quarter and that generally there seemed to be a tendency towards improved conditions. A very satisfactory coal business, he said, was expected in July.

NEW FACTORY

Bowden Bros., Toronto, are establishing a factory on Primrose Ave., for the manufacture of belt dressing, rope filler, etc. It is hoped to have this plant in operation about the first of June, with about six employees. Different grades of dressing for transmission and conveyor belts as well as rope filler for drives will be made. J. William Bowden, and C. Wilson Bowden are the members of the firm. The former will be sales and general manager, and the latter will have charge of manufacturing. One ton a day will be the plant's capacity.

MARINE NEWS

The death occurred at Port Credit on July 2nd, of William Newman, who for a number of years sailed on various lake boats. Death was due to heart failure.

Tug Joseph L. Russell. formerly the passenger steamer Lakeside, which plied between Port Dalhousie and Toronto for many years, carried away both head gates of lock 12, Welland Canal, on July 2nd, causing damage estimated at $9,000.

The British freighter Antrim, said to be bound from Montreal for a United Kingdom port, run aground in a dense fog at Bay St. Lawrence, Cape Breton, while on her way to Sydney for bunker coal, on July 2nd.

The single screw cargo steamer. "Canadian Engineer," one of the fleet of the Canadian Government Merchant Marine, was launched by the Collingwood Shipbuilding Company from the Dominion Shipbuilding Company's yards at Toronto on June 30th. The christening ceremony was performed by Mrs. J. H. Porter, in the presence of a large number of Toronto citizens.

A conference of the Institution of Civil Engineering was held on June 29th at London, England, to present the John Fritz medal to Sir Robert A. Hadfield, for the invention of manganese steel. A number of prominent American engineers were present. The medal is the highest honor awardable by the American engineering profession.

LOCOMOTIVES BEING MADE IN SWEDEN

According to Swedish Export, the Munktell engineering workshops at Eskilstuna is going to co-operate closely with Nydqvist and Holm's locomotive works, Trollhattan. Some time ago the Trollhattan works received an order for 1,000 locomotives from the Soviet Government. It is in conjunction with this and other orders that the co-operation has been effected. Part of the Munktell works is consequently to be adapted for locomotive building; it is also announced that the interests which control Nydqvist and Holm have largely been able to extend this control to Munktell.

PERSONAL

Mr. David Ewart, for many years chief architect of the Federal Public Works Dept. at Ottawa, died recently, at the age of 80 years. Mr. Ewart was born in Scotland and first entered the public works department 50 years ago.

Hon. Edgar M. Rhodes, speaker of the Canadian House of Commons, has been appointed president and managing director of the British American Nickel Corporation, and he will undertake the re-organization of this concern.

The city of Kitchener, Ont., is considering the appointment of an assistant city engineer.

The death occurred recently of Mr. Aubrey G. Robb, who for more than 20 years has been superintendent and chief engineer of the Robb Engineering Works, Amherst, N.S. Death was due to bloodpoisoning. Deceased was secretary of the Maritime Branch of the Canadian Manufacturers' Association for some years.

THE PIG IRON OUTPUT

According to recent reports the total output of pig iron in Canada during the month of March was 60,433 long tons, an increase of 2,700 tons over February.

TRADE GOSSIP

The Transportation Commission has purchased for $25,000 from John Harris and Co., a lot, 237 x 135 feet, on the west side of Coxwell Ave., Toronto, north of the G. T. R. for railway yards and siding purposes for handling materials. After checking up the tender of $350,000 for rails awarded to the United States Steel Products Co., and finding that, owing to the exchange rate, the tender is not as advantageous as expected, the contract has been awarded to the Consolidated Steel Corporation at Bethlehem, Pa. The order for intersection track work goes to the Canadian Steel Foundries, Ltd., Montreal, at $50,000. Canadian firms, in so far as possible, will receive contracts for ordinary and special ties, amounting to about $90,000. All new civic cars are to be painted a rich wine color.

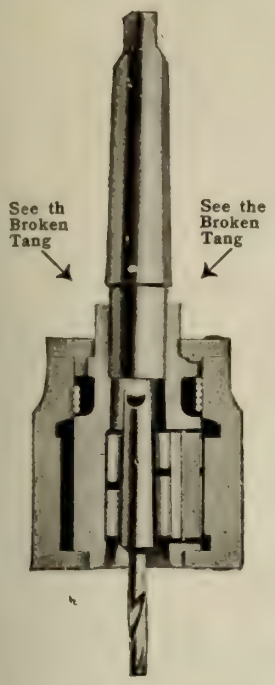
After careful consideration of the case, Judge Coatsworth announced the verdict of "guilty" in the case of Allis-Chalmers, Ltd., charged with criminal negligence in the management of a crane and bucket, which prematurely dumped a quantity of sand on George Hearst, a worker in the foundry, killing him. The counsel for the defendant company, W. K. Murphy, was granted the right to ask for a stated case for argument in the Court of Appeal. Meanwhile the judge imposed a fine of $1,000 staying execution until October to allow of the argument of the stated case.

It was decided that next year's convention would be held in Kitchener, Ont.

Tenders will be received, no closing date set, by Geo. K. Dewey, City Clerk, Brockville, Ont., for construction of a steel bridge.

A tannery is being built by Geo. G. Potvin, Metabetchouan, Que., at a cost of $10,000.

Aikenhead's



Grips the Entire Shank— Never Slips

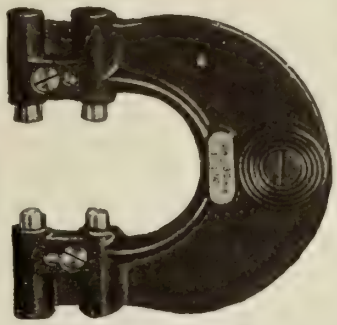
Wahlstrom Chucks

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Mechanical Features of Motor Installation

Position of Motor Important—Question of Couplings—Gear Drives—Adjustment must be Arranged for—Belt Drives—Chain Drives—Speed of Chain Should Be Closely Watched.

By GORDON FOX*

IN selecting a motor for a given service, the location and method of drive should receive consideration. It is desirable to locate motors in cool, clean light, high, and dry places as far as possible. If the motor must necessarily be in a hot place, it must be liberally rated. If it must be in a dirty place, total or partial enclosure should be employed, for dirt causes many a failure. If moisture or fumes are present, the motor should be protected, as far as possible, and the insulation specially treated to meet the condition.

The position of a motor should be such that it is easily accessible for inspection, else neglect is probable. Clearance spaces should be provided for the removal of the entire motor or its parts. In the case of important machines, care should be exercised to see that part replacements may be quickly made. Failing this, the entire motor unit should be exchangeable. It is of advantage to have important moors served by a crane or repair trolley, or at least to provide ready means of rigging for handling of motors and parts.

Direct-connected motors are best mounted so as to be intrinsically a part of the driven machine. This is advisable for the sake of retaining alignment, but is not always necessary. Usually some form of bracket or platform is arranged. If it is not possible to attach this to finished surfaces, it may be bolted to the frame of the machine. The motor may be aligned and the bracket forced into position with wedges. A dam is then placed around the feet of the bracket and any spaces filled with lead.

Motors should not be supported or directly attached to machines which vibrate or shake, as the motors will likely develop trouble under such conditions. Railway, mine, and mill type motors are better adapted than general utility motors to withstand such conditions. In attaching a motor to a bedplate or similar support, through bolts are preferable to cap screws or stud bolts, as the motor may be more readily removed and breakage of a bolt is a less serious matter.

Care should be exercised to have the motor shaft level, otherwise end pounding may result.

When mounting motors upon a floor, it is best to use a base and to keep the motor above the dirt and moisture, with sufficient space for sweeping. A base is better than rails, especially where the floor is uneven, due to the tendency for rails to settle away from a plane surface. Motor bases should be heavy enough to retain shape under stress, but they should not be bolted down in a manner to distort them. Large motors may be neatly installed by providing a concrete foundation and anchor bolts, the motor base being aligned with wedges and grouted in. Motors without bases should not be routed in, as removal for exchange or repair is too difficult. If a base is not provided, heavy steel plates or rails may be grouted in the foundation, and anchor bolts passing up through the plates and also through the motor feet.

Side Wall Suspension.

Motors may be readily arranged for side-wall suspension by shifting the bearing brackets through 90°. They are sometimes attached to the ceiling for driving to the floor above. As the motor usually has a small pulley, it should be borne in mind that the weight of the belt decreases the tractive power. It is not the best practice to hang small direct-current motors directly from the ceiling, as they are inaccessible and do not receive proper attention. It is better to suspend the motor on some form of rack.

The structural supports for a motor should be sufficiently heavy and rigid to prevent movement and vibration. Use of channel-iron supports for wall or ceiling mounting is suggested as permitting easy alignment and rigidity.

Many motors are direct-connected to the driven machine, driving through couplings or gearing. Remote drives may be through belt, chain, or rope transmission. These various modes of application will be considered in sequence.

Couplings of both solid and flexible types are in common use for motor applications. Solid couplings are almost always of the safety flanged type. Flexible couplings supply a considerable measure of protection to the motor. They should be used where there is any possibility for relative movement of motor and machine, where there is vibration or shock in the driven machine, and where an end thrust occurs which might be imposed upon the motor.

Although the great majority of flexible coupling installations are successful, this type of coupling is necessarily less simple than the solid flanged coupling, and troubles are occasionally experienced. There are many designs of flexible coupling. The leather-link and leaber-buffer coupling are among the older ber-buffer couplign are among the older types. As both leather and rubber are subjected to deterioration, all-metal couplings have features of desirability. All-metal couplings are particularly well adapted for the more severe service applications, finding extensive use, for instance, in the steel mill.

Although flexible couplings permit of a small amount of relative motion, they should be aligned as perfectly as possible when installed. The margin then safeguards operation in case either part becomes slightly displaced. Limits of misalignment within which successful performance may be expected are about 1/16 in. offset of shaft centre lines and 5° angularity between shafts.

Gear Drives.

Gear drives permit of compact arrangement, are positive, and are particularly well adapted for slow-speed work. They have fair efficiency, ranging from 90% to 98%. They require good alignment, well maintained. They transmit all shocks to the motor. They are usually more or less noisy.

The ratio of the drive gearing depends upon the relation of motor speed under load and desired machine speed. In the case of constant or adjustable speed motors this ration is easily determined. In the case of variable-speed motors the proper ratio is not always so readily determined, as the motor speed varies with the load. For drives which start and stop frequently the factors of machine and motor inertia may materially affect the selection of gear ratio for the drive.

The allowable ratio for a single reduction is limited by the allowable diameter and surface speed of the gear and by the minimum number of pinion teeth. For small motors a 10-to-1 ratio is allowable. For moderate sizes 8-to-1 is about the maximum permissable. The motor pinion should have at least 15 teeth, if possible, as the teeth of smaller pinions are weakened by their undercut shape. In determining a ratio of gearing, it is well to avoid the maximum possible ratio, as this leaves no margin for future change, should such be found desirable. It is better to use an intermediate ratio, but to provide clearances which will permit of a change of the gear ratio in either direction, if desired later. In calculating a gear reduction the gear should, if possible, have a prime number of teeth, so that the shocks due to a repeated cycle of operation may be distributed; the use of an old tooth prevents the same teeth from meshing so often.

Can. Mach. July 7 Galley 14—

When motors have double-extended shafts, placing of the pinion on the commutator end should be avoided if possible, as the shocks and vibration are more severe and the bearing wear likely to be more rapid. Outboard bearings should be used for all geared motors of 100 R.P. and larger, and, in many cases, for smaller motors. Outboard bearings should be used for ordinary motors of 50 H.P. and above when subjected to reversing duty or severe fluctuating loads.

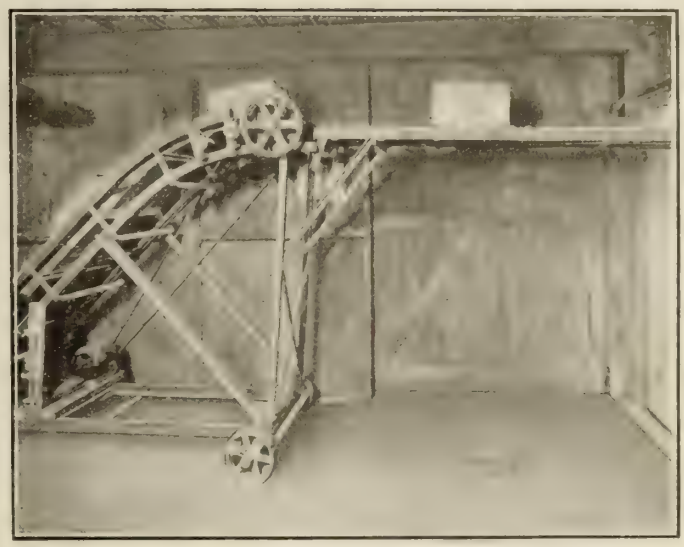
Permits of Adjustment.

The motor pinion should be located preferably on the same horizontal level and to one side of the driven gear. Bearing wear or slight errors in elevation then have little effect. It is not good practice to locate the motor pinion directly below the driven gear. Bearing wear is then likely to throw excess weight on to the motor bearings. It is also difficult to remove armatures so located. If the arrangement is such that motor elevation affects the meshing of the gearing (also for coupled drives), it is advisable to have the motor support a trifle low and to supply shims under the motor feet. This arrangement also permits of adjustment to care for differences in individual motors.

Gears are usually of cast iron or cast steel with cut teeth, while pinions may be of steel, brass, rawhide, fibre, or cloth. The latter types usually have end-plates of brass. Steel pinions have excellent life and are not affected by temperature or moisture, but are noisy and cut quickly unless well lubricated. Steel gears are about twice as strong as cast iron. They should be used for im-

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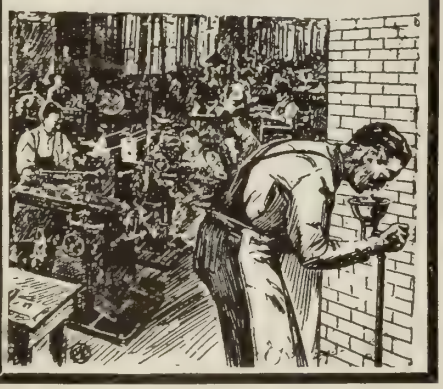
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portant work, where shocks or overload may be expected, or where the face of a cast-iron gear would exceed 4½ in. The cost of cast-steel gears is about double that of cast iron gears. The pinion is subject to the more rapid wear, due to its smaller diameter, therefore it is important to have a pinion of good wearing qualities as well as of sufficient strength. Steel pinions are usually forged of 0.30% to 0.40% carbon steel, and are frequently heat-treated to increase their strength and durability.

Iron and steel gears ordinarily become noisy at about 800 ft. per min. linear speed, but may not be disagreeably noisy below 1,200 ft. per min., or even higher. Where it is desired to employ high surface speeds without noise, brass, fibre, rawhide, or cloth pinions may be used. Brass pinions, although somewhat quieter, have shorter life than steel. They are particularly adapted to conditions of heat and moisture prohibiting the use of a non-metal pinion. But where noise is objectionable, fibre pinions are quiet, but are not very rugged, and are subject to deterioration by moisture. Rawhide pinions are satisfactory unless subjected to extremes of heat or moisture or excessive load fluctuations, or frequent starting, stopping, or reversing. For equal strength, the face of rawhide pinions must be about 25% wider than corresponding steel pinions. The surface speed of a rawhide pinion is limited more by rapid wear than by noise. A speed of about 2,000 ft. per min. is a fair average limit, but 2,500 ft. to 3,000 ft. per. min. may be used under favorable circumstances of attendance and lubrication, in the absence of moisture, and for intermittent service where the life of the pinion is not important. Cloth pinions are quiet, not easily affected by heat or moisture, are quite elastic, and give good service when subjected to strains and shocks. The allowable surface speeds correspond to the values for rawhide. Where quiet operation is desired it should be noted that rigid and massive supports and close-fitting bearings, both on motor and driven machine, are conducive to a noiseless drive. The pinion should always be placed as close as possible to the motor bearing.

Gears must be kept well oiled, and at high speeds some method must be used the effectiveness of which will not be destroyed by centrifugal force. Rawhide gears should not be oiled, but should be lubricated with talcum and graphite or graphite and lard oil. Gears should always be guarded, both for safety and for protection and to prevent throwing of the lubricant. Inspection openings should be provided in the gear guards at the point of meshing.

Worm-gears are used for special cases where a large speed reduction is desired. They are positive, quiet, and free from vibration. They have low efficiencies, ranging from 70 to 80%, and require excellent machining and good lubrication. A carefully adjusted end-thrust bearing must also be provided. The worm should mesh with the bottom of the gear and should run in oil. If the worm is placed above the gear it will not receive good lubrication. The best rubbing-surface speed for worm-gears is about 300 ft. per min., although speeds as high as 700 ft. per min. are sometimes permissible. Worm-gears are not reversible—that is, the wheel will not drive the worm. They can sometimes be used in a braking capacity due to this feature.

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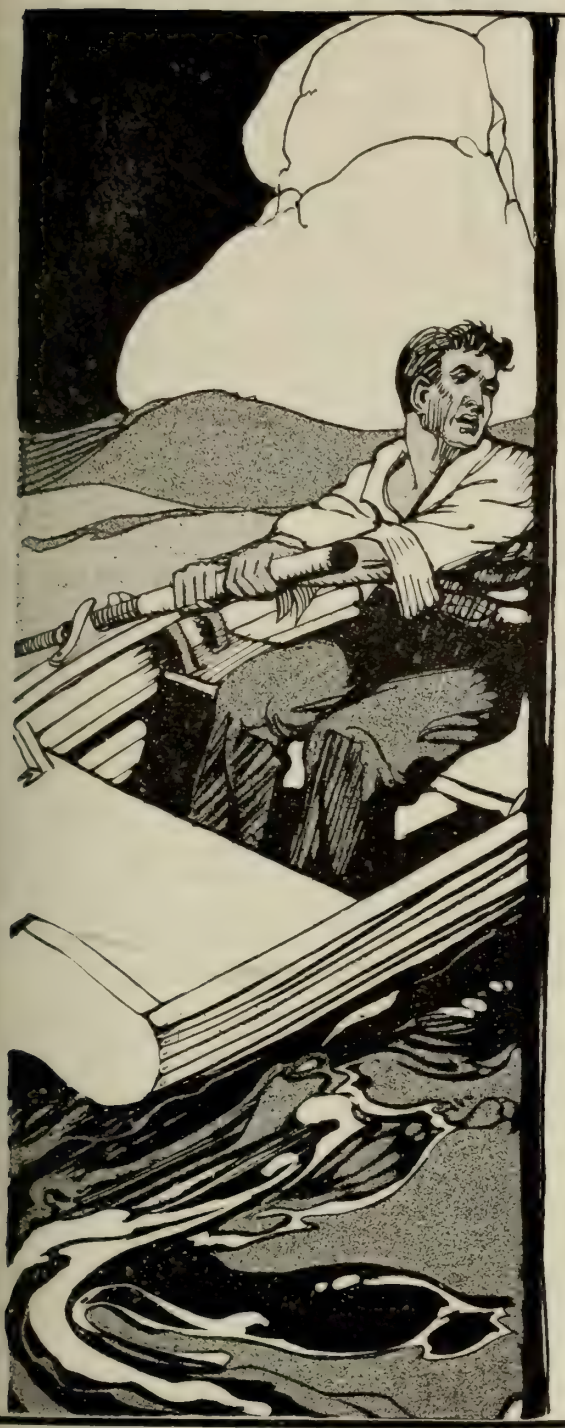
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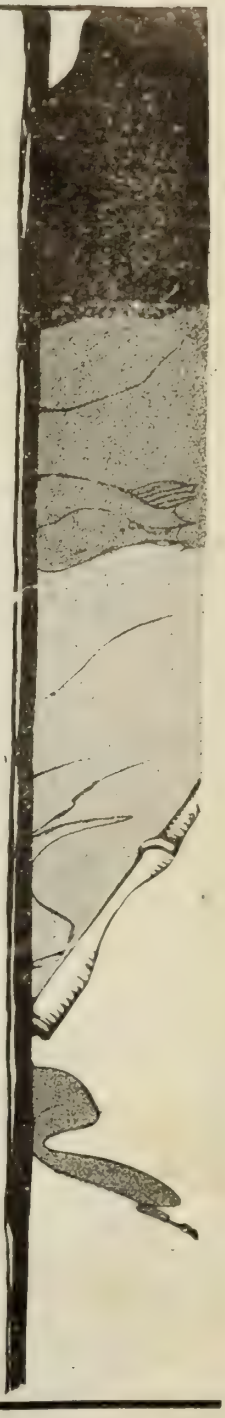
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Advertising is being put to a test to-day, which it can meet if you put circulation to the test of A. B. C. reports.

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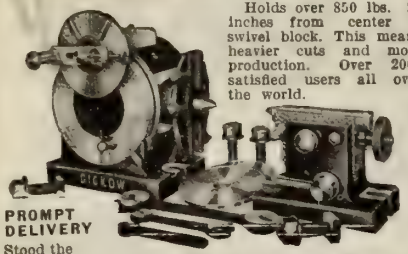


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power is to be transmitted at high speed and low torque, for small amounts of power, and where it is desired to change the speed or throw into and out of gear while in motion.

Belt Drives.

Belt drives are simple, flexible, inexpensive, and elastic, affording protection to the motor in case of overloads and shocks. The drive occupies considerable space, however, is not so positive, has relatively high maintenance cost, and is not suited to rapid reversals or other than fairly uniform speed service.

In determining pulley sizes for a belt drive, the desired ratio and the belt speed are determining factors. The power which can be transmitted by a belt varies with the speed, increasing nearly in direct proportion until a linear speed of about 4,500 ft. per min. is reached. Beyond this, on account of increased centrifugal stresses, the effective transmitting power is reduced. Belt speeds between 2,000 ft. and 4,000 ft. per min. are conservative values. Ordinarily, about 1,000 ft. per min. is the minimum and 5,000 ft. per min. the maximum. It is most economical to operate belts within the range of conservative speeds, due to lower first cost and maintenance and minimum power loss. Where very low speeds are used, wide belts are required. The centre of the belt then overhangs the motor bearing some distance and trouble may ensue. Decrease of contact surface means higher belt stresses due to greater tension required to prevent slipping. Wherever possible, the lower side of the belt should be made the driving side, so that the sag may be at the top.

Single leather belts should, in general, be used for widths up to 6 in., and for use over pulleys less than 10 in. in diameter. Double leather belts should be used for most other installations, except the very large, when triple belts may be used. Rubber belts are elastic, durable even under adverse conditions of temperature and moisture, have good tensile strength, and are uniform in width and thickness; their tendency to stretch, however, is often a disadvantage. Laced belts should not be used for motor drives; endless belts are preferable. Belts should run with, and not against, the lap at the joint, and the joints should be smooth to prevent jarring. The grain side of the belt should run next to the pulley, because it is smoother and adheres more snugly; also because the flesh side is stronger and less liable to crack. A belt will transmit about 25% more power without slipping with the grain side next to the pulley.

Wobbling of belts is sometimes due to pulleys having unlike crowns. Flapping is usually caused by slippage between some portion of the belt and pulleys, resulting from grease spots on the belt. A back-and-forth movement of the belt at the pulley is caused by the edges of the belt being of unequal arrangement.

The distance between centres of the motor and driven shafts depends upon the relative elevation of the smaller pulbottom. The distance should be such as to allow a gentle sag. Five times the diameter of the larger pulley is usually a safe distance, provided the difference between the sizes of pulleys is not too great.

The maximum advisable ratios of reduction through a single set of pulleys are: 8 to 1 for motors about 5 H.P.; 6 to 1 for about 10 H.P.; 5 to 1 for 20 H.P.; and 4 to 1 for about 50 H.P. If it is desired to ascertain the smallest pulley under which the motor bearings will give service, this may be done by figuring the total belt tension required, according to the formulae given below.

For iron pulleys—

$$\text{Tension} = \frac{3 \times \text{H.P.} \times 33{,}000}{\text{belt travel, feet per minute}}$$

For wood pulleys—

$$\text{Tension} = \frac{2 \times \text{H.P.} \times 33{,}000}{\text{belt travel, feet per minute}}$$

Knowing the tension at the centre of the pulley, the distances between bearings and the overhang of the pulley centre, the shaft may be considered as a simple lever, and the thrust on the bearing next to the pulley determined. The thrust per unit of projected bearing area may then be figured if the bearing dimensions are known. For motors under 50 H.P. the pressure per square inch bearing area should not exceed 70 lbs. For large motors, pressures up to 100 lbs. are allowable under favorable circumstances. Since belt tension must increase rapidly with a decrease in diameter, the limitations imposed by the bearings are usually the factors determining minimum diameter and maximum face.

Where there is insufficient space between the pulley centres to permit an open belt, or where the ratio of speed reduction desired is too great for open belting, or where a compact drive is desired, a belt tightening device on the motor is warranted. As it affords good arcs of contact, low tensions may be used and there is little or no loss in efficiency. The ability of the belt tightener to decrease slippage and to lower maintenance expense, as well as to increase reliability should recommend its use in many cases.

Large pulleys and those running at fairly high speeds should be carefully balanced by placing them on a mandril and balancing them on ways. It is well to use gib keys for pulleys, also for pinions, to facilitate removal. Series motors should never be belted, as the belt is liable to slip off, relieving the motor of its load and permitting it to race.

Chain Drive.

The silent chain drive is excellent for many applications. It is quiet and efficient, and permits of compact layout. Moreover it can be used for wide reduction ratios, particularly where the motor cannot be placed close enough for gearing. The centre line distance for silent chain drives should approximately be equal to one half the combined sprocket diameter, plus half the diameter of the larger sprocket. In a vertical drive the small wheel should not, if possible, be the upper one. Where feasible it is best to have the pull on the bottom of the chain. To provide for elongation particularly in vertical drives where the chain tends to fall away from the lower sprocket a sliding base should be used. The driven wheel should be flanged. Where the load is of a pulsating character it is well to use a driven sprocket with a spring centre to absorb fluctuations. Chains and wheel should be protected from dirt. When operating at speeds above 1,300 feet per minute they throw off their lubricant. Therefore should be enclosed and run in oil. The best practice restricts the chain to not over 1,000 feet per minute travel.

BANKS ASSIST EXPORTS

Continued from page 82

we could not at least try to do. One thing we have always stressed—and I think you will agree with me that we are right—is that an attempt to commence business by correspondence is a difficult and perhaps an unsatisfactory thing. I know that it is sometimes necessary, and that everyone cannot afford to take a trip to a prospective market. Where they can, it is by far the best way, and Canadian business men who go abroad will find that Canadian bank branches, or Canadian bank correspondents, are there to assist them wherever they go. I think that these service departments of our banks have really been of service. I know one of them at any rate that has passed a great many thousand dollars' worth of orders on to Canadian manufacturers who have filled them, and—what's more—have received cash for them. Such departments have during the last year or two had a peculiar situation to deal with. Until about a year ago, it was foreign importers who were writing us, asking for the names of sellers, and Canadian firms who were themselves too busy to accept new business. Now, when more goods are available, foreign conditions are not what they were. In spite of that, however, business is done.

TRADE GOSSIP.

Savard Motor Sales, 124 Laurier Ave., Montreal, are contemplating the erection of a garage.

The Municipal Council, Bagotville, Que., are contemplating the construction of a Hydro-electric plant.

Jos. Langevin, Coteau du Lac, Que., is contemplating the erection of power house and electric line at cost of $20,000.

The Dominion Power and Transmission Co., Terminal Station, Hamilton, Ont., contemplates laying new street railway tracks on York St.

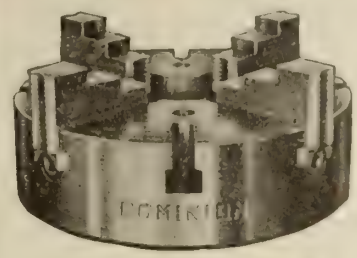
John Inglis Co., Ltd., 14 Strachan Ave., Toronto, have been awarded the contract for 7 150 H.P. Boilers by the Canadian Oil Companies, Excelsior Life Bldg., Toronto.

Reid and Brown Structural Steel and Iron Works, Ltd., 63 Esplanade E., Toronto have received the steel contract for garage costing $10,000, for J. M. Schneider and Son, 53 Courtland Ave., Kitchener, Ont.

A reader of Canadian Machinery desires particulars of new or second hand light machinery suitable for cabinet work. Those who feel they can supply this information should write J. Talbot, Ridgeway, Ont.

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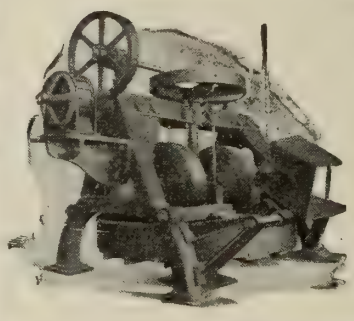
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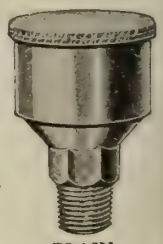
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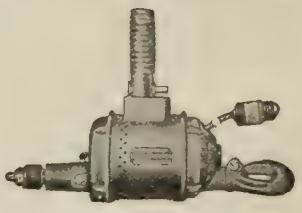
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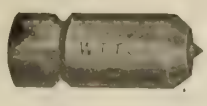
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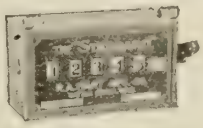
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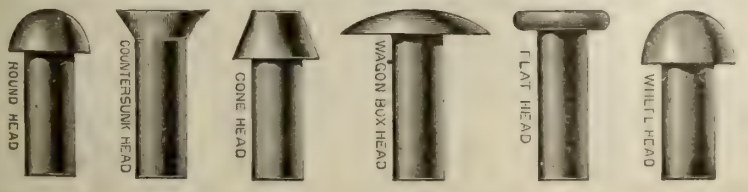
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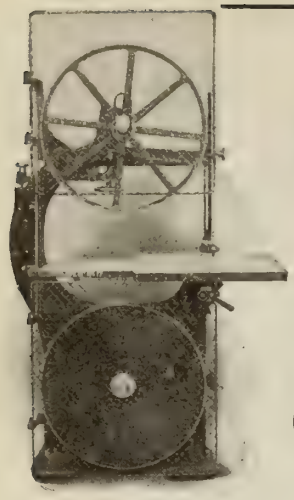
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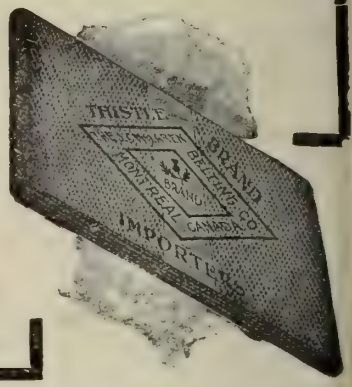
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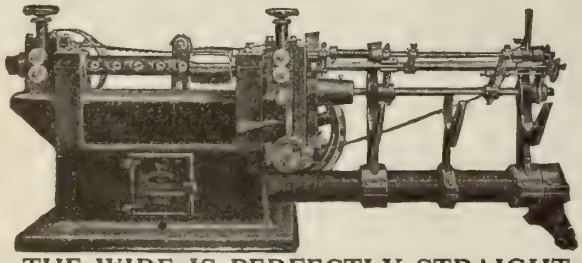
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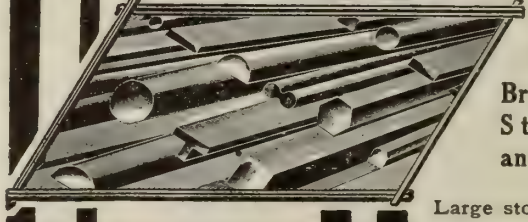
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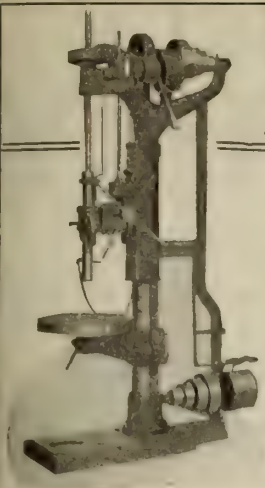


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Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Can Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U S Electrical Tool Co., Cincinnati, O

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Burners, Oil and Gas
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Semi-Steel
Davidson Mfg. Co., Thos., Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis
Jones & Lamson Machine Co., Springfield, Vermont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Semle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Helwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que
Main Belting Co. of Can., Montreal, Que
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong-Whitworth Co. of Can., Ltd., Montreal, Que
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Atlas & Co., Inc., [illegible]
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Madison Mfg. Co., Madison, Wis.
Penn Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio
Garlock Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Starrett Co., L. S., Athol, Mass

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton Ont.
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Toledo Machine & Tool Co., Toledo, Ohio

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Stringer Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence, R.I.
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Springfield, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
Johansson Inc., C. E., Windsor, Ont.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Chesterman & Co., Ltd., J., Sheffield, Eng.
Crescent Machine Co., Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.

BUYERS' DIRECTORY

Ackworthic, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis,
Johansson Inc., C. E., Windsor, Ont.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong Whitworth of Canada, Ltd Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can. Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow Sco.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co., Ltd., Montreal, Q.

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Engineering Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blahill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pig Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthle, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthle, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Sawing Machines, Power Hack
Ackworthle, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal Q

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stuart & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
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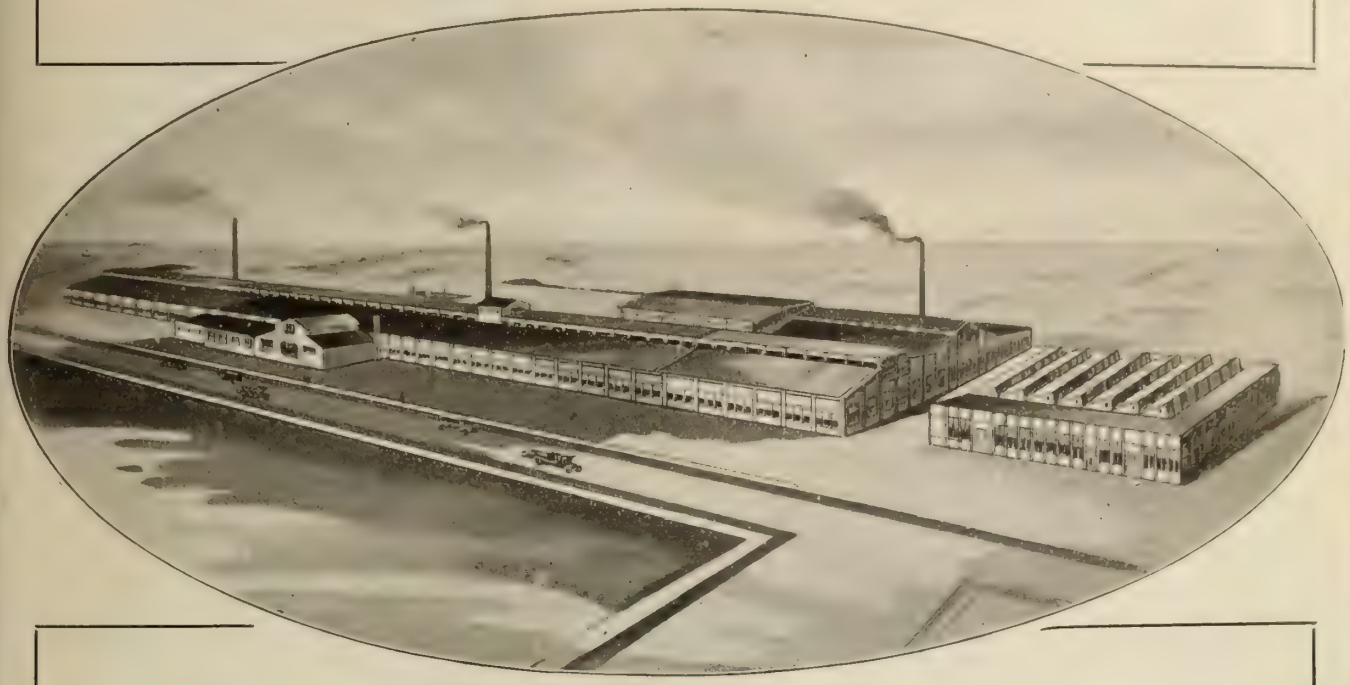
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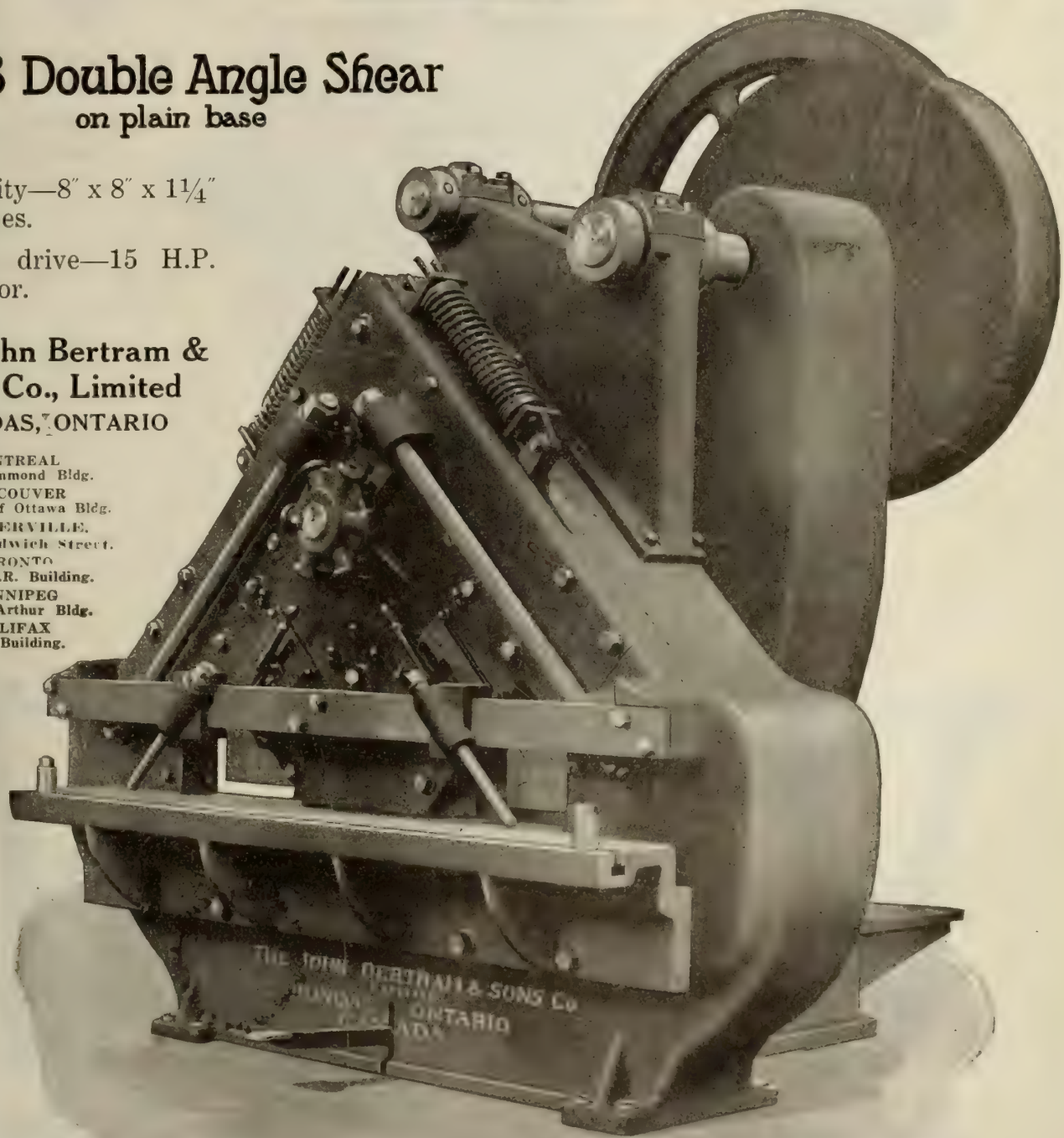
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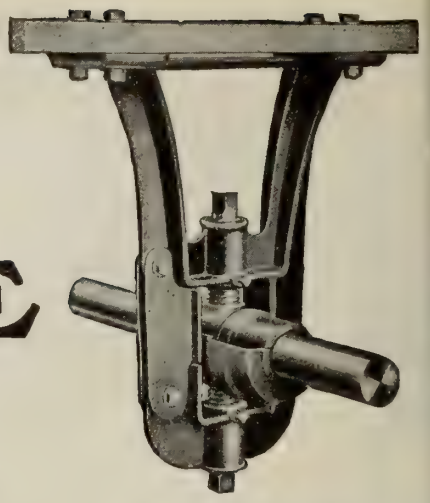
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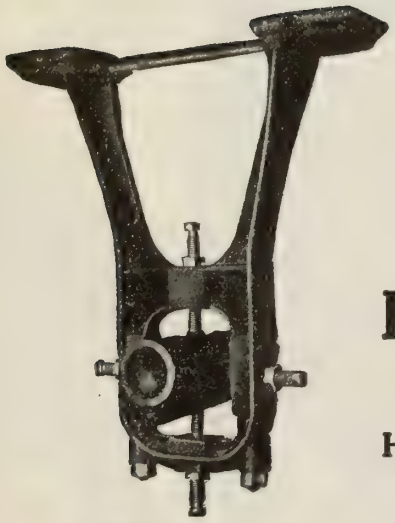
Dodge will at any time give an unbiased opinion concerning the right hanger type for any job—an opinion based on and backed by the best engineering knowledge and practice.

But whether that opinion is accepted or disregarded for personal preference, the final selection should in every case be Dodge.



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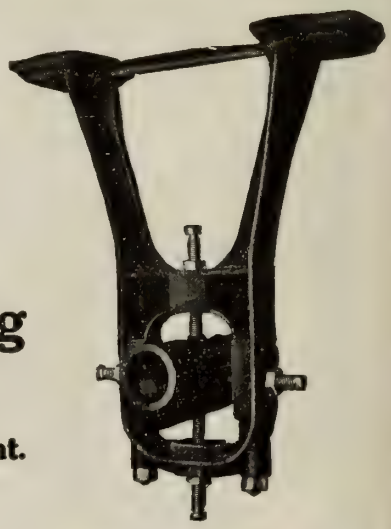


Keystone

Four-Point Hanger

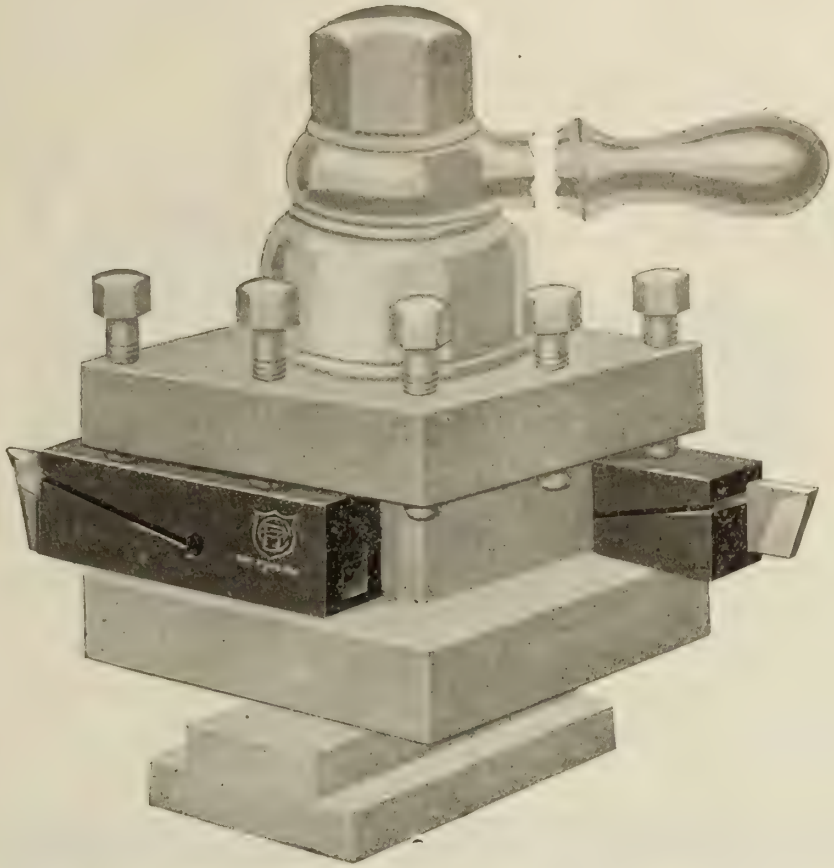
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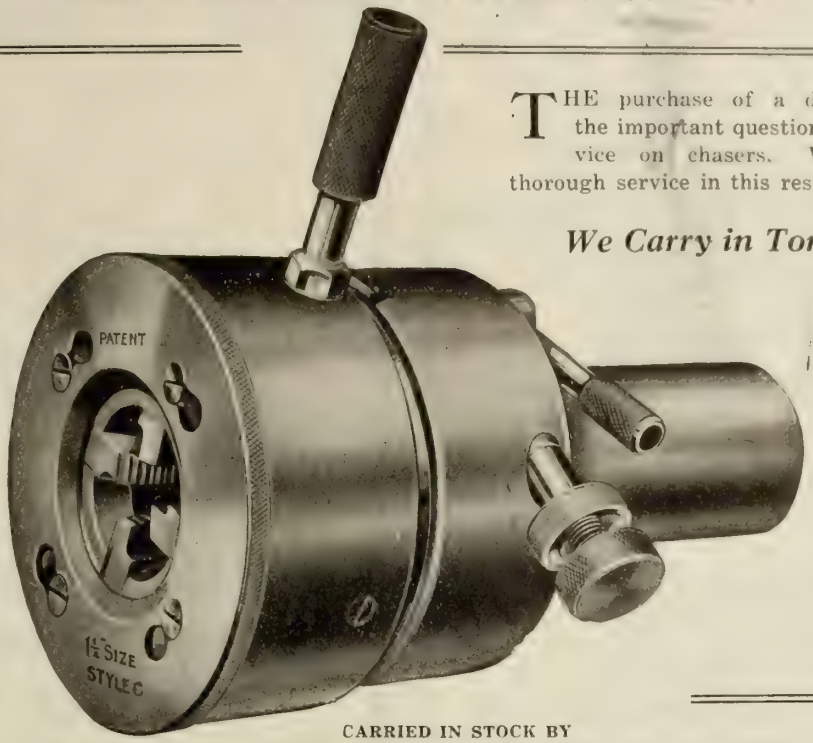
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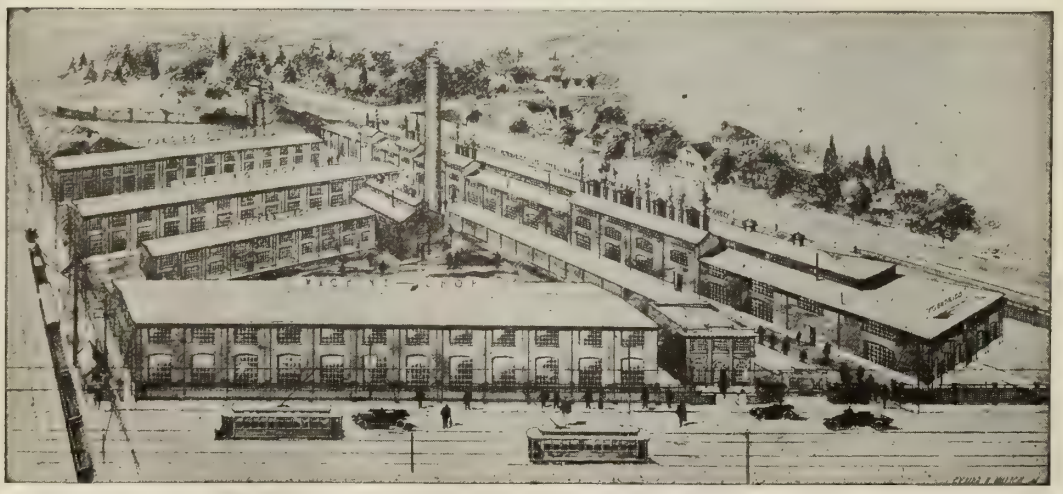
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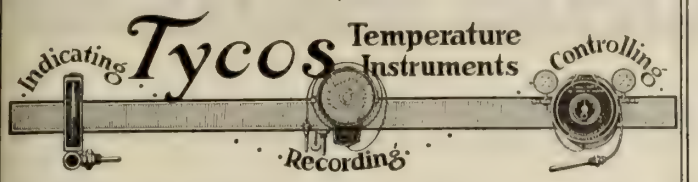


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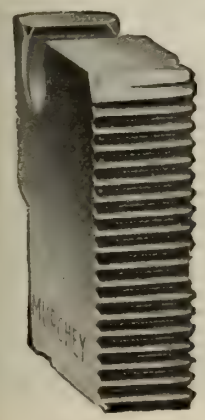
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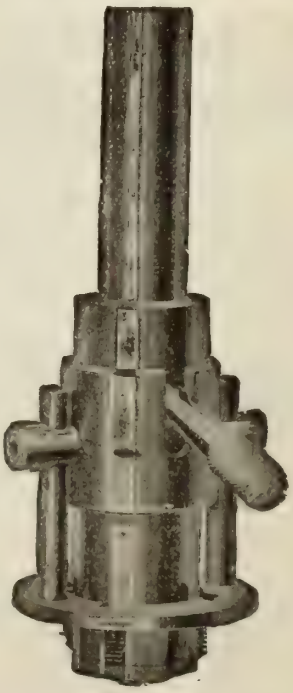
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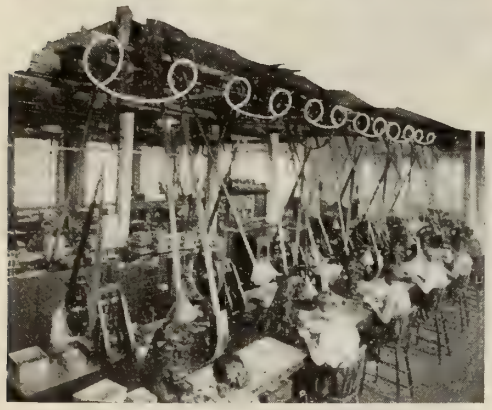


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THE JOHNSON FRICTION CLUTCH



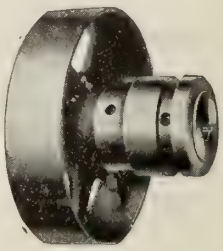
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A battery of twelve light presses, all on a bench about 30x5 driven from one line shaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operaton at their Elmwood Plant.

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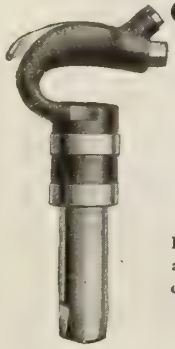
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FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

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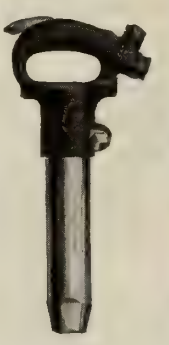
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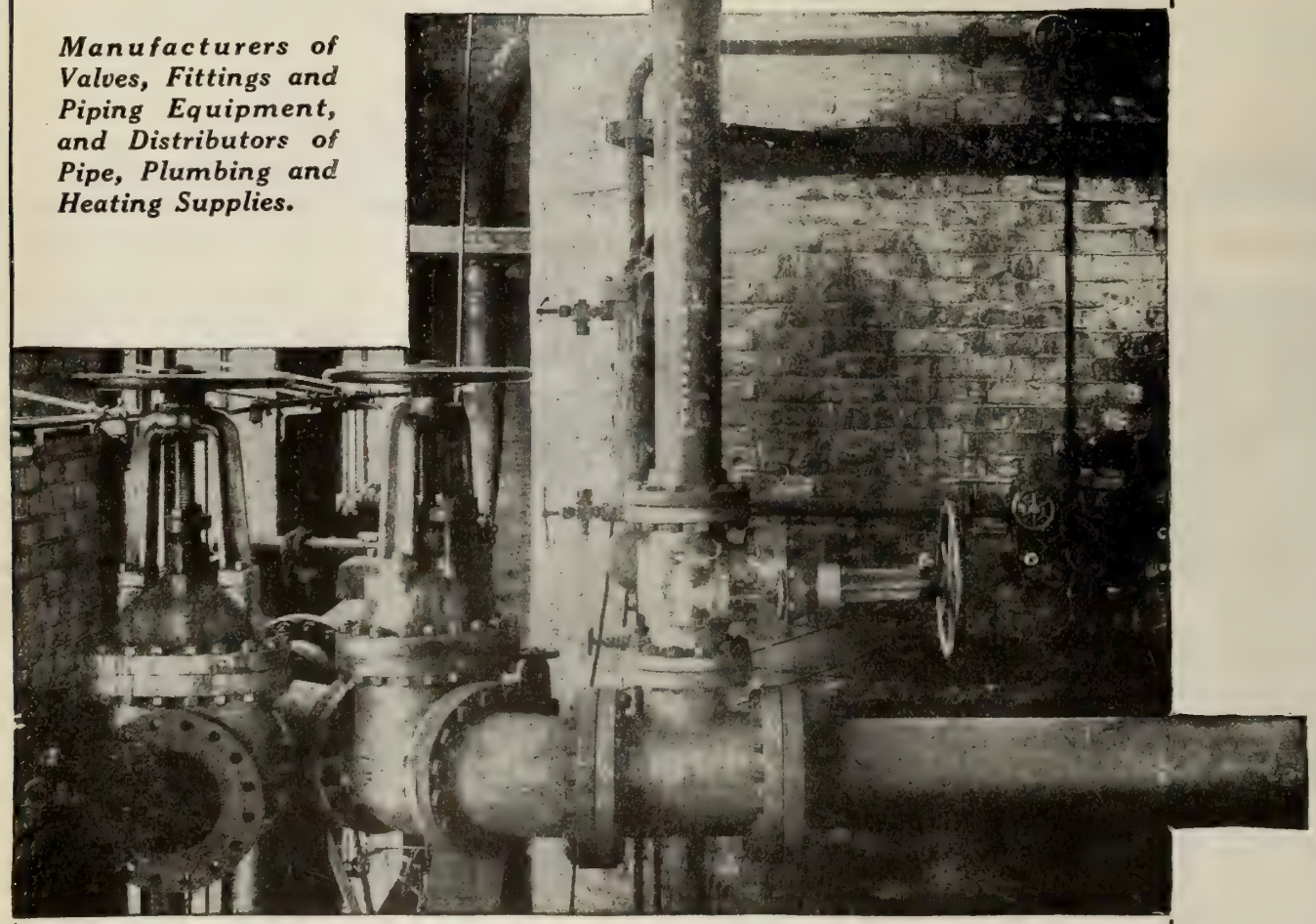
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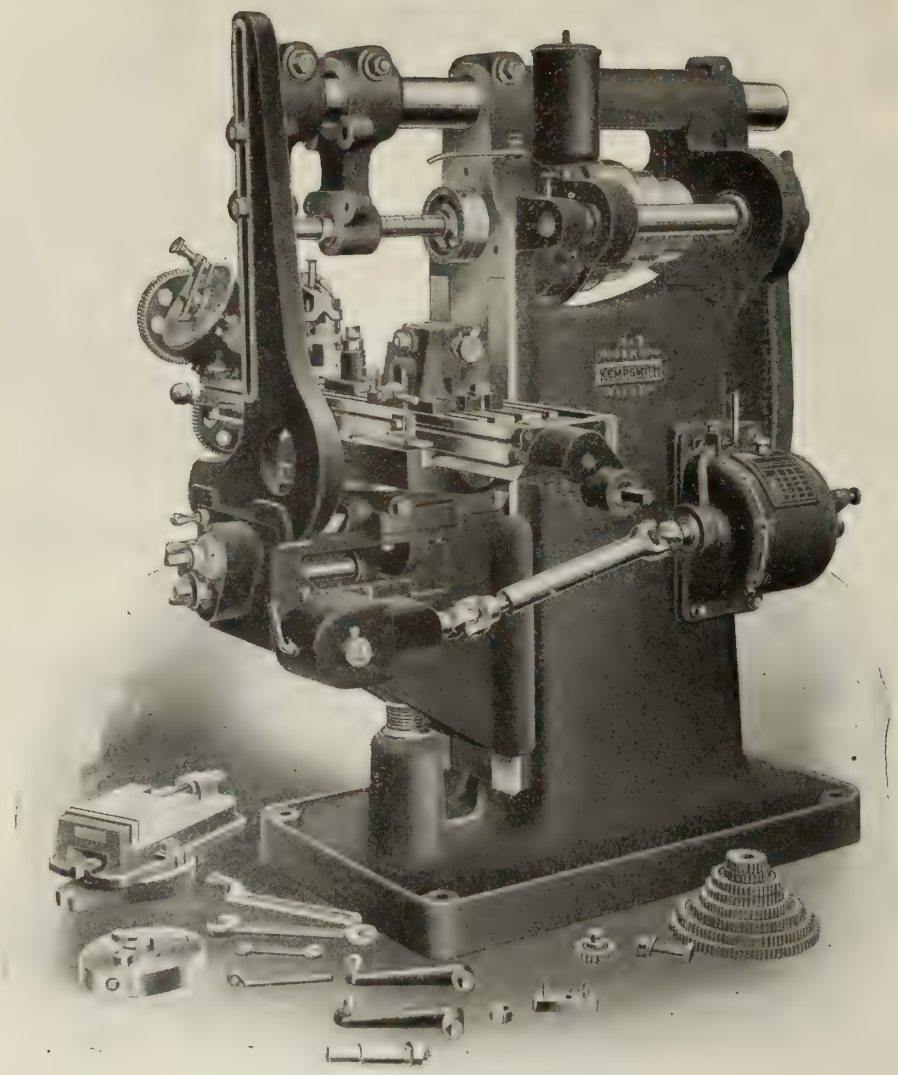
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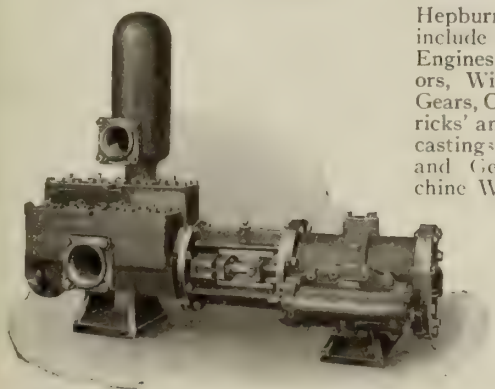
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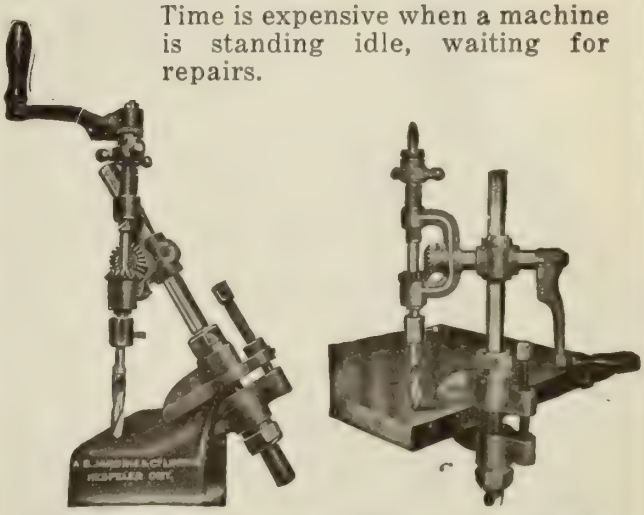
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Made in Canada

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We make chains of practically every kind from the Original Ewart Detachable Link-Belt to the highly efficient Link-Belt Silent Chain for high-speed power transmission.

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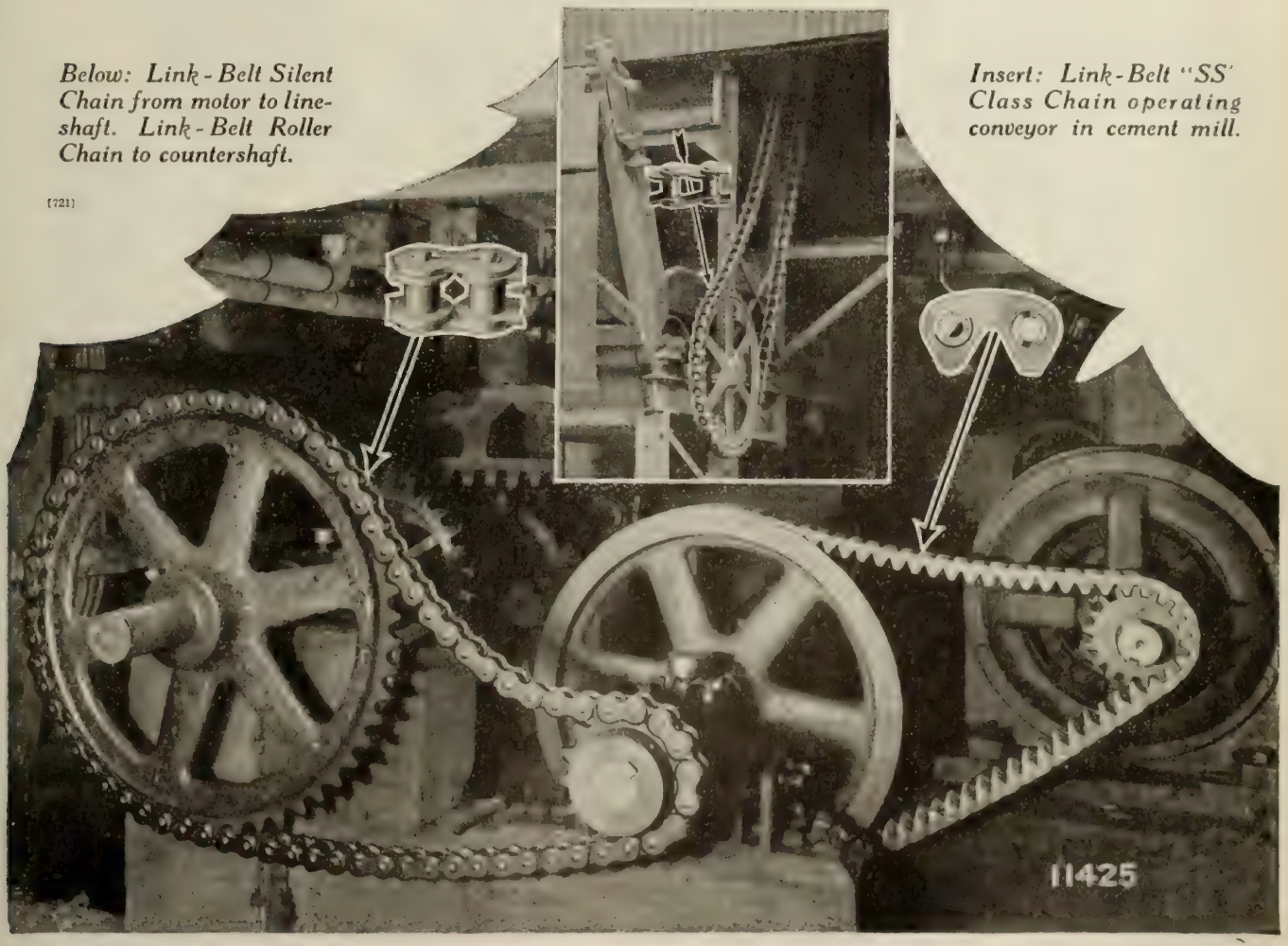
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Below: Link-Belt Silent Chain from motor to line-shaft. Link-Belt Roller Chain to countershaft.

Insert: Link-Belt "SS" Class Chain operating conveyor in cement mill.

[721]



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"In the first place he knows tools. That's why he bought Starrett's. Or even if he bought 'em on the say-so of someone else, I'll take my hat off to him as a man whose got sense enough to take good advice.

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"If he tries to get along without—and make such tools as he has do for the work on which other tools save time and are more accurate—it means more lost time and more spoilage.

"Starrett Tools are the machinist's best friends. And the more of these friends he has on the job, the better the job will go.

"Ask the hardware man to show you the full Starrett line.

"And—first of all—write for the Starrett Catalog No. 22 -3"

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The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

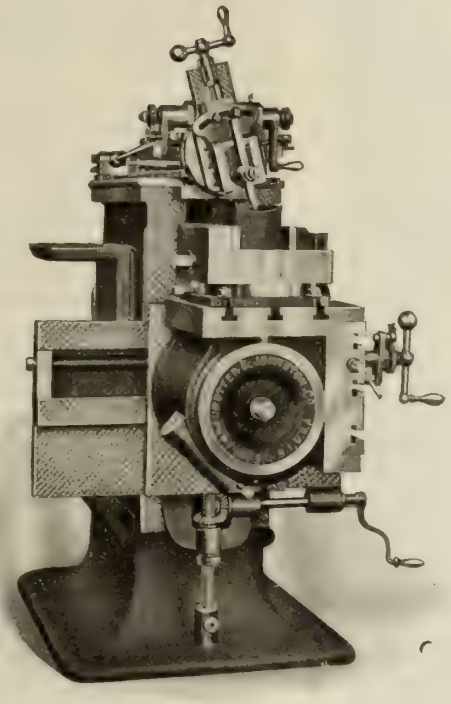
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Swivel vise with graduated base.

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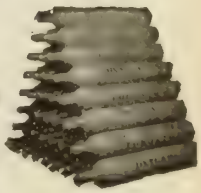
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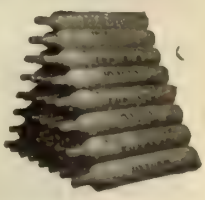
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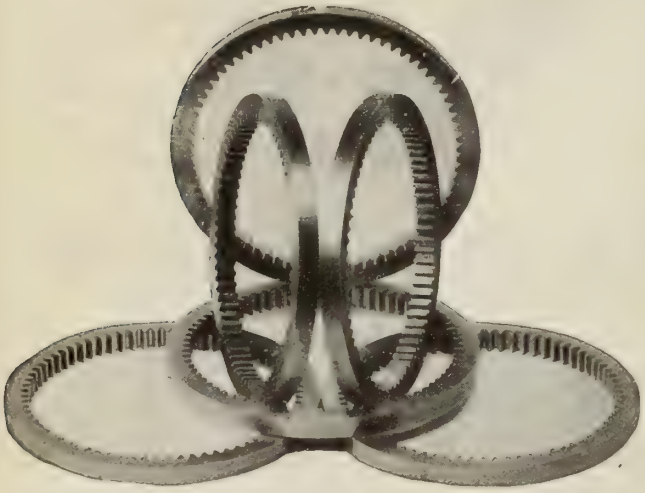
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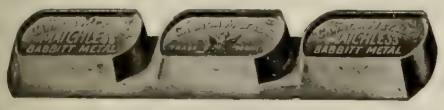


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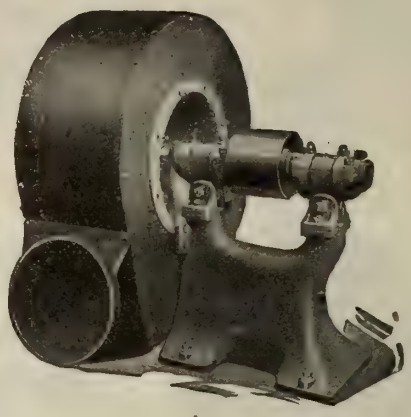
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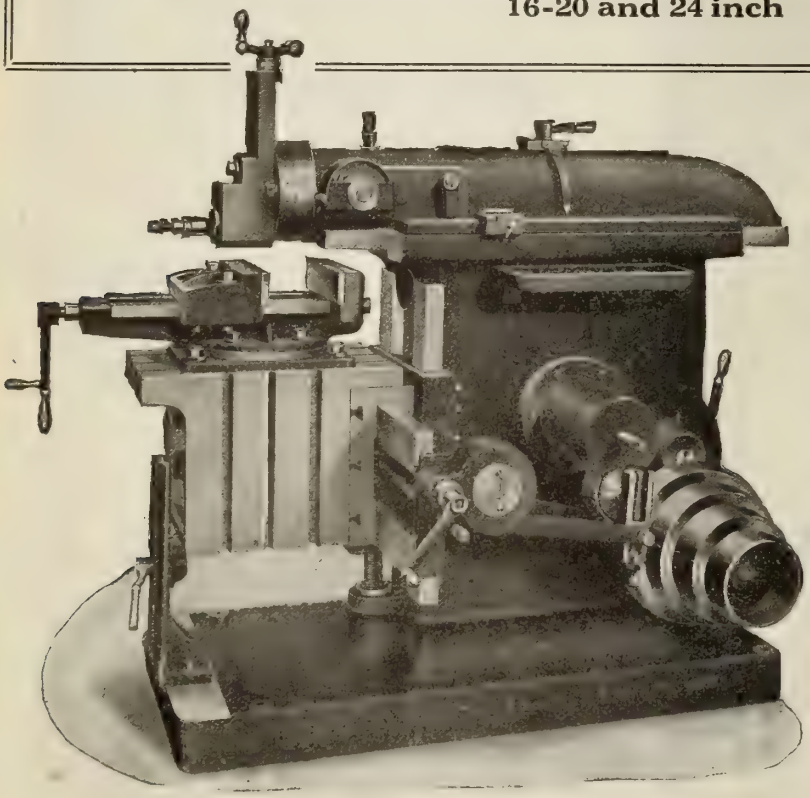
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is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

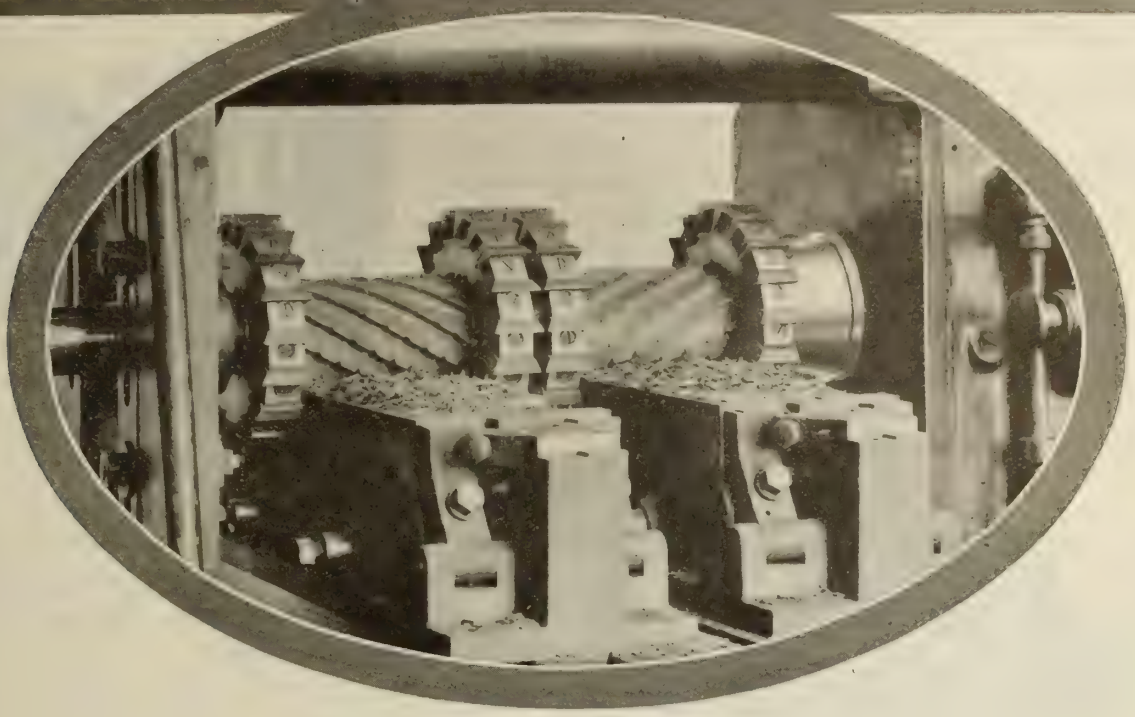
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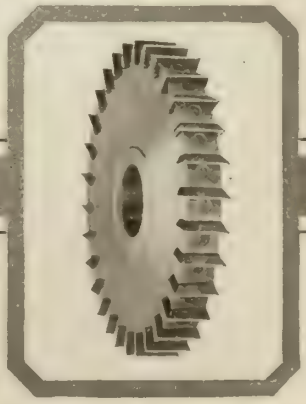


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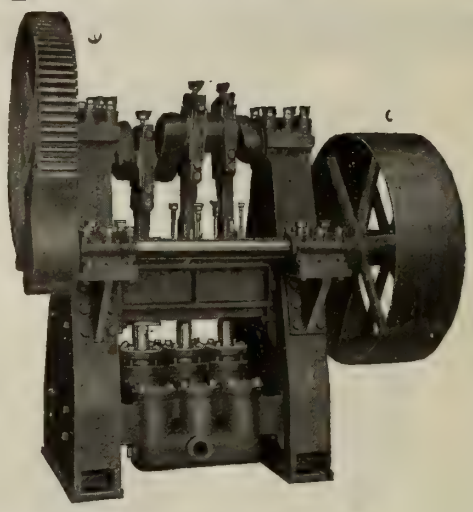


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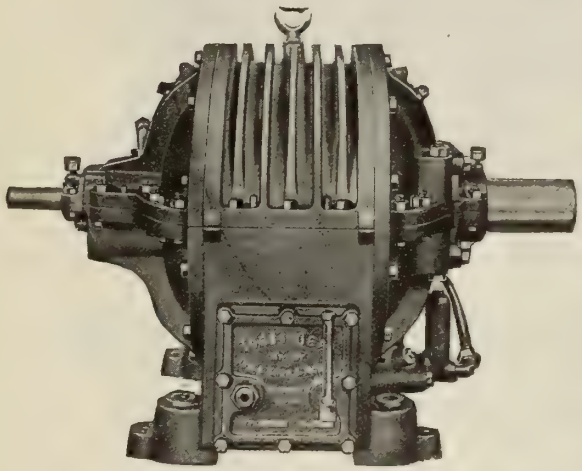


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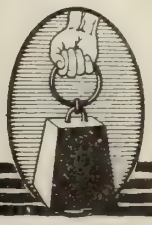
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI. No. 2. July 14, 1921

The Pyrometer As An Aid To Heart Treatment

The Pyrometer is Now Thoroughly Practical for Everyday Shop Use—Different Temperatures Can Be Handled Easily—Recording Type Becoming More Popular—Description of Its Action—Method of Installing

FOR indicating or recording temperatures higher than 800° F., Thermo-Electric pyrometers are extensively used. The "Thermo-Electric" principle as applied to pyrometry, was first discovered in 1820 by Seebeck and has been developed so that the pyrometer instrument is now thoroughly practical for everyday shop use. When two wires of dissimilar metals or alloys (called thermo-couple) are heated at the point of junction, an electrical current is generated—this phenomenon is known as the "Thermo-Electric" principle. The current generated is measured by an electrical instrument known as a Millivoltmeter, the scale of which is graduated in degrees of temperature and the equipment constitutes the modern Thermo-Electric pyrometer.

For temperatures above 2,000° F., a thermo-couple of Platinum—Platinum-Rhodium is used. This consists of one element of platinum and the other of platinum and 10 per cent. rhodium. This combination will generate a potential of about 17-millivolts, and is used for taking readings as high as 3,000° F. Because of the delicacy and care required in handling the platinum couple together with the first high cost, for temperatures below 2,000° F., a thermo-couple of base metals or alloys is more commonly used. These base metal couples are not as fragile, and less expensive. There are a great many applications for which pyrometers may be used in the machine shop. Some of the more important ones come under the classification of "Heat Treatment of Steel," including tempering, hardening, annealing, etc.

In some classes of work in connection with small furnaces, an Indicating Pyrometer as shown in Fig. 1, is sufficient to guide the operator. However, for larger furnaces and for work where long periods of heat treatment are required, a Recording Pyrometer like Fig. 2 gives better results and a complete check on the accuracy of the work is supplied with the chart record made. One pyrometer instrument may be connected by switches to any number of thermo-couples, so that readings may be taken in several different furnaces without changing leads and thermo-couples. A combination of indicating and recording instruments are very often used. The indicator near the furnace to guide the operator and the recorder in the office where a constant check on the work in hand may be had.

Recording Pyrometer.

The recording pyrometer, however, is becoming more and more popular for use by the operator, because it not only provides an indication of the temperatures, but also records the temperature over a period of time, making it possible to keep a check on what actually takes place. It shows what the temperatures are now, what they have been, and in what direction they are leading. This is especially important where the process involves the time element. In fact the recorder tells the complete temperature story.

When selecting a pyrometer it is advisable to give the manufacturer of the equipment a complete outline of requirements; including the character and material to be treated and the usual temperatures required to cover. Also the length of leads necessary between the thermo-couple and the instrument. A very important feature is the protection well used to protect the thermo-couple. This should be considered both from the standpoint of possible mechanical injury and chemical action due to fumes and gases to which it may be exposed, in order to obtain the maximum service from the thermo-couple.

Until recently the one big hindrance to thermo-electric pyrometry was the method required to maintain a constant cold-end. Several devices are used which partially take care of the cold-end error, but some of these are very

Illustrations and data through courtesy of the Bristol Co., Waterbury, Conn.

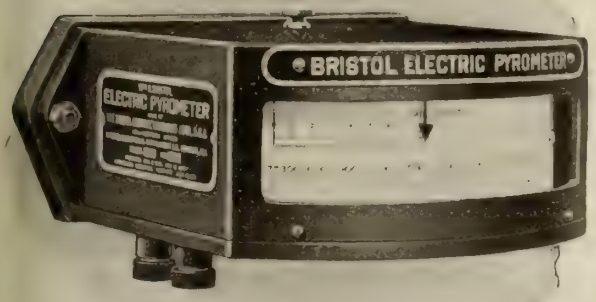


FIG. 1—AN INDICATING PYROMETER.

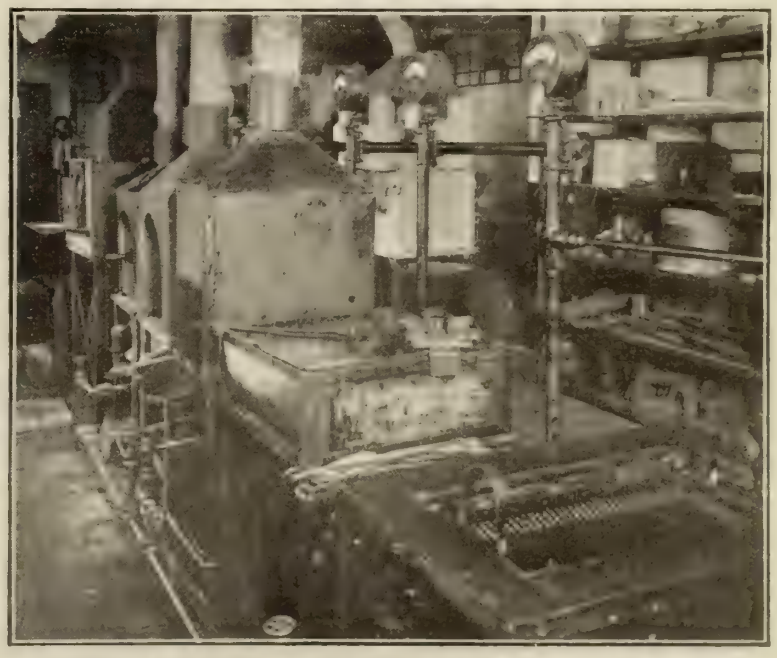


FIG. 4—SHOWING A RATHER NEAT INSTALLATION.

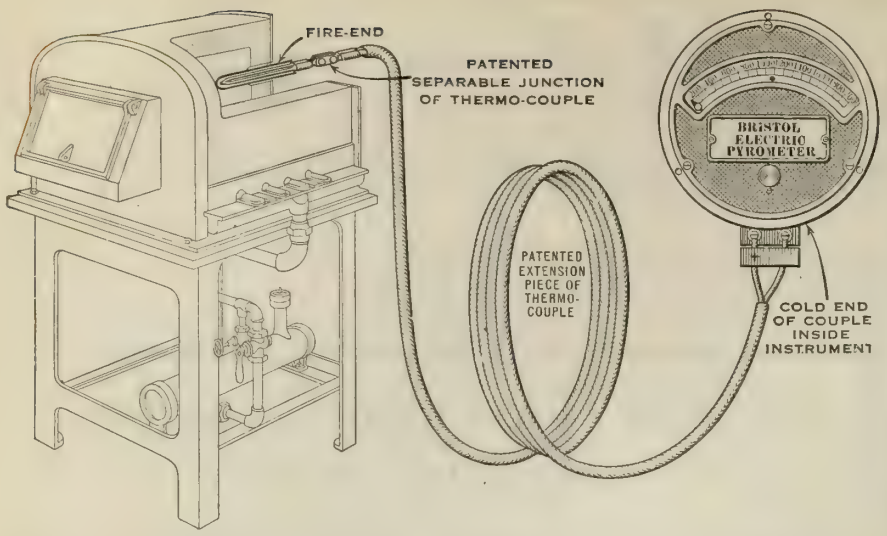


FIG. 3—ONE METHOD OF APPLYNG PYROMETER TO SMALL GAS FURNACE.



FIG. 2—A RECORDING PYROMETER.

expensive and also impracticable because cumbersome and complicated. A recent development in cold-end compensation is the automatic internal cold-end compensator. This is a very simple device installed in the pyrometer instrument itself.

When the compensator is used the flexible extension lead is made of the same elements as the thermo-couple. This makes the instrument the cold-end of the thermo-couple, and as the device automatically compensates for any variations in temperature it obviates any necessity for maintaining constant cold-end. This method of automatic cold-end compensation eliminates all the complicated wiring and equipment formerly necessary, and, furthermore the readings on the pyrometer are absolute. The complete pyrometer outfit is simplified and now consists of three parts only—the thermo-couple, flexible extension lead, and the instrument.

Figure 3 shows one method of applying a pyrometer to a small gas furnace. Attention is especially directed to the simplicity of the pyrometer equipment, consisting of the thermo-couple in the furnace, the flexible extension lead and the instrument itself. This clearly illustrates the simplicity possible where the compensation is applied.

Recording pyrometers are often used in connection with electric furnaces which are used to temper steel parts for automobiles, these operating at temperatures between 1,290° and 1,350° F. The furnace temperatures are usually controlled by a pyrometer regulator and the recorder gives the foreman a check on the accuracy of the regulator.

The pyrometers of the indicating type shown in Figure 4 are used in connection with hardening and annealing. The instruments are mounted directly back of the furnaces on standards. The flexible lead to the thermo-couple is enclosed in the pipe.

Several other installations in photographic form are at present before us, these including equipment for a hardening and annealing furnace; for pack hardening furnaces; also equipment for asphalt stills. To state the uses of pyrometers in a short article of this nature is impossible, but enough has been said to emphasize the importance of pyrometers in obtaining accurate results in any phase of heat treatment.

BEVELING TO PROVIDE FOR CONTRACTION.

When setting a patch in a firebox sheet and welding with the oxy-acetylene torch it is necessary to provide for expansion and contraction. It is customary in some railway shops to bump or corrugate the patch so as to provide a certain amount of elasticity within the sheet itself. Another method is turning the sharp edges of the bevels back with a fuller tool. The practice is substantially as follows:

The defective portion of the side sheet is cut out and beveled to an angle of about 45 degrees. The corners of the openings are rounded to a radius of about one inch or thereabouts. The patch is cut to the same dimensions as the opening and beveled all around to an angle of 45 degrees. It is drilled and tapped for the staybolts set in place and the staybolts screwed in. The edges of the plates are heated with the torch and a fuller tool from 3/16-inch to ¼-inch wide is driven into the vee to curl the sharp edges back. This is done all around before starting to weld. Welding is started at one corner, using filler rod to bridge the opening, and the "tack" is carried clear around without stopping. Welding then is done in the usual manner, using the torch and the welding rod in approved fashion to puddle and make a ripple weld.

No reinforcement is required; i.e., it is not necessary to build the weld above the level of the sheet. The curled edges tack welded are put in tension but they are supposed to yield by straightening out. When welding has been completed the projection of the curled edges on the far side of the plate should be reduced to a negligible amount.

Unfortunately, the practice just described to provide for expansion and contraction, is not preferable to bumping or corrugating the patch, because the elasticity of the curved edges is more apparent than real.

DETERMINING STRENGTH.

An electrolytic method of determining the strength of certain kinds of solutions, which can be applied to analysis of steels, is described in L'Industrie Electrique. Two electrodes, one of platinum and the other of calomel, are used. The former is immersed in the liquid to be tested, and the latter is in a separate vessel containing a neutral solution connected by a syphon to the main electrolyte, which is an oxidizing solution. The electro-motive force produced is watched by means of a galvanometer, and a neutralizing solution is added to the electrolyte drop by drop until the voltage suddenly falls off. The strength of the original solution can then be determined from the amount of neutralizer added.

BENDING WITH THE AID OF THE TORCH.

Repair men using welding torches soon learn to apply them when bending and straightening shafts, bars and structural parts. A workman who understands heating in just the right spots can quickly straighten a badly bent piece with the expenditure of very little gas and strength.

A secret of easy bending, continues Autogenous Welding, is heating a small area to a bright red or yellow heat and bending no more than necessary. Several heats may be necessary, each followed by angular displacement which in the total restores the part to the original lines.

Heating in a forge fire is at a disadvantage or bending and straightening, often-times because of the impossibility of confining the heat to a small section. Hence, the bend cannot be exactly localized where wanted.

A skilled straightener using the oxy-acetylene torch can bend his work with very little or no hammering, a matter of great importance when working on finished pieces. When bending structural steel it will be necessary often to cut flanges and remove parts to allow the bends to be made without distortion. The cutting torch is a most convenient tool for the purpose, of course. In fact, wonders can be accomplished by a welder and helper, using a cast iron floor plate to anchor and align, a welding torch to heat and a cutting torch to vee out for bending. The cuts can be so made that the flanges are readily welded again after bending, thus producing fabricated parts of any shape, still having the strength and characteristics of the original section before bending.

What is a Comprehensive Purchasing System?

In Organizing an Effective Purchasing System Three Things Must be Kept in Mind; First—Experienced Buyers—Second—One Man Must Direct Operations—Third—A Definite System Must be Adopted.

By WILFRED G. ASBLE.

RIGHT buying—of materials, to be shaped into products; of goods to be sold again; of equipment, to handle manufacturing; of supplies, to satisfy the daily wants of the factory—is one of the most important steps in distribution. To keep the wheels of the modern business in motion the price paid must be judged only in relation to the value secured. Each purchasing agent's effort towards helping the big national industries counts in the profits of all.

In organizing an effective purchasing department three things must be given the most careful consideration. First, a staff of able, experienced buyers must be secured; second, there must be one man at the top to coordinate, unify, and direct in a general way the work of these buyers; and third, there must be a system which will get the best prices, the quickest shipments, and an absolutely accurate knowledge in regard to stock on hand.

To handle the many details of a purchasing department with the accuracy necessary in such work requires a definite, coherent plan of recording, filing, and ordering. No slipshod methods will do, for prices must be definitely kept in mind and deliveries hurried in on the desired date. The system used must be essentially practicable and built around your business. It is folly to try and fit your business to any set system.

Sources of Supply.

In compiling and tabulating information regarding sources of supply there are several factors to be taken into consideration. Firms to whom business is given, and those with whom negotiations are conducted, should not only be able to make the goods, but should be so geographically located that you will have an unfailing source of supply.

Information as to sources of supply can be obtained from at least three different sources. First, through trade journals (supply, consumption and prices), which are clipped and filed. Second, through a catalog file. There are many ways of filing catalogs, but the most simple way is to number them and file them numerically in a correspondence unit. A card index should then be maintained in connection with this file. One set filed by name of manufacturer, as illustrated in Figure 1, and the other filed by article, as illustrated in Figure 2, while the third source of securing buying information is through a buyer's directory.

Gentlemen

Referring to your quotation of _____

for _____

please be advised that you were unsuccessful in securing the order for this material.

We wish to thank you, however, for your figures and trust that you will be more fortunate in your next quotation.

Very truly yours,

_____

_____

Purchasing Agent

FIG. 5—SHOWING CIRCULAR FORM OF LETTER.

Quotations and Prices.

When a requisition is received for an article not carried in stock, or when the supply of a particular item has reached the minimum, a quotation sheet, illustrated at Figure 3, is sent to the concerns handling the desired article. This form asks for a quotation by a specific date, the terms and number of days from receipt of order necessary to make shipment. These forms are sent out in duplicate, and after a firm has filled in the necessary information one copy of the sheet is returned to the purchasing agent.

Promiscuous requests to manufacturers for quotations will work to the disadvantage of the purchaser. The real buyer is the man who can discover live prospects among those concerns who are able to sell him what he wants, when he wants it, and at the right price. To be able to do this the purchasing agent must, by a process of selection and elimination make his list of suppliers accurate, complete and confined to those concerns which are in the best position to supply his requirements.

Quotation Record Card.

As the quotation sheets come in, the data is entered on a quotation record card, illustrated as Figure 4. This permits a quick survey for the purpose of choosing the company with which to place the order. These cards are filed by material and are referred to when making later purchases. After calling for a number of quotations on an article, and after the order has been placed and acknowledged, those concerns who furnished quotations should be notified that the order has been placed elsewhere. As a matter of courtesy this is due them. Such notification can be in the form of a postal card or by letter. It is my opinion that a letter is the best form. This can be in circular form, printed as illustrated in Figure 5.

The Purchase Order.

Figure 6 shows the purchase order form. All forms are stamped with a serial number and are bound in alternating sheets of white, green, pink, and yellow. There is at present no standard form for the purchase order. Take a dozen different orders coming into an office and you will find that rarely no two are alike in wording, though in size a standard is often observed, that of 8½ x 11½—letter size. The odd size purchase order sheet is a bother in a systematic office, but the National Association of Purchasing Agents have made a move for more uniform stationery.

The first or white sheet goes to the

NAME
ADDRESS
NO

ARTICLE	CAT.	PAGE
Fig 1		

ARTICLE

FIRM	ADDRESS	CAT. NO.
Fig 2		

QUOTATION RECORD.
MATERIAL

DATE	FIRM NAME	QUANTITY	UNIT COST	TERMS	TOTAL COST	SHIPMENT
Fig 4						

PURCHASE RECORD FORM.
ARTICLE

DATE	ORDER NO	FIRM NAME	QUANTITY	RECEIVED	COST	
Fig 8						

FIGS. 1, 2, 4 AND 8 REFER TO ARTICLE FOR USE OF THESE FORMS.

supplier. The second or green copy is the acknowledgment form and goes to the supplier, after which it is filled in and returned to the purchasing agent. The third or pink copy goes into the purchasing agent's follow-up file. Ordinarily the fourth, or yellow copy, goes to the receiving room to assist the receiving clerk in checking up receipts. This procedure, however, is now condemned .

Receiving Methods.

The receiving clerk if obliged to check only the number or quantity of goods will not be as particular as though that column were left blank and he had to fill it in on arrival of the shipment. This would necessitate an accurate count and instead of being just a check mark it would be written in the handwriting of the receiving clerk. In order to effect this a slip of paper the width of the quantity column is tipped to the fourth or yellow sheet of the purchase order. This slip takes the carbon impression of the quantity column and is removed and discarded, leaving the blank with that information to be supplied. This method prevents any careless checking on the part of the receiving clerk.

If the receiving clerk is under the jurisdiction of the storekeeper, the fourth or yellow copy may go to the storekeeper with the rider attached. He thereupon removes the rider, numbering the back to correspond with the order number, when he turns over the form to the receiving clerk to check. This enables the storekeeper to have any discrepancies checked immediately. This method does away with a memorandum of receipt blank sometimes used. The fourth or yellow copy of the purchase order properly checked is used in its place.

Article | Location | Unit | Max. | Min.

RECEIVED			DELIVERED								
Date	Ordered	Received	Date	Quantity	Balance	Date	Quantity	Balance	Date	Quantity	Balance

FIG. 9—PEPETUAL INVENTORY RECORD CARD.

Acknowledgment of Order.

The acknowledgment form, illustrated at Figure 7, is enclosed with each order. This takes the place of a return letter of acknowledgment and often accelerates delivery by binding the supplier to do a definite thing—a good plan at all times. When this form is received a signal is placed over the date on the follow-up folder in which the third or pink copy of the purchase order has been placed, showing when goods are expected to be shipped.

Purchase Record Card.

When making purchases, it is often desirable to have, for reference, a record of former purchases of the same material. A purchase record card, il-

BLANK & COMPANY

Blankville, Ont.

Date June. 24. 1921.

GENTLEMEN:

Please QUOTE us prices on the material as specified below for delivery, Advise.

8000 Tons - Soft Steel, Bessemer or Open Hearth, for Wire Rod Rolling. 5" Square by 4' long.

Please quote best prices and earliest delivery.

THIS IS AN INQUIRY FOR PRICE---NOT AN ORDER

Unless otherwise specified we want prices F. O. B. our Works. All proposals must show F. O. B. Terms and time of delivery.

MATHEWS GRAVITY CARRIER CO.

W. J. Tolle

Purchasing Agent.

TO _____

CONTRACTING DEPT. Ack. 25/6/21 A.

Fig 3

FIG. 3—SHOWING STYLE OF QUOTATION SHEET USED.

lustrated at Figure 8, is used for this purpose. Such a record, properly kept up-to-date, acts as a supplement to the quotation record. Further, there are times when an article is needed in a hurry with no time to secure prices. This record will then enable the rush order to be placed intelligently and with a considerable degree of certainty that a fair deal will be given you.

Perpetual Inventory Record.

The perpetual inventory record card, illustrated at Figure 9, shows at a glance the maximum and minimum supply of any article. This record has been the subject of much study, both as to the devising of proper forms and in their use to determine accurately the amount of material or supplies on hand at any given time. The working of this record is extremely simple, only requiring that the accurate report of all incoming and outgoing stock be recorded and the balances brought forward. Thus, when the balance on hand shows that the minimum has been reached, attention is automatically brought to this fact.

The up-to-date modern purchasing agent should be a man of good education, a big broad-minded, broad-gauged fellow, with big ideas, strength of character sufficient to withstand temptations to petty or great graft, and with a vision of things which compels a system in all he does. He should keep himself posted on general conditions of business, being alive to what is going on in the various markets, and keep especially properly posted on lines he handles. To this end, he should be a reading man—a reader of such trade periodicals as are devoted to his and related lines.

He should be self-contained, self-possessed, and a quiet man. This makes him strong in his place. As someone has said, "Power is usually the quietest thing in the world. As a rule it makes the fewest motions and the least noise. It never spends itself in ways that count for nothing. When we are in the presence of men and women of real power we are in the presence of peace and quiet. Such a presence is conducive to confidence, and a mighty helper to fair and honest decisions. A man of power knows that the smallest things can destroy the power of the strongest."

Right buying is like the healthy constitution which pulls you through a serious sickness—you don't think much about it until the doctors mention it. It is the same with buying, you will not know the real worth of your buying policies until they are tested by one of the temporary periods of hard sledging through which business tugs from time to time. Buying is the first point at which profits can be made. It is the first place in the business organization where ability can be shown. Remember, it is no small thing to reach out in the markets of the world and bring together the varied products which are now necessary to make up even the simplest manufactured articles of to-day.

ANNEALING ALUMINUM.

Aluminum castings such as oil pans of motor cars are somewhat difficult to weld when broken, owing to the liability of the part drawing out of shape while cooling or cracking owing to the locked-up stresses. If the art changes shape much it will be impossible to reassemble it, and if held rigidly to a steel frame while cooling off so as to maintain the original form there is danger of cracking.

One of the most effective materials for insulating aluminum castings and for insulating preheated aluminum castings and preventing cracks while cooling down is dry soft wood sawdust, continues Autogenous Welding. The sawdust should be used liberally, covering the welded casting to a depth of say two inches. If dry it is an excellent insulator, and if the casting is quite hot it is likely to take fire and smolder slowly, thus extending the cooling period considerably. An aluminum casting so treated will be annealed so soft when cooled that it can be bent without fracture.

In this connection it is of interest to note a method employed by coppersmiths to anneal large copper and brass sheets and keep them flat. The same method is used for aluminum and monel sheets. After being heated the sheets are laid between dry pine boards and left to cool. The boards are excellent heatinsulators and as the wood chars and smolders for a time the slow combustion helps to maintain the heat. The sheets cool very slowly and when finally cool will be found soft and easily bent.

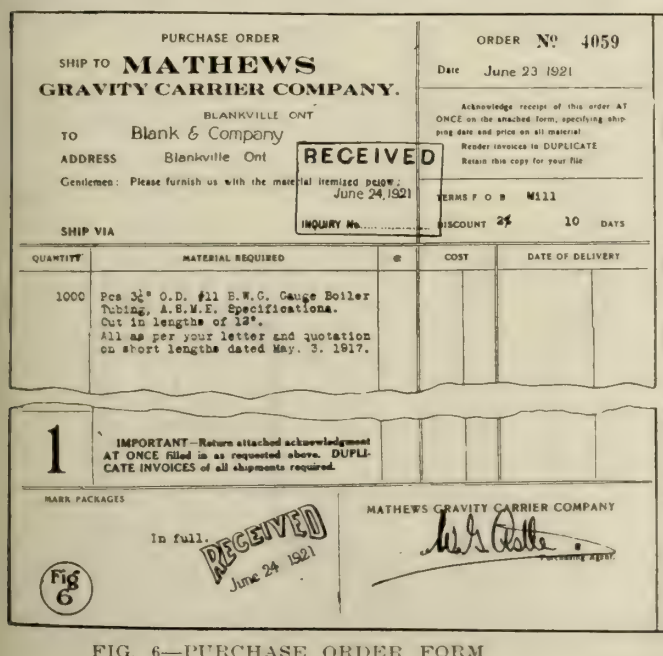
FIGHTING FUEL SHORTAGE.

In order to meet the prevalent fuel shortage and to make better use of the large quantity of small coal sent out from the pits, some German works are putting up small briquetting plants. These plants save the cost of adapting the furnaces for burning dust and other low-grade fuel. In one such plant, with an output capacity of 24 tons per hour, the coal is screened in a revolving drum and the dustis mixed with pitch ground to powder. The mixture is then heated by steam of 250° to 300° C. temperature, and pressed into round briquettes of about 2½ in. in diameter and weighing about 5 oz. A large proportion of the moisture in the coal is squeezed out in the briquetting press.

The highest monolithic structure yet built is said to be the reinforced concrete wireless tower built at Tokyo for the Japanese Government. It is 660 ft. high above ground and tapers from 55 ft. in diameter at the bottom to 4 ft. at the top. The corresponding thicknesses of the shell are 33 in. and 6 in. The footings extend to a depth of 12 ft. and have an area of about 6,000 square feet resting on gravel and clay. The work required some 6,000 cubic yards of concrete and 425 tons of steel.

In order to check the internal corrosion of pipes conveying hot water, it is much more effective and economical, according to Mr. F. N. Speller, the metallrugical engineer to the National Tube Company, of Pittsburgh, to remove the dissolved oxygen from the water, rather than to use protective coatings on the pipes.

At a German steel works there has recently been erected a single-cylinder steam engine which is stated to be the largest in Europe. The engine, continues Engineer, which is of the uniflow type, drives a three-high 30 in. steel rolling mill, and has a normal rating of 4,000 H.P., with a maximum of 8,000 H.P. The cylinder diameter is 68in., with a stroke of 56 in. The speed is 136 revs. per. min., and the working pressure 130 lbs. The crankshaft weighs 30 tons, and the fly-wheel 90tons. The main bearings are 29 in. diameter and 48 in. long, and are water-cooled.


PURCHASE ORDER

SHIP TO MATHEWS GRAVITY CARRIER COMPANY.

BLANKVILLE ONT

TO Blank & Company

ADDRESS Blankville Ont

Gentlemen: Please furnish us with the material itemized below:

SHIP VIA

ORDER No 4059

Date June 23 1921

Acknowledge receipt of this order AT ONCE on the attached form, specifying shipping date and price on all material.

Reorder invoices in DUPLICATE

Retain this copy for your file

RECEIVED June 24, 1921

INQUIRY No.

TERMS F O B Mill

DISCOUNT 2% 10 DAYS

QUANTITY	MATERIAL REQUIRED	@	COST	DATE OF DELIVERY
1000	Pcs 3½" O.D. #11 B.W.G. Gauge Boiler Tubing, A.S.M.E. Specifications. Cut in lengths of 12'. All as per your letter and quotation on short lengths dated May. 3. 1917.			

1 IMPORTANT—Return attached acknowledgment AT ONCE filled in as requested above. DUPLICATE INVOICES of all shipments required.

MARK PACKAGES

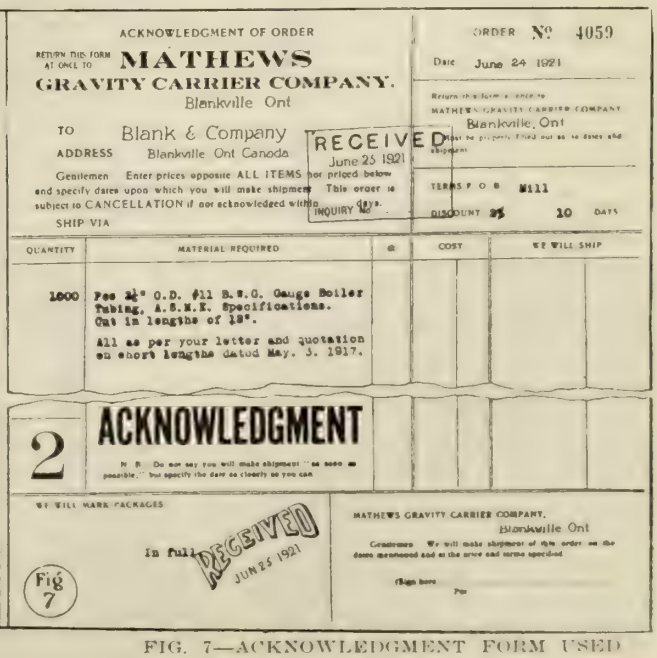
In full. RECEIVED June 24 1921

MATHEWS GRAVITY CARRIER COMPANY

Purchasing Agent

Fig 6

FIG. 6—PURCHASE ORDER FORM.


ACKNOWLEDGMENT OF ORDER

RETURN THIS FORM AT ONCE TO MATHEWS GRAVITY CARRIER COMPANY.

Blankville Ont

TO Blank & Company

ADDRESS Blankville Ont Canada

Gentlemen Enter prices opposite ALL ITEMS not priced below and specify dates upon which you will make shipment. This order is subject to CANCELLATION if not acknowledged within days.

SHIP VIA

ORDER No 4059

Date June 24 1921

Return this form at once to MATHEWS GRAVITY CARRIER COMPANY Blankville, Ont

Kindly be prompt, filled out as to dates and shipment

RECEIVED June 25 1921

INQUIRY No

TERMS F O B Mill

DISCOUNT 2% 10 DAYS

QUANTITY	MATERIAL REQUIRED	@	COST	WE WILL SHIP
1000	Pcs 3½" O.D. #11 B.W.G. Gauge Boiler Tubing, A.S.M.E. Specifications. Cut in lengths of 12'. All as per your letter and quotation on short lengths dated May. 3. 1917.			

2 ACKNOWLEDGMENT

N B Do not say you will make shipment "as soon as possible," but specify the date as closely as you can

WE WILL MARK PACKAGES

In full. RECEIVED JUN 25 1921

MATHEWS GRAVITY CARRIER COMPANY.

Blankville Ont

Gentlemen We will make shipment of the order as the dates mentioned and at the price and terms specified

Sign here

Per

Fig 7

FIG. 7—ACKNOWLEDGMENT FORM USED

Labor Saving Devices in Use in Railroad Shops

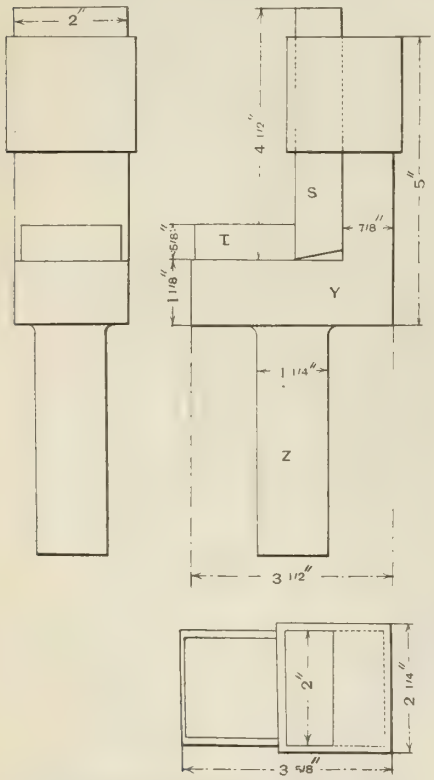
Trimming Cold Chisels—Punch for Strap Hangers—Seat for Dressing Sledges—Boring Air Brake Cylinders on a Wheel Borer—and a Special Wheel Support

QUITE often the use of a very small tool, or a very simple fixture will increase accuracy and production to an amazing extent. Railroad shops are in a peculiar class by themselves, insomuch that the variety of jobs that come to them are much greater than in any ordinary manufacturing plant. This of course means that the workers' ingenuity is often taxed, the result being many ingenious labor-saving devices.

Speaking on the use of such devices, "Railway and Locomotive Engineering" comments as follows:—

Trimming Cold Chisels.

There is a handy little tool in the blacksmith shop of the Erie Railroad at Marion, Ohio, for trimming the ends of cold chisels. It is a one-man affair. Ordinarily, when a blacksmtih has dressed a chisel he needs a helper to strike while he holds the trimmer and the chisel.



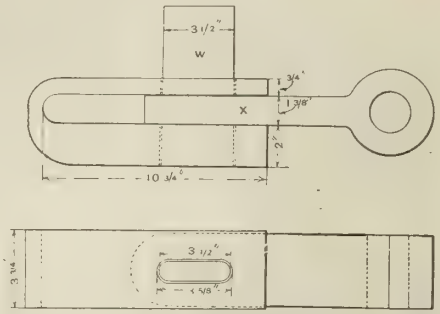
DEVICE FOR TRIMMING COLD CHISELS IN USE ON THE ERIE.

With this device he can dispense with the helper. It consists of an L-shaped forging Y, having a square stem Z that fits into the hole in the anvil. The upright portion of the forging has a band welded about it which serves as a pocket and guide for the cutter S. This last is of tool steel hardened and shaped like a shear knife at the lower end. A small square anvil I with a square stem fits into a hole in the horizontal portion of the forging, just as the stem B fits into the anvil.

After the chisel has been forged to shape, it is laid on the anvil D and the cutter C dropped down on it. A blow of the hammer causes the cutter to trim the chisel.

Punch for Spring Hangers.

There is also a punch for spring hangers that is used under a steam hammer for punching the key holes in spring hangers. It consists of a U-shaped forging with one leg considerably thicker than the other. An oblong hole is cut through the two holes



PUNCH FOR SPRING HANGERS IN USE ON THE ERIE.

into which a hardened steel punch W is loosely fitted. The spring hanger X is heated and slipped between the two legs, and the punch driven through by the steam hammer.

Seat for Dressing Sledges.

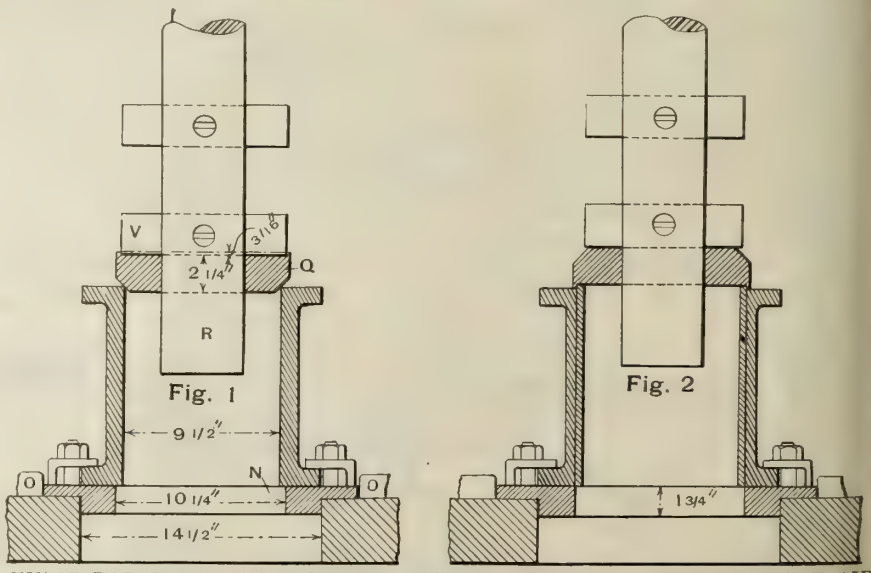
It is a rather long and difficult job for a blacksmith to redress the face of a sledge hammer and give it a properly rounded surface. The simple die, shown herewith, enables the work to be done very quickly under a steam hammer. It consists of a disc about 6 in. in diameter and 1¾ in. thick, into the upper face of which a spherical pocket is sunk. This pocket is about 4 in. in diameter and ⅝ in. deep, struck with a radius of about 3 9/16 in. After the hammer has been dressed, the face end is heated and set on the pocket, when a few blows of the steam hammer on the upturned pene drives it home and gives the face the rounded surface that is desired.

Boring Air Brake Cylinders on a Wheel Borer.

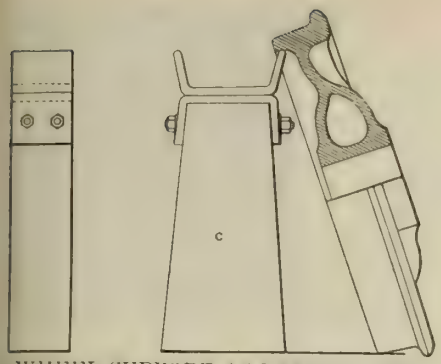
It has been the practice to rebore and bush the cylinders of the Westinghouse air pumps for the whole road at the Meadville, Pa., shops. The volume of this work at last became so great that the department was swamped and the output did not keep up with the demand. In reboring and bushing the pumps a bushing ⅜ in. thick is used. The work was done in a lathe but this was found to be too slow. Accordingly the method now in use was devised.

The machine used is an ordinary car wheel boring machine, fitted with a Davis micrometer boring bar.

The set up for boring the cylinder is shown in Fig. 1. In this N represents a base plate which is held central on the table of the machine by means of the jaws O of the universal chuck. The cylinder is placed on this base and centered by means of the plug Q which is bored out to slip over the boring bar R. The conical surface is dropped into the cylinder and by pressing down on it with the roughing tool V, it is squared and the cylinder drawn to the center; it being understood that the tools used in the boring bar are squared on both sides, so that as the lower one is pressed down on the plug Q the latter is moved so as to be square with the bar. The plug thus centers the cylinder with the bar, when it is clamped to the base plate with the straps as shown. The plug is then removed and it is bored out to a standard diameter, the tools being set to micrometer measurements in the boring bar. This makes it possible to turn the bushings to a standard diameter by a micrometer gauge so as to insure a uniformity of pressure in putting them in place. They are made a trifle long so as to project beyond the end of the cylinder when in place as shown in Fig 2. The cylinder is placed on the base as before and the plug reversed and set over it. It will be noticed that the upper side in Fig. 1, has a lip around the outer edge. This lip sets down over the



DEVICE FOR REBORING AND BUSHING CYLINDERS OF WESTINGHOUSE AIR PUMPS IN USE ON THE ERIE.



WHEEL SUPPORT AS USED AT THE DELAWARE & HUDSON SHOPS.

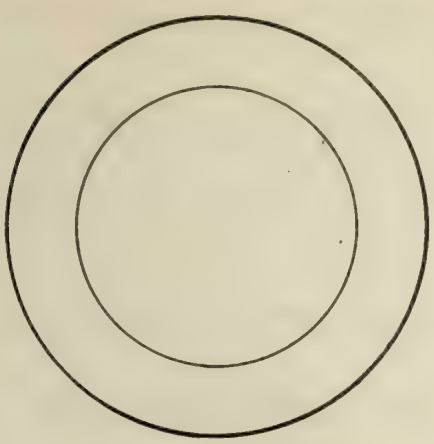
end of the bushing and, when the boring bar is run through the hole in the plug, the cylinder is centered. When this is done the cylinder is again clamped to the base and the bushing bored and faced off. It is a unique use for a wheel borer and one that has served to greatly decrease the time required for this class of repairs.

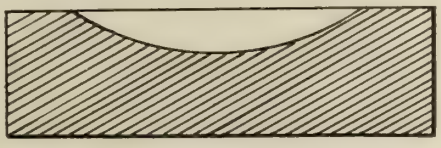
Wheel Support.

In connection with the wheel borer in the shops of the Delaware & Hudson at Watervliet, New York, there is a very simple and handy wheel support to hold the wheel in an upright position after it has been rolled up to the machine and before the lifting tackle to place it in the machine has been adjusted. It consists of a substantial block C bolted to the floor and capped by a U-shaped piece of flat steel the upper end of whose legs are of the proper height from the floor to catch under the rim of the wheel as it is leaned against it as shown in the illustration. This avoids throwing the wheel to the floor and holds it in a convenient position for the adjustment of the tackle.

WATER TIGHT JOINTS.

An ingenious system of making water-tight the joints in concrete structures, such as dams, has been devised by Mr. F. B. Smith, of San Francisco. During the process of construction a groove is formed at the joint and is filled with asphalt blocks. The blocks have a hole down the centre through





DISC FOR FORMING FACE ON DRIVING SLEDGES IN USE ON THE ERIE.

which a pipe is threaded and left in place. Two such sets of blocks are arranged close to one another, and the bottom ends of the pipes are connected together. When the structure is finished the asphalt is melted by passing steam through the pipes. If settlement subsequently takes place the asphalt can be remelted and added to if necessary.

BORING, DRILLING AND MILLING MACHINE.

The Jones Machine Tool Works, Philadelphia, Pa., have developed a horizontal boring, drilling and milling machine of the planer-table type. This machine is said to be very useful on such work as boring cylinders, motor housings and other classes of horizontal boring mill work.

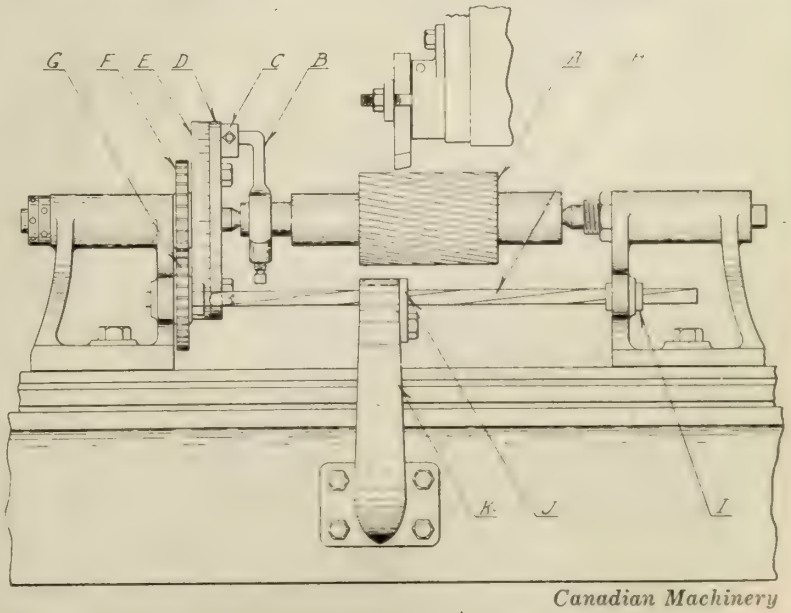
The machine may be driven by either a constant or variable-speed motor located at the base of the column. Power is transmitted to the vertical driving shaft through spur and bevel gears, and the vertical shaft drives through a set of heat-treated steel bevel gears and sliding speed-change gears to the bull gear and quill, and thence to the spindle. All of these gears are fully enclosed in the saddle. The saddle is raised and lowered on the column by a bronze nut revolving on a steel screw, the movement being obtained by means of either the handwheel, power feed, or rapid traverse. Provision is made for traversing the main column on its base by hand, power feed, or rapid traverse, the movement being controlled from the saddle. Power for traversing the column is transmitted from the saddle gearing to a bronze nut and steel screw; operation by hand from the floor is also possible. A steel scale is set in the front vertical shear to facilitate setting the spindle in line with the outboard column bearing.

The table is also operated from the saddle by hand, power feed, or rapid traverse, and there is also a hand feed from the floor. Centralized control of the saddle is arranged for all levers being within easy reach of the operator. All sliding speed-change and feed-gears, except the bull gear, which is made of electric steel, are produced from 0.60 to 0.70 per cent. carbon steel and heat-treated. All gear shafts are made of steel and run in bronze bearings provided with sight-feed lubrication. The bull gear, in addition to being carried by a steel quill, runs in a large conical bearing that takes the thrust when using a faceplate, milling cutters or facing attachments.

The spindle is made from 0.60 to 0.70 per cent. carbon steel and has a standard Morse taper bore at the front end. It is supported by the quill and a steel clamp bushing which runs in the bronze-bushed rear slide. Thrusts in either direction are taken by large bronze thrust washers located on the faces of the rear slide. The feed to the spindle is accomplished by a bronze nut in the rear slide, acting in conjunction with a steel screw. Power feed gears are all located in the front cover of the saddle, and are provided with a friction safety device. The rapid traverse is also of the friction type, and provides against breakages, should the spindle, saddle column, or table become jammed when at the end of one of their respective traverse movements.

Planing Helical Grooves

The sketch illustrates a fixture used on a planer for cutting helical grooves on a crusher roll. The work "A" is supported on centers. On one end is the driving dog "B," the tail of which is located in the slot of the lug "C"—back lash being taken up by the small set screws. Plate "D" is independent from plate "E," and may be revolved by slackening two nuts, the bolt heads moving in T-slots in plate "E." Plate E and gear "F" are keyed to the spindle in the drive head. Gear "G," which meshes with gear "F," is secured to the square twisted (and milled) shaft "H," this shaft being supported in lugs extending out from either head, the bushing "I" in the right hand head providing a cylindrical bearing. "J" is a flanged bush fitted to shaft "H" and secured to bracket "K." This bracket is bolted to the planer bed. Movement of the planer table rotates roll while tool is cutting. Adjustment for different cuts is made by movement of plate "D" to the desired setting, graduations being provided for this purpose.



Canadian Machinery



WELDING AND CUTTING



Welding of Heavy Sections by the Electric Arc

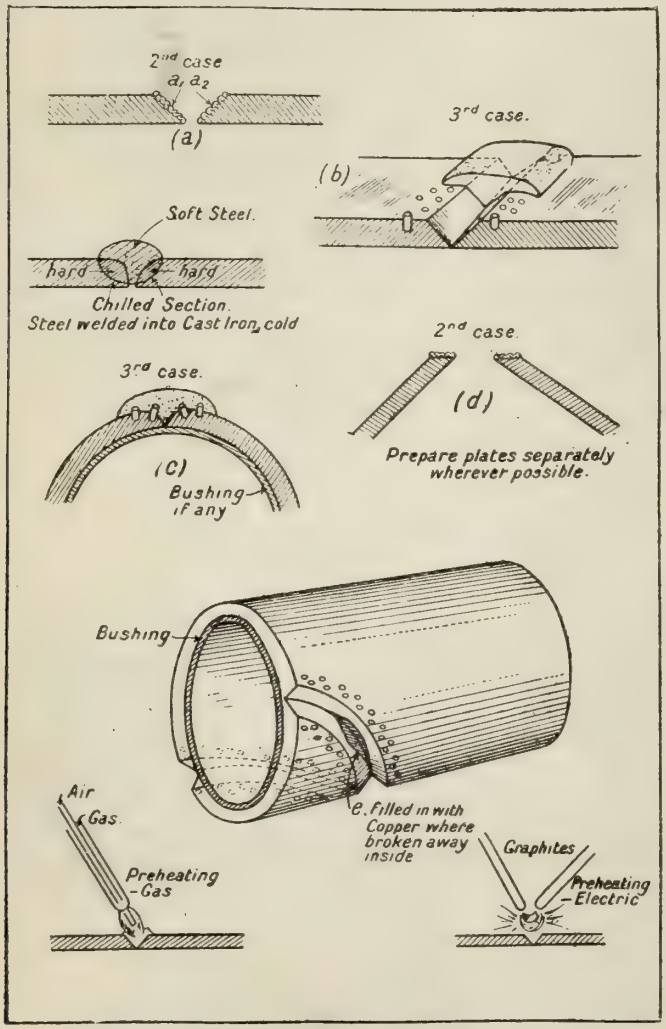
This Method, if Attacked Systematically, Should Prove Easy—Instructions for Preparing the Work to be Welded—What to Avoid—The Welding of Cast Iron is Classed Under Four Heads.

THE welding of heavy section is something which some welders unfortunately fall down on. When attacked in a systematic and common sense manner however, no trouble should be experienced and the following information, which has been taken from a recent book on *"Electric Arc Cutting and Welding" by alternating current, should aid readers to master this branch of welding.

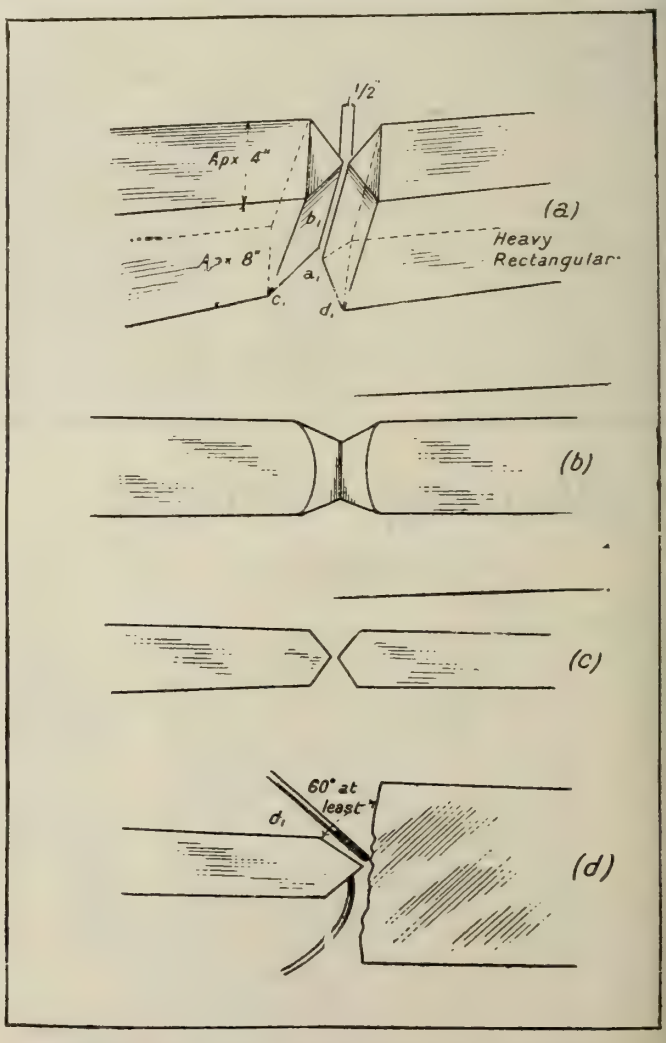
Fig. A shows how a large section can be successfully joined by electric arc welding. It will be noted that the smaller dimension of the section is "veed" into a double V by machining or gas cutting or electric cutting. If the job is such that it can be turned, i.e., rolled over, a smaller or similar "V" should be made on the other two faces, and if it can be rolled over this "V" should made on the top face as shown in Fig. A, so that the length of edge abutting is somewhat reduced.

A section like this, however, should never be brought to a pencil point as there is then infinite chance of its becoming warped out of alignment during welding, whereas with a chiseled edge preparation of each piece is shown, there are only two chances, when once properly lined up and tacked of its being drawn out of line by expansion in welding. The piece should be tacked at the top, bottom and middle of the chiseled edge, and the entire length of the chiseled edge filled up from the side opposite to the tacking, then welding from the other, or first side. Add two or three layers or beads, proceeding from side to side as in the direction, A-1, D-1, A-1, C-1. When two or three layers have been added on this side,

*Permission secured from the Publishers, The Electric Arc Cutting & Welding Co., Newark, N J.



SHEET COVERING THE WELDING OP CAST IRON



INSTRUCTION SHEET ON WELDING HEAVY SECTIONS.

proceed to the other side and add approximately twice as many, then proceed to the first side and add twice as many on the other side and so on by degrees from each side until the job is finished. This is to prevent the original alignment being pulled out of place by the contraction of the welding method.

Where the two pieces of the parent metal, or one of them is non-rigid, during the welding, they may pull out of alignment, but if the welding is equally done and not too much increments from either side, the resulting alignment will be reasonably perfect. A way of insuring the alignment as near perfect as possible is to have two men weld at the same time and at the same rate, one from each side.

This is especially applicable to large pieces symmetrically arranged, and where the time of one man welding would cover more than a day's work, or where rush work is required and costs must be sacrificed in welding a job of this nature. For subsequent machining it is practically impossible to have the weld and parent pieces alignment sufficiently for machine fitting or bearing alignment. In this case one of the pieces, or both, should be larger than the finished size, or a pad of welding metal can be added all round, or on the low side so that subsequent machining to the correct size can be accomplished.

The greatest care should be taken, however, in lining up the pieces so that this bead or excess of metal required should be a minimum. In welding a broken crank shaft by the use of "V" blocks passable jobs have been made without this addition in metal, yet it is much simpler and surer to pad the entire surface and machine all over to the correct size.

Circular Sections.

Figures B and C show the method of joining circular sections. Here the mistake is often made of preparing the two ends to a pencilled point instead of a chiselled edge. As explained, it is very difficult to get true alignment even with the chiselled edge preparation; with the pencil point preparation, or as might better be termed centre punch preparation, there is absolutely no chance of ending up even with a reasonable amount of padding or excess metal to be machined. This does not come from the inability to line it up perfectly from the beginning, but the impossibility to equalize strains in the welding metal. In welding large sections, too great a bite into the parent metal on either side of the "V" should not be made at once, i.e., the amount of the parent metal bit into in each layer should not exceed the width of one bead.

This for two reasons:—1. That too great a leverage for pulling out of line is not allowed. 2. If the parent metal is covered with the weld at the start the "V" after the second or third layer will become too narrow to do proper welding, i.e., to be able to hold the electrode at approximately right angles to the face to be welded.

Where the bottom of a large section is inaccessible a plate can be put at the bottom; starting either underneath and flat up against the section or the plate veed out as at C-1, A-1, D-1 to provide a foundation for the successive layers. A succession of these plates could be provided, successively welding one on top of the other until a laminated joint is made. This method is used by some engineers to weld engine frames, making the laminations up out of scrap boiler plates; while others are using the solid weld and fill in a section with an equal or better success. If the weld is properly made it is obvious that this is the better method as a 100 per cent. section is thus obtained; whereas the laminated method is too similar to the process known as "slugging" which should not be countenanced in any method of welding—but often used in filling in large sections or holes. It consists of putting in solid pieces of metal such as slugs, burs, washers or rivets and then filling in around with the weld and presenting at the finish an apparently beautiful job. Obviously the inner section is valueless and the job fails in time to detect the guilty party. This process should not be mentioned to operators, as it is bad in practice: it will probably be met with sometimes. There are a few cases, however, where slugging is permissible:—

1. Where a finished surface only is desired and no strength need result. 2. Where a reinforcing member is added as a longitudinal bar welded along a member under bending strain, to reinforce its centre section as a strut, where its bending moment is greatest.

If a job is welded and it breaks in the weld, and the weld seems to be perfect, the break of the original bar and the breaking of the weld show that the section is not large enough. If a slight increase is necessary or allowable, it can best be put on by a pad of welded metal, but if a considerable length of section is to be put on, it is sometimes advisable to apply the section by new good metal welded by fillet or "veeing" to the size desired.

Avoid This Method.

Figure D shows method of preparing a joint which is to be avoided. Sometimes it will be met, especially when joining to a section much larger, or to a flanged section where the break is very close to the flange. In this case the angle of the chiselled edge must be greater and more nearly equal to the double angle when prepared from both edges. Even when this angle is such, great care must be taken that the weld is made to the vertical heavy face carefully, and for this purpose sketch D shows how wire can be bent into a shape which will assist in this. A joint made in this manner has not the chance of being as reliable as a joint made as in A, B, and C, because more surface is available on one of the pieces to be welded to than on the other, and because there is no chance of an overlapping fillet on the larger piece, where it is most needed.

In the case where the large piece is cast iron or both pieces are cast iron, steel studs can be used to advantage.

Welding Cast Iron.

Welding cast iron might well be classed under different heads. For this reason we will consider the subject in the form of examples or cases.

We will consider the first case, where the method is used simply as a means of filling in, or building out, where grinding is the only machining necessary. Clean out the spot to be welded by chipping or grinding so that all dirty, oily, sandy, or porous metal is cleaned away and a reasonably bright metal foundation is provided for the weld. Weld with either steel or cast-iron electrode according as to whether a reasonably hard or a very hard surface is wanted after grinding. The steel gives a hard surface and the cast iron a very hard surface. Care must be taken in using the cast-iron electrode that the quick cooling does not catch gas bubbles in the weld leaving holes after finishing. The steel causes no such trouble, but if one or two imperfections show a peening hammer will close them up.

Second Case.

Welding cast iron where tensile strength is required, but no resistance to bursting pressure will be experienced, i.e., welding broken machine-parts, bedplate, etc. In general where no undue strain results, and the part was originally broken by some accident which will hardly happen again in the same place, i.e., "V" out wide enough so that the electrode can be held at approximately right angles to either face of the "V." Weld the two faces of the "V" separately with steel, using great care to have the steel united to the face as the arc progresses and not let any of it run down ahead of the puddle; weld from the bottom up, and, if any of the deposited metal does get away stop and chip it off. After the two faces are successfully covered, it is extremely easy to make a good weld from the steel faces, using steel or cast iron in the "V."

Third Case.

Welding cast iron where heavy bursting pressure is to be met or great tensile strength is required. Use steel studs in single or double row either side of the "V," i.e., from 1 in. deep on the upper half of the "V." The studs to be ⅜ in. to ¾ in. diameter depending on the size of the work, to be screwed into a tapped hole from ½ in. to 1 in. deep, according to the thickness of the work. Saw off ⅛ in. to 3/16 in. above the surface of the work.

First:—Carefully weld round the studs so that the studs are part of the cast iron, then weld diagonally as in lacing a shoe across the weld from stud to stud, and finally finish as with a pad over all, completely covering the studs. In general, studs of steel are needed in a number so that their cross section by 60,000 lbs. their strength equal the cast-iron section by 18,000 lbs. its strength, i.e., about one-fifth area of steel studs to the C. I. for a 100 per cent. job.

The first welding from stud to stud draws the casting together into original contact, especially if a small amount of the original break is left intact at the bottom of the "V." This can be done except in the instance where the piece breaks out and is lost, as in engine cylinder wrecks. A bottom of copper forced in with an air hammer should be used so that for subsequent machining the chilled cast-iron surface under the weld will not be met. In general, much more satisfaction can be had by introducing a bushing especially in large cylinders, which bushing makes the piston fit the weld simply taking the bursting strains. Many cylinders are supplied with the which bushing makes the piston fit the bushing should be removed and replaced after the welding job is finished, machining slightly to size if necessary.

Fourth Case.

Welding cast-iron for subsequent machining through the weld. In all the foregoing cases the weld may or may not be machinable, but the chilled layer of cast-iron directly under the weld will seldom be machinable except for very thin pieces, due to the cast-iron having been heated and chilled quickly and uncombined carbon left in its graphitic state.

To remove this hardened layer when

Continued on page 46



WHAT OUR READERS THINK AND DO



PROPORTION OF STAIRWAYS.

By JOHN S. WATTS

IT often happens that stairways are required, and that rather than get the work done by some outside concern, the shop tackles the problem itself. Judging by the awkward, in fact dangerous design of some stairways, I am convinced that definite data on the proportion of stairways would not be amiss.

In architectural work, the staircase is always an important part of the design, indeed in some cases the most important, being often the central object upon which much thought is expended to create an impression of grandeur. In mechanical structures, on the contrary, the stairs are necessarily relegated to the lowest place, being usually placed in the design after the more important matters, such as the machinery, engines, etc., have been placed, and the stairs must be located where space can be found for them, or wherever they can be crowded in.

Under the circumstances that control the dimensions of buildings for housing machinery, which must be made to suit the machinery, it is impossible to standardize the dimensions of the stairs, but a knowledge of the limiting factors that determine the ease and safety with which stairs may be used will be of considerable help.

The accompanying table shows the proper width of tread that experience dictates as the most desirable for any given rise, the rise being the vertical height from one step to the next, and the tread, the horizontal distance face to face of risers. The last line in the table shows the ratio of rise divided by tread for each step, and enables us to pick out the combination which the space in the building will permit.

Referring to Figure 1, we will take as an example, a case where the vertical height from floor to floor is 12 feet, and the maximum horizontal length available for the stair is 18 feet. The ratio will be 12/18—.666; and from the table we pick out the step having the nearest ratio, namely .67, which has a tread of 10 inches and a rise of 6⅝ inches, as the easiest stair way we can get into the space allowed. We note that in Figure 1, there is always one less tread than there are risers, and that if we wish, we can add one tread to the horizontal length in making out calculation of the ratio. This would make the ratio $\frac{144}{216 \div 2} = .637$; which will permit the use of a stair having a 10½ inch tread with a 6¾ inch riser.

The dimensions of stairs given in the table cover all those that should be used, as the lowest ratio given, namely, 12 inches tread, by 5½ inches rise, is as easy a stair to climb as can be made, and cannot be improved upon by either lengthening the tread or reducing the height of the riser. At the other end of the scale, the stair having a 9½ inch tread and 7 inch rise, is as steep as a stair should be, anything steeper than that is a ladder, and will be safer and more comfortable to use if made as a ladder without risers, and having treads only.

The best width for a stairway is purely a matter of the traffic which will pass over it, but should never be less than 18 inches, and as the stairs given in the table can be safely travelled down with the hand resting on only one handrail, the width may be made as great as the traffic may require.

Ladders being steeper, require for safety to be limited to a width which will permit taking hold of both handrails, and for this reason, should not be made over 24 inches wide. Where space is limited, this width may be reduced to 18 inches. The steps of ladders should be 9½ inches apart vertically, and for ladders up to 18 inches wide, the rungs may be made of two ⅝-inch diameter bars, spaced 1½ inches apart horizontally. Wider ladders are better made with cast iron treads about 5 inches wide, the width depending upon the inclination of the ladder.

HOW DO THEY CUT THREADS IN WOOD?

By D. A. HAMPSON.

Frankly, I do not know how they do it. Two or three times such work came our way and we tried in vain to cut the thread, as it is cut in metal, but to no avail. Naturally, we used tools with more top rake but the wood would break off and we would lose the top of the threads in spite of our efforts; and we even attempted to recut one of these poor threads with a die! We tried the tool method with soft wood and with hard. Finally we decided to turn down such work in the future because very few customers want to pay for spoiled work.

But when we could not get replacements for broken wood screws in the parallel clamps the pattern maker used, we decided to attack the problem more deliberately. A little block was made to go on the lathe cross slide; a hinged piece was used on this block, also a file. The file was clamped in the hinged piece—it became our cutting tool.

The lathe was geared for the wood screw thread and the block swivelled to the thread angle. Instead of cutting the thread, it was filed in by pressing the edge of the file in the blank as the carriage moved to the desired pitch. The operation proved that the saying, "You can file what you can't cut is as true for wood as it is for metal." To prevent the finished thread being oval and to get a constant diameter throughout the length, the block of wood was set at the back for a depth gauge, or stop, for the file. Pressure for the file was obtained by the hand at the top end of the hinged piece. On the return movement, the file was lifted.

Following this successful threading job, others were accomplished in a similar manner. Either a half round or a three-square file was used, the shape depending on the angle of the thread. Neither file produces our familiar 60 degree thread to a nicety on account of the angle of the file shape, and the fact that there is a slight drag when a long piece like this is laid across and below the surface of a cylinder—much as an angular cutter does not reproduce its shape on a spiral milling job; but in the case of wood threads, the results are close enough, besides it was possible by this method to turn out acceptable, whole threads.

PORTABLE GRINDER.

A portable pneumatic grinder has been placed on the market by the Keller Pneumatic Tool Co., Grand Haven, Mich. This grinder, which is known as No. 22-G, is provided with a rotary-piston type of motor. The grinder is built in two sizes, the smaller weighing 5¾ pounds, while the larger type weighs 18 pounds.

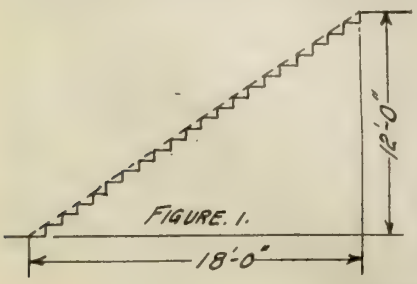


FIGURE. 1.

TABLE OF STAIRWAY PROPORTIONS.

RISE	5½	5¾	6	6	6	6⅛	6⅜	6⅝	6½	6¾	6⅝	6¾	7	6⅞	7
TREAD	12	12	12	11½	11	11	11	11	10½	10½	10	10	10	9½	9½
RATIO	.46	.48	.50	.52	.54	.56	.58	.60	.62	.64	.66	.68	.70	.72	.74

SHOWING HOW THE STAIRWAY IS PLANNED STEP BY STEP.



The Danger of Too Free Credit

ON Page 39, June 23rd issue of Canadian Machinery, we published a short article by Elbert H. Gary, chairman of the board, United States Steel Corporation, on the subject of "Good Times are Actually Here." The author further on in that article speaks on the danger of too free credit, and here are a few of the pertinent points brought out:—

Too free credit is not good for business. It is about as destructive as unduly tight credit and because it permits expansion without much regard for repayment of the money borrowed, excepting through the continuation of ever-increasing prices, it leads eventually to a crash. It is fortunate that our banking system was able to avert this crash which was at one time imminent.

Too free credit not only tempts toward extravagance, but it tends toward confusion of thought as to the right use of credit. If one can discount an apparently unlimited amount of paper, the way is indicated toward using purely commercial and what is supposed to be self-liquidating credit for capital uses. Then when the day comes for repayment, high-cost, emergency financing must be had to fund in some manner the capital which has been borrowed under the guise of credit. This has been happening to an unusual extent and where the fresh capital could not be had reorganization has been necessary.

It is not safe to borrow money on short-time obligations unless that money can be repaid out of the sale of the goods. Capital borrowing against surplus earnings that are expected in the future is never sound business and it is particularly dangerous business when it seems most feasible —that is, in a rising, boom market. For then the risk of non-payment is greatest. One must have capital in order to do business. Nothing has happened to change that elementary fact. Nothing will happen. The shareholders and the bond-holders, not the banks, are to be looked to for capital. The banks perform their whole service when they lend the the money with which to carry goods through the processes of fabricating up to final sale. Or they can carry sound securities in the same fashion—whether of new or old issues.

Safety Rules For The Factory

SPEAKING on the need of "Safety Rules for the Factory," George Swetman in a short article in American Machinist, offers ten rules that are well worthy of consideration. Here they are in the order given:—

1. Open high voltage switches and transformers should be enclosed, or at least fenced off from the rest of the factory. Prominent signs should also be posted.

2. Concealed wiring is less liable to receive damage which will cause fire or accident than is open wiring. Use it. It is also well to protect all bus bars from possible falling wires, etc.

3. Forbid workmen to crawl through narrow, moving belts. This seems foolish but if you will watch you will be surprised at the prevalence of this little short of lunatic performance.

4. Never run a boiler at a pressure higher than its rating without the advice of the maker. The same is true of superheaters and engines.

5. Most boilers are kept too full, as this does much to prevent explosions. It causes priming, or water in the steam, which is likely to cause broken piston-rods, cylinders, and cylinder heads, and scored pistons and cylinders to say nothing of making packing renewals very frequent. Avoid this trouble by having the chief engineer look the boilers over frequently.

6. It happens once in a while that a lazy fireman keeps his boiler only about one-half full, being under the false impression that so doing makes firing easier. As this is only courting explosions it is best to dismiss such a man at once.

7. Never allow machines to be cleaned while running. Any number of one-armed men could testify to the foolishness of such an act. It is still sometimes done.

8. Don't let bearings stay loose. They endanger life and property by causing broken shafting, and are responsible for loss of power.

It seems useless to say this as it should be an axiom, but I know of one man who ran his plant with an important bearing loose for more than a month, cutting down his production perhaps as much as 25 per cent.

9. Bar all irresponsible people and children from your plant while it is running, unless they are accompanied by a careful escort.

10. Don't wait until an accident occurs to put these rules into operation. You are responsible for the safety of all concerned. Act!

The Value of Common Sense

SPEAKING on the value of education to engineers, Knox Taylor, C.S.C., president of the Taylor-Wharton Iron & Steel Co., stated some valuable truths, some of which appear below.

"An engineer,"said Mr. Taylor, "should be educated to know a great deal about a few things and a little about a great many things. Where should the line be drawn? That is the great question. To draw it properly is a matter for judgment, and good judgment is so rare! How much time, money, and even life, is wasted through poor judgment! Too much emphasis cannot be placed on educating to develop good, sound judgment, for without it nothing else avails.

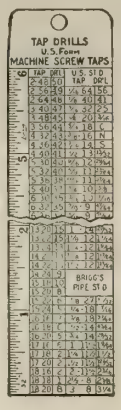
"Good judgment is often called 'horse sense' or just plain, good common sense, and how many so-called well educated men we meet who do not have it. A man who does not possess it in at least a considerable degree is just not an educated man, and cannot be an engineer in the true sense. Good judgment is obtained only in part from books or the laboratory. It is obtained for the most part from the fullness of life's experiences. A full life must have lots of study, with a lot of other activities. Some of the studies must be thorough and intensive, enough so that the student will realize that much that has been pointed is either wrong, or, upon proper analysis, points to some entirely different conclusion than that previously assumed. This develops individual thought and judgment through analysis and discrimination. Every subject cannot be so fully studied, but ordinary study in any one subject helps to acquire education by only a general or superficial study of other subjects. The other activities in a man's education, outside of study or laboratory work, should develop the human side, and how to get results for, with and through other people.

You see so many men who cannot get on well with others. They may be wonderfully well informed scientifically or technically, but they are not good members of a group or team. They are not cheerful, courageous, or considerate, or they have been too busy (with less important things) to learn how to secure any one or all three of these Christian characteristics.

What I have said applies to learning all through life, but of course especially to the school and college age. I think I have made it evident that in my opinion the engineer should have the broadest possible foundation. If this is sacrificed to a great deal of early trade or technical work, time is gained at first and lost later, never to be made up again. What a rich world this would be if only we could profit more by the experience of others. So many lack the judgment to do it.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Owing to the Armstrong Bros. advertisement being switched at the last moment, the contest for June 23rd issue of Canadian Machinery, became obsolete, insofar as question No. 2 was concerned. This query read "A very essential quality in a W—? The answer was the strength contained in wrenches, but as already stated the advertisement to suit the query did not appear. To make up for this omission, we will award two prizes for the July 7th contest.

CONTEST FOR JULY 14TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something you can't help noticing.
2—An interesting piece of information.
3—A purchase that involves an important question.
4—Something that refers to the high cost of lumber.
5—How to save time and labor.
6—A product that has resilient packing.
7—A case where there is a weight for every pressure.
8—Something that started 32 years ago.
9—Where time is expensive.
10—How to tell a good machinist.
11—A case where a leak means dollars wasted.
12—Something said to stand steady heavy pressure duty.

These are Correct Answers for List from June 23rd Issue.

1—John Bertram & Sons Co., Ltd.
2—(See special note).
3—S. F. Bowser Co., Ltd.
4—Dalton Mfg. Co.
5—Elk Fire Brick Co., of Canada, Ltd.
6—W. H. Banfield & Sons, Ltd.
7—Rice Lewis & Son, Ltd.
8—Kearney & Trecker.
9—United States Electrical Tool Co.
10—Selson Engineering Co., Ltd.
11—The Bristol Co.
12—Audit Bureau of Circulations.

Closing Date for This Contest is Aug. 4th



DEVELOPMENTS IN SHOP EQUIPMENT



NEW LATHE.

A newly designed heavy-duty, triple-geared lathe of 60-inch swing has been placed on the market by the Houston, Stanwood & Gamble Co., Cincinnati, Ohio. The bed of this machine is a one-piece casting, 42 feet long, and the total weight of the lathe is approximately 40 tons. The machine is driven by a 35-horse-power variable-speed motor mounted on the headstock. An additional motor is furnished on left end of the apron, affording rapid power traverse to the carriage. Two steady-rests are provided, the larger having a capacity for work from 23 to 37 inches in diameter, and the smaller, for work from 2 to 23 inches in diameter. The jaws of these steady-rests have bronze shoes.

The various spindle speeds are obtained by operating the levers and handwheel on the headstock, and the different positions of these are designated by letters to enable an operator to determine a speed readily by referring to this speed plate on the headstock casting.

The majority of the headstock gears on this machine have a pressure angle of 20 degrees. Lubricant is delivered to the headstock by means of a pump mounted at the rear of the lathe, which is driven from the motor shaft. To insure that the oiling system is functioning properly, an indicator is located on an oil-feed line from the pump to the headstock. This indicator has an aluminum wheel which spins rapidly when oil is flowing. The wheel may be observed through a glass at the front of its container. A device is provided to prevent oil from flowing up on the motor pinion and leaking out through the housing.

Starting, stopping, and reversing of the motor on the headstock are controlled from a controller mounted on the right-hand end of the apron. The action is transmitted through the horizontal shaft near the bottom of the bed and through sprockets and a chain at the right-hand end of the bed, which connect with a second horizontal shaft at the rear. The feed mechanism in the apron is driven through a positive angular-tooth clutch. This clutch permits feeds to be instantly engaged or disengaged without excessive strain on the operator's wrist. Both the front and back walls of the apron are bolted to the carriage.

In a test on this machine a cut 1⅞ inches deep was taken on a 16-inch diameter, 0.50 per cent. carbon, hammered steel forging, at a feed of ¼ inch per revolution and a speed of 15 feet per minute. The cross-sectional dimensions of the tool used were 2 by 3 inches, and its length 20 inches.

MEASURING MACHINE.

Various improvements have been made in the design of the precision measuring machines made by the Pratt & Whitney Co., Hartford, Conn.

For example, pedestals can be supplied for the 36 and 48 inch machines, and in addition two brackets are furnished which support a wooden shelf mounted between the channels, thus affording a convenient place for holding work to be measured. A tangent screw has been provided for the measuring head that facilitates making very fine adjustments of the index-circle. This was formerly accomplished by a knurled knob at the rear, but the tangent screw with its multiplied leverage supplies an easy movement, so that it will be easier to bring the anvil up to the measuring point without going by. A magnifying glass has been mounted over the index-circle, so that the measurement can be seen more accurately. When desired, a vernier may be added to the zero line for the index-circle, which will provide greater accuracy. The microscope on the objective tube has been improved, and a small electric light has been added at the bottom, to illuminate the cross-line of the microscope and the objective line which is etched on the plug of the standard bar.

ATTACHMENT FOR MILLER.

An attachment for their No. 102 pattern milling machine has been placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. This attachment consists of a complete set of appliances for cutting teeth on the patterns of spur, spiral, bevel, and worm gears. The outfit consists of a special 14-inch universal dividing head, tailstock, index-plate, index-chart, 6-inch faceplate, 12-inch faceplate, a set of raising blocks, change-gears, quadrants, and a mechanism for driving the dividing head. The attachment is so designed that in turning a pattern for a spiral gear, the pattern is rotated according to the angle of the spiral as the cutting tool progresses across the face of the pattern.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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The Return of The Miners

THE return of the coal miners throughout Great Britain should have a world-wide effect. Now that the strike is over and the men are back at their tasks, they no doubt see the folly of their past actions. This will be especially true of those who are eager to return to work, yet find that the mines in which they were formerly employed are so badly flooded that it will take considerable time before they are fit to be worked. In some cases mines have been totally ruined, and will never be worked again. It is to be hoped that this condition will be an object lesson to those who advocated drastic action during the strike and who were largely responsible for the sabotage perpetrated.

Let Britain once ge to work in earnest on her coal industry and the results of her activities will be world-wide. For example, suppose for a moment the mines to be in first class shape and the workers producing at a better rate than they ever did before. This is to be expected, as the men will go back with a new zest. What then will be the natural consequences?

As soon as Britain can supply her own industries with cheap coal, the price on British goods will be lowered accordingly. This will mean that she will be in better condition to compete in the world's markets. Once having supplied the home industries, the coal owners will again start exporting to all parts of the globe. This in turn means cheaper coal for the various countries, with a correspondingly lower production cost, allowing them to market their goods at a lower price. Britain and other countries will be able to establish large credits because of their increased business activities, and it will also mean that the mercantile marine of the various nations will prosper exceedingly. Employment will be found for those running the ships, those loading and unloading, and the shipping industry will benefit generally. Freight rates will be lowered, which again helps the manufacturer to market his goods at a better price, this in turn meaning that industrial conditions throughout the world will improve. The far-reaching effect of the re-commencement of the coal industry can hardly be overestimated, for indirectly it will influence the general downward trend of prices, and add a little more grease to the slide down which "Old High Cost" is still dropping.

Watching The Details

THE details of a business should receive just as close attention as the larger matters, for to make any concern a financial success, the money leaks must be closed up; otherwise the finished product cannot be turned out economically.

All this may sound very prosaic, yet in spite of the above fact being known, considerable waste is allowed to exist in many plants, even in these days of keen competition. For example:—In passing through a plant recently, a miscellaneous mass of material was noted in a pile in one end of the building. On enquiry this was found to be "Shaft Ends." Two words, but what a story could be told were it possible for shaft ends to speak.

In fancy we hear one of these ends say:—"Do you know that every year there are over 6,000 pieces exactly like I am sold to a junk dealer? True, we are too short to be of any actual use for any parts made at this plant, but I know we could sell for better than shaft ends to some other firm who could use us to good advantage. Instead of that we are carelessly dropped in a pile and left until there are a sufficient number of us to sell as scrap.

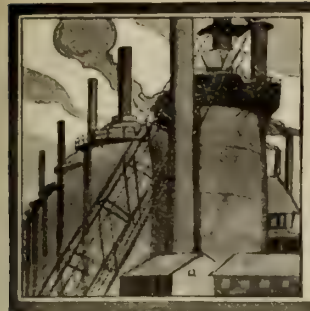
"If that purchasing agent, whoever he is, would only think:—We are only 1½ inches too short. Why can't he order our complete bars longer, even 3" more in length if he cannot get us 1½" longer. Better to waste 1½ inches, than over five. He would find before the year was out that he had partially paid his own salary by the saving effected.

"He may say that shafts come in standard lengths, but ordering as we do, such large quantities, I feel sure he could arrange for a suitable length of bar."

How about this fanciful tale of the shaft end? Does it apply to you, Mr. Manufacturer? If so, study your parts, see what you can do to stop the often ignored bar waste, thus eliminating a constant source of annoyance.



GOOD ADVICE—BUT————



MARKET DEVELOPMENTS



PITTSBURG BELIEVES BOTTOM HAS NOT BEEN REACHED IN STEEL PRICES

Syecial to CANADIAN MACHINERY.

PITTSBURGH, July 14.—The fourth general decline in steel prices since the period of Government price control has just been completed. The first decline was by way of the voluntary reduction made in December, 1918, while the second was that brought about by the Industrial Board appointed by the Secretary of Commerce, effective March 21, 1919. In 1920 there were great advances by independents but the Steel Corporation did not advance its prices, so that the recession in independent prices late in 1920 to the Steel Corporation level was not in one sense a market decline. The third decline came from about February 1 to the middle of April of this year, the independents shading prices more and more until eventually the Steel Corporation made reductions and the market was made uniform. In June some independents began shading again, in certain products. This grew more extensive. On July 5 the Bethlehem Steel Company, one of the three largest independents, announced formal reductions in its asking prices on bars, shapes, plates, sheets and tin plate. Some of these reductions did not go altogether as far as the open market had gone, plates being a conspicuous instance, while some of the reductions, particularly that on black sheets, went below the open market. The Steel Corporation then adopted the reduced asking prices announced, and went farther by reducing pipe and wire products.

On pipe, wire and black sheets the market is now lower than it was before these formal announcements. On the other products it is a question whether it is any lower, but the upper limit, the ostensible or nominal prices, are reduced. Possibly the formal reductions are announced in an attempt to preserve the semblance of there being a plain and clear-cut market instead of a purely open and competitive market, but a more cogent reason probably was to make entirely public the price declines that had actually occurred, so that when mills reduced wages, as they are doing, they could not be charged with receiving higher prices than they really were receiving.

Prices in Detail.

What is commonly called the "April schedule" of steel prices was arrived at by the independents making slight advances in most products, after their extensive cutting of the Steel Corporation or Industrial Board prices, and the Steel Corporation then making certain reductions in its prices. Since then there had been two general declines, one in wire products, the other in sheets, $5 a net ton in each case. On other products the formal reductions just announced are from April prices. These reductions include $4 per gross ton on billets, slabs and sheet bars, making billets $33, slabs $34 and sheet bars $35, Pittsburgh or Youngstown. Several weeks ago sheet bars sold at about $35 delivered, so that presumably these new asking prices could be shaded. Other reductions from April prices are $4 per ton on bars, shapes and plates, making bars 1.90c and shapes and plates 2c. As early as the middle of June plates had been done quite freely at 1.90c on moderate sized orders, so that it is doubtful whether 2c will really stand as the market. Bars at 1.90c, however, may hold.

Sheets having already declined squarely $5 a ton from the April prices, the reductions just made, in addition, are $4 a net ton on blue annealed and $5 on black and galvanized, making the new prices 2.65c on blue annealed, 3.50c on black and 4.50c on galvanized. It seems quite improbable that the black sheet price will be shaded in the near future. Blue annealed sheets are not so certain, as to the heavier gauges, as they are sometimes sold on the plate mill schedule. As galvanized had previously been sold in some cases at 4.50c when the mills were still holding to 3.75c on black, it is not certain that 4.50c will hold on galvanized when black is squarely down to 3.50c.

Wire products having previously been reduced $5 a ton from the April prices, with in addition a reduction from .70c to .50c in the galvanizing extra, a straight reduction of $5 a ton is now made, making wire in general $10 per net ton under the April prices. The new wire prices are: Plain wire, 2.50c; galvanized wire, 3c; wire nails, $2.75; painted barb wire, 2.90c; galvanized barb wire, 3.40c.

Standard steel pipe had not been shaded by independents to any extent, though there had been considerable shading in line pipe and oil country goods generally. In the case of standard pipe therefore the reduction is a straight reduction by the Steel Corporation of its own initiative. The reduction is from the list of April 13, which carried a basing discount of 62½ per cent. The new card, which is dated July 7, carries a basing discount of 64½ per cent., so that on base sizes the reduction in price is about $4 per net ton, a point being about $2 a net ton, though making allowance for the "trimmings" or extra discount to the large trade a point amounts to somewhat less than $2. In detail, the reduction from the April list is nothing on ene-eighths inch, one point on ¼ and ⅜-inch, and two points on ½ in to 6-inch, sizes 7 to 12 in. inclusive being reduced three points. Galvanized pipe three points. ½-inch galvanized pipe is reduced the same amount as black. Line pipe is reduced the same as standard pipe, and there are general reductions in oil country goods, casing, etc. Discounts on boiler tubes are increased cent.; six points on 2 and 2¼-inch to two points on 1 ¾-inch to 17 ½ per 32 per cent.; six points on 2½ to 3-inch to 43 per cent., and five points on 3¼ to 13-inch to 48 per cent., these prices being basing discounts on less than carload lots.

Striking a general average, the new steel prices are 47 per cent. above their ten-year pre-war average and 30 per cent. under the war control prices.

The new prices are, of course, only temporary. The general feeling in the trade is that whenever there are signs that buyers are getting ready to take hold the mills will voluntarily make further concessions in order to encourage them. In the past few months the feeling among many producers has been that buyers in general did not wish to see prices at mill reduced, since they were endeavoring to liquidate their stocks. If voluntary reductions were not made, the appearance of inquiries of important size would probably lead to price cutting, and a general decline by that route. Eventually, no doubt, steel prices will advance again, but they would hardly advance except by the mills becoming fairly well filled with business, and as the mills are now operating at not over about 20 per cent. of capacity such a condition is not in immediate prospect. The market is likely to remain stagnant for a few weeks more.

Pig iron is down 50 cents, with Bessemer at $22, basic at $20 and foundry at $21, valley furnaces.

Connellsville furnace coke is a shade stiffer, being rather firm at $3, but foundry coke is easier by about 25 cents, being quotable at $4 to $4.50 according to brand.

NEW RULINGS IN THE TARIFFS

Dealers Trying to Find Out What Effect New Regulations Will Likely Have.

TORONTO—One can make the rounds of the iron, steel, and machine tool market without finding much evidence of life. How long can the present conditions last? It is impossible to say. There have been so many false prophets arise in the land that the market is wary of believing any of them. At the end of last year there was nothing short of a regular flock of experts who were

quite certain that the turn of the year was going to see the turning of business toward better channels. There was nothing to justify such a belief, but is became prevalent and popular, at least until it didn't happen. Then there was an equally large number of critics and experts ready to turn around and say that it was quite foolish to expect trade to turn at any given date.

The fact of the matter is that a runaway market is hard to stop. Prices in many lines may be more or less stable, but all that is needed to try them out is that a good sized order shall come up on the horizon when dealers promptly forget schedules and selling lists and are off to make a killing.

New Rulings Cause Trouble.

New customs regulations, which are dated at the 30th of June, are causing steel merchants more or less worry. On shipments that are brought in here from United States, the invoices must bear a footnote certifying that the prices are market values, or cost plus a fair profit. To be exact, here is the footnote, as copied from an invoice going through the Toronto office of one of the largest U. S. concerns:

> "We certify that the fair market value, as shown on this invoice, is not less than the cost of production of similar goods on the date of shipment to Canada, plus a reasonable profit thereon."

"As far as we are concerned," stated the dealer in question, "it is making quite a lot of bother. For instance we started putting this clause on the invoices that arrived here after the first of June, although they may have originally been sent out several weeks in advance of that date. It is a most ambiguous ruling as we see it. No doubt the idea is to prevent dumping of steel in Canada."

As Other Dealers See It.

Brokerage houses have called the attention of all their clients to the new ruling. Here is the way anther dealer sees it: "I can see no good reason for trying to put through such a clause as that now. Surely the government at Ottawa understands that steel, in the great majority of cases, is not being sold at a 'reasonable profit' or any other kind of a profit at this time. As far as the yards around here are concerned, it is a case still of getting the stocks down, at times without regard to fair profits. It would mean that had a jobber a chance to pick up a lot of steel at a very favorable figure in the United States market, he would be barred from bringing the same into this country. There is not a very great deal of shipping being done now, but were a big volume passing the border it would cause no end of trouble."

As Buffalo Sees It.

A Buffalo correspondent, who has seen the ruling in operation at that point, has the following to say about its application, and takes a view that is probably a little more extreme than anything we have come across in the Canadian steel market. Here is his view:

"A situation with reference to Canadian business—always interesting in this vicinity—has arisen and threatens to bring a complete withdrawal of shipments of American-made steel products into the Dominion. The Canadian customs has promulgated a ruling which requires every invoice of steel going into Canada to bear a footnote showing that the shipment is billed at cost plus a reasonable profit. Coming at a time when sales are either at cost or less, shippers here say the ruling is offensive, and that it will result in an advance in prices on Canadian shipments, or withdrawal from that market."

Interest Lags in Steel.

Apart from a discussion of this new ruling the steel market has little to say for itself. The buyer is still very much in control of the market, and he does not hesitate to take advantage of the situation. One hears such incidents as the following: "The purchasing agent of the Blank Company called me up this morning and wanted to know our price on a bar of quarter-inch round." The price of the thing would be well under a dollar, and the firm taking such an order and not charging for delivery would lose money. Another dealer tells of having thirteen orders for sheets, and out of this stroke of business disposing of thirteen sheets, as each order was for a single sheet. These are not isolated or unusual cases. They are rather indicative of the real spirit of the steel market at the moment. Dealers are buying from mills in much the same way. They are afraid to specify heavily, for although little is said openly, the feeling is very much in evidence that the market looks for lower prices, and there may be radical departures from present prices, although they represent several reductions from war peaks. Bars are selling around $3.75 base, although sales are reported at a lower figure. Canadian mills will do around $3.25 on an attractive order. Small shapes are quoted at the same base, $3.75.

The movement in sheets is restricted. Black, 28 gauge, is quoted at $5.70 base; blue annealed, No. 10, at $4.75; Galvanized, No. 28 at $7.50. Cold drawn is sold at $6.00 base. Bands are $4.25 and hoops $4.75.

Boiler tubes are in very small demand and many of the warehouses have extra large stock on their hands owing to the fact the buying has been carried on in a very stinted way. We quote lapweld as follows, O.D.: 2", 23½c per foot; 2½", 30c foot; 3", 37c; 3½", 40c, and 4", 51c.

Machine Tool Market.

Few sales are being made in the machine tool market, although some of the houses state that they have received a number of inquiries, but there has been very little real business resulting from these. The new customs ruling may have a bearing on the machine tool business as well, as an effort is being made to prevent firms taking advantage of the absorption of exchange to evade the anti-dumping law.

Firms carrying a large number of lines are still in a peculiar position over trying to keep up an assortment and at the same time clean out high cost material, and keep in shape to cater to the trade.

The scrap metal market is stagnant, but hardly any worse in the hot weather than it was in the cooler months preceding. Business is done in a small way, the volume is small and the figures involved are simply a matter of arrangement between buyer and seller. Any price that could be quoted would have to be regarded as more or less nominal.

TRADE GOSSIP

A syndicate of Toronto and American capitalists have secured a large tract of property in Toronto which lies east of Coxwell Ave. This land has a frontage of between 4,000 and 5,000 ft., and is said to have cost about $125,000.

The intention is to build about 150 moderately priced homes, and as soon as arrangements can be made with the proper authorities, 20 or 30 houses will be started. According to present plans the houses will cost from $4,000 to $5,000, and the new homes will be surrounded with sufficient land to make them desirable. The remainder of the 150 homes will be built as the demand grows.

It is said that Hamilton intends spending $10,000 on the construction of asphalt pavement.

Plans have been prepared for a new theatre and office building in Halifax, N. S. Herbert R. Brewster, of Brooklyn, is the architect, while the building itself is for J. M. Franklin, Strand Theatre, Halifax. Tenders will be called for in the near future.

Plans for an addition to the New System Laundry Co., Elizabeth St., Toronto, are about completed. The proposed cost will be around $10,000.

Tenders will be received until July 25th, by J. W. Pugsley, sec. Dept. Railways and Canals, Dom. Govt., Ottawa, for section 1 and 2 combined Welland Ship Canal. The plans are at the office of the Chief Engineer of Dept. Railways and Canals, Ottawa, and office of Engineer in charge, Welland Ship Canal, St. Catharines, Ont. An accepted cheque for $700,000 is required.

One of the most recent enterprises to become established in Walkerville, Ont., is that of R. H. Cunningham & Co. This concern are specializing in industrial electrical furnaces, covering a wide range in heat treating. Mr. Cunningham, who was formerly with the Hiram Walker Metal Products, Ltd., states that electricity is becoming more extensively applied to the requirements of the various industries.

Hi-Speed Tools, Ltd., Galt, Ont, manufacturers of taps, dies, and specials in small tools, have recently appointed as their representatives, W. Bruce Campbell, Confederation Life Bldg., Winnipeg, for jobbers only in Winnipeg and the West; and Price & Campbell, 444 Main St. E., Hamilton, for Hamilton and Niagara Peninsula section, covering both jobbers and consumers.

The Philips Gies Foundry, Kitchener, Ont., are placing a number of specialties on the market, among the most important at present being "Superior" shaking and dumping grates, adaptable to any style of boiler, also a full line of water service boxes.

PERSONAL

William Washington Wylie, one of the pioneers of electric car manufacture, died at Ottawa recently. For nearly a quarter of a century the deceased was head of the Ottawa Car Mfg. Co. Mr. Wylie came to Canada about 40 years ago, and it was under his direction that the Ottawa Car Mfg. Co. reached its present day proportions.

LeBLOND
HEAVY DUTY
Universal Millers

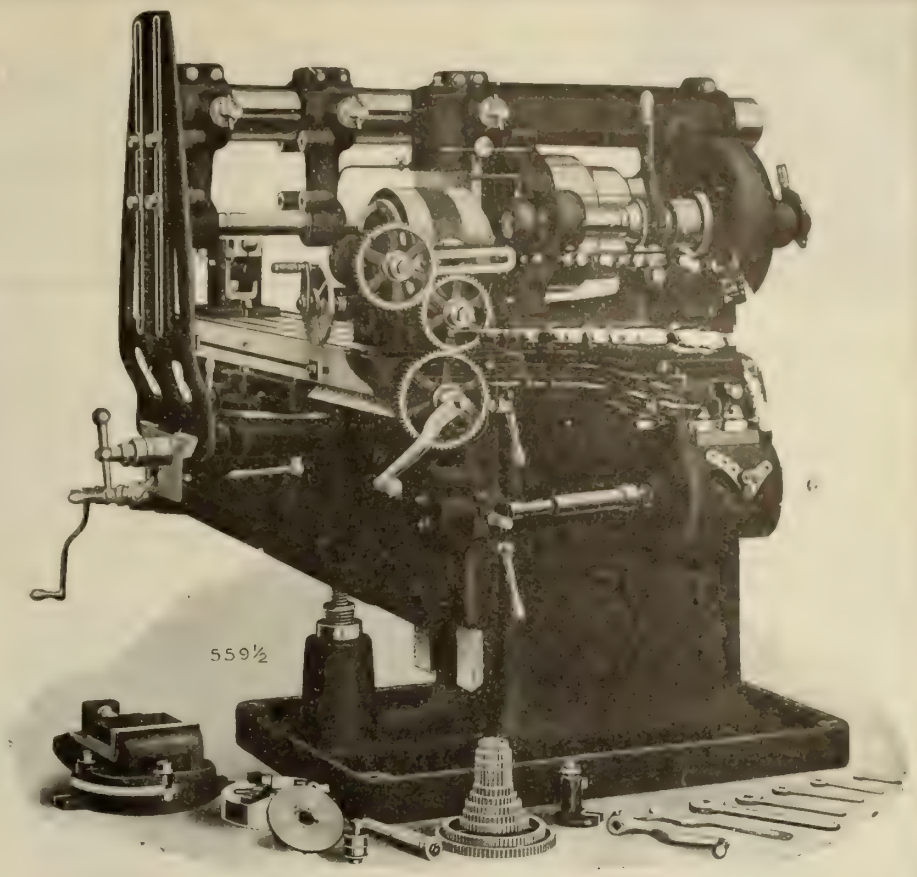
Are not only Tool Room Machines, but as a manufacturing proposition appeal to the careful buyer.

Their long life insures ample returns for the investment made.

May we explain to you their many advantages and the convenience of their control?

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Heavy Duty Draw Cut Shapers, Special Heavy Duty Draw Cut R.R. Shapers, Special Locomotive Cylinder Planers, Traveling Head Planers, Special Roll Wobble Planers, Portable Planers, Stationary and Portable Keyway Cutters, Finished Machine Keys. See our full page advertisement in the first issue each month of "Canadian Machinery."

FUSING POINT.

Determinations of the fusing point of ncrete have been made at the Ameri- n Bureau of Standards on small speci- ens. They were found to have a fus g temperature of approximately 200° F., but the temperature probably ries with the kind of sand and cement ed. Fusion of concrete has been ob- rved in one or two very hot fires in inforced-concrete manufacturing ildings, and was also noticed in the e tests on columns recently completed the American Underwriters' labora- ries.

NEW DEPTH GAUGE.

The Brown & Sharpe Mfg. Co., Provi- nce, R. I., have developed a new mi- ometer depth gauge, to be know at No. 7. This gauge is said to be primarily portant because of its simplicity and acticability. It is furnished complete th three measuring rods and enables adings from 0 to 3" to be obtained thousandths of an inch, he micro- ter screw having a movement of 1". The desired rod is easily and simply placed in position by a cap, which permits the rod in the gauge to be withdrawn and the one desired inserted. Replacing the cap brings the shoulder on the rod against a finished seat. The shoulders on the rods are adjustable and permit individual adjustment of any rod. The tool is obtainable with either a 2½" or 4" base. The same adjustment for wear on the threads is used as that on their regular line of Micrometer Calipers. This tool is not shown in the Brown & Sharpe Small Tool Catalogue, but separate pamphlet, describing the tool, is obtainable from the company.

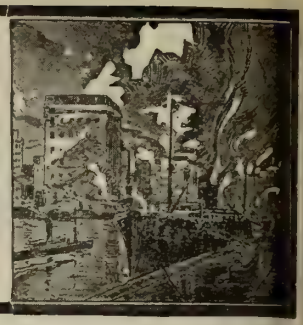
ARC WELDING ALUMINUM.

In a paper read before the Liverpool Sub-centre of the North-Western Centre of the Institution of Electrical Engineers, Mr. F. J. Heyes—Metropolitan-Vickers Electrical Company, Limited—stated that he had attempted the arc welding of aluminium, using the ordinary acetylene welding fluxes, without any success whatsoever, and he reached the conclusion that it is essential to use a flux which is not easily vaporized. For this purpose he found cryolite suitable. Cryolite alone was no use for oxy- acetylene, as in that process the aluminium was only heated up to the melting point of the metal, and as the cryolite was only viscous at that temperature it would not allow the molten metal surfaces to come together, and no weld could be made. On theother hand. in arc welding, a small pool of molten aluminium was formed at the point being welded, the temperature of which was far above the melting point of the metal, some ofthe aluminium being deposited in the form of vapor. At thot temperature the cryolite became quite fluid and ran freely on the surface, enabling a very good weld to be made. In trying to weld with a plain electrode the aluminium hung in globules at the end of the electrode, and there was still a tendency for this to occur when using cryolite alone. A small percentage of chloride, however, overcame that difficulty, and rendered welding much easier. In acetylene welding it was advisable to use a rod of aluminium containing the flux.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



BELIEVES BRITAIN WILL SOON REGAIN HER HOLD ON WORLD'S MARKETS

"NOW that the coal strike is settled, we may expect the British manufacturer to return to his former position in the world's markets." This is the opinion of F. W. Field, British Trade Commissioner in Ontario. He goes on to say that there is an increasing use of oil for steam arising and power purposes generally. Compared with coal, however, its use is of such relatively limited extent that it has no very material bearing upon the main position, and before industry could look forward to a period of progress the coal dispute had to be settled upon a more or less stable basis. The production of ample supplies of coal and its sale at lower prices is of such paramount importance that, while a settlement of a temporary character would have been welcomed by a portion of the community, the majority felt that our industries must be safeguarded, as far as possible, against an early recurrence of such a disastrous dispute, and that it was not sufficient to aim at peace at any price.

"Our manufacturers are again beginning to quote attractive prices in the Canadian market. A Birmingham firm, for example, submitted a price to a Toronto buyer last week which was well under the best foreign price received. The process of regaining our trade may be a little slow, but I have no hesitation in saying that the British manufacturers will continue to compete keenly with foreign countries, and will regain much of their former trade, which was lost during their great efforts to win the war. The Old Land and the Dominions will also build up a substantial volume of inter-Empire trade during the next few years. In this business Canada will be a very important factor, both as buyer and seller.

"An analysis of British trade satistics for the first quarter of this year shows some interesting changes in the direction of trade. By grouping the countries into European, the U. S. A., other foreign, and British possessions, it is seen that, owing rather to a decrease in exports than to larger imports, the excess of exports over imports with the European countries has fallen from approximately £76,000,000 in the first three months of 1920 to a little over £3,500,000 in 1921, which compares with an adverse balance of £16,000,000 in 1913. With U. S. A., the excess of imports over exports was £24,600,000 in 1913. £111,900,000 in 1920, and £67,200,000 in 1921, while, in the remaining two cases (other foreign and British possessions), adverse balances in 1920 of £22,900,000, and £71,100,000, have been converted into favorable balances of £3,400,000 and £7,200,000 respectively."

FUTURE IMPORT TRADE OF POLAND

Conditions Must Become More Normal Before Trade is Likely to Increase. German Competition Feared. Goods Must be Adapted to Suit Local Requirements.

"The import trade is not likely to increase until conditions become more normal, the currency appreciates, and the buying power of the country is larger." So states a writer in the British Board of Trade Journal, speaking on the future import trade of Poland. He goes on to say that it is readily admitted that Poland will become a buyer of foreign goods in the future not only for her own needs but as a middleman for the Russian market. The Poles have an extensive and accurate knowledge of Russia and should play an important part in the commercial and industrial regeneration of that country. German competition is likely to be very keen in this part of the world, as, having lost important colonial markets, she will probably devote special attention to the capturing of Polish trade. It is therefore essential not to consider the Polish market as a buyer of goods to be utilized only in Poland—the scope is much larger.

German and other competition was not felt much during 1920; this, as regards Germany, was perhaps due to the enforcement of special regulations by which the export from Germany to Poland of a large number of articles was prohibited by law, but such goods as have been offered are cheaper than British-made goods.

With a view to competing successfully, it will be necessary for British and other traders, in the first instance, to adapt their goods to local requirements, to appoint local representatives of a good standing with a thorough knowledge of the country, and to sell goods on credit, as soon as local conditions will justify the granting of it. In some branches it will be indispensable to keep stocks of goods in Poland to enable quick delivery with a view to overcoming the advantage which Germany, Czecho-Slovakia, or Austria possess, owing to their more favorable geographical position.

ORDERS EXPECTED FROM RAILROADS

It is expected that railroads will i the near future release orders of fai proportions for repair work materia such as steel plates, sheets, angle bolts, nuts, channels, spikes, smal beams, bars, rods, etc., etc.

Speaking on the subject, W. A. Bald win, manager of the Ohio region of th Erie Railroad, says some roads are plan ning to place tonnage for car and loco motive material. Such business wi probably be let as soon as the carrier ascertain the results of reduced wag payments. Cars used in the grain trad are badly in need of repairs and man box cars have defective roofs whic must be repaired before they can b used.

Steel makers state that the bank are prepared to deal liberally with th roads in the matter of furnishing mone to repair cars, especially for movin crops.

INCREASE IN PARCEL POST RATE

The recent increase of rates on pa cels is, according to the United Kin dom authorities, due to the heavy i creases of cost of handling and conve ance. As a consequence parcel po rates to the United Kingdom on an after July 1st will be 20 cents for th first pound, and 16 cents for each su ceeding pound or fraction thereof.

Below is shown in table form th rates existing at present on parce from 1 to 11 pounds.

1 lb	20 cen
2 lbs	36 cen
3 lbs	52 cen
4 lbs	68 cen
5 lbs	$0
6 lbs	1
7 lbs	1
8 lbs	1
9 lbs	1
10 lbs	1
11 lbs	1

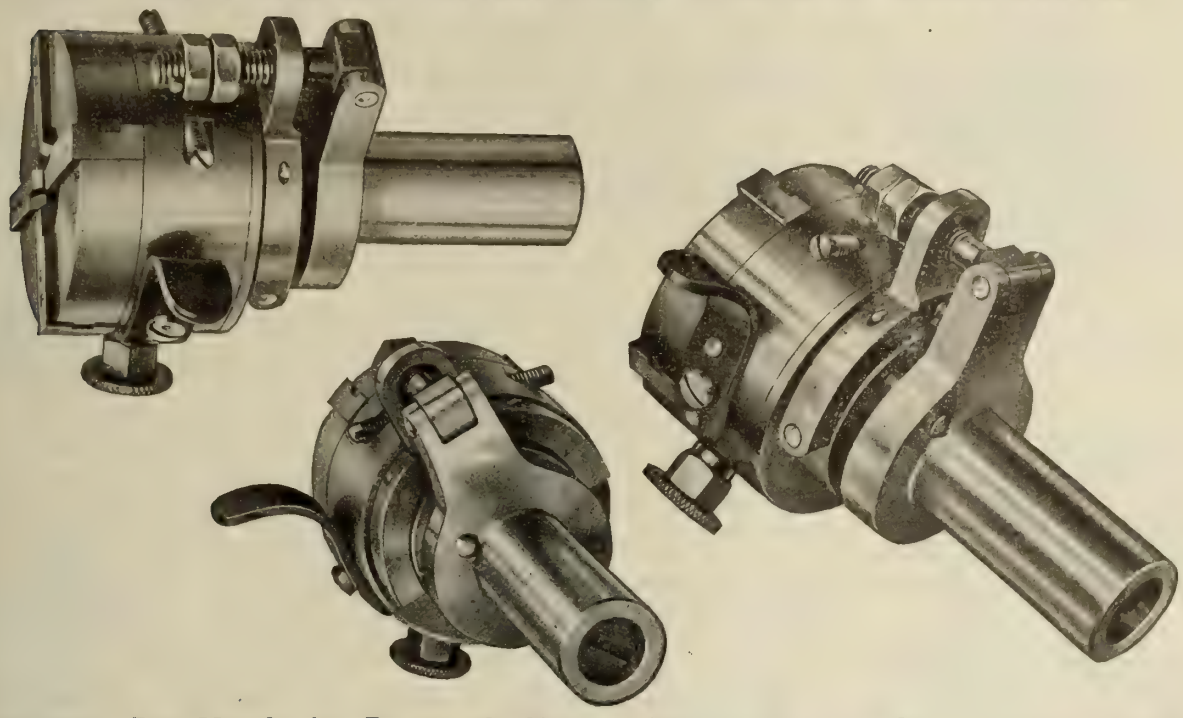
GOING DOWN.

A survey of the labor situation Canada for the month of May, 1921, more encouraging than for some tir past, and warrants optimism for the i mediate future. The review discloses further decline in the cost of living, illustrated in the cost of a weekly fa ily budget of staple goods, and a ge eral improvement in wholesale and r tail trade throughout the Dominic There was an increase in the volume employment, activity being especia noticeable in building construction, t value of permits taken out being nea double of that of the month of March.

The Geometric Tool Company **New Haven, Connecticut, U.S.A.**

Right on the Lead

A NEW HIGH MARK IN SCREW CUTTING



Geometric Die Heads for Brown & Sharpe Automatics and Other Single Spindles

THE New Style DS Geometric Self-Opening and Adjustable Die Heads were designed primarily for the Brown & Sharpe Automatic Screw Machines. They are quite as well adapted to other Automatics, and where they are used, there is no reversing of the spindle to back the Die Head off the threaded work.

These Die Heads are simple and compact. They do not depend on the turret feed, but float to suit the thread being cut. This prevents stripping and shaving of the threads and makes the usual close camming of the machine unnecessary.

Note the lever trip, which reduces the force of tripping the Die Head and lightens accordingly the reaction on the threads being cut.

Buffer Springs allow the Die Head to yield slightly when the Chasers come in contact with the work, insuring a good smooth thread from the start.

The two check nuts at the side of the Die Head provide easy adjustment of the point of tripping.

Shock and wear are eliminated by the spring closing attachment. This is of special value when closing the Die Head rapidly.

Push Buttons eliminate all trouble in inserting the Chasers.

No face plate is necessary, making it possible to use projecting Chasers where required for cutting close to a shoulder.

The Closing Attachment is located in a convenient position to strike a stop on the machine, which automatically closes the Die Head when the turret revolves.

The Chasers are of sturdy construction. They have long bearings in the Die Head skeleton and are supported by hardened keys, which prevent tilting and consequent cutting of taper threads. There are four Chasers in each size Die Head.

The Die Heads are provided with shanks to fit the particular size machine on which they are to be used.

Consider the economy of using one of these Die Heads with its Micrometer Adjustment, over a button die, which has no adjustment.

Geometric Die Heads are sent out on trial to reliable concerns.

SPECIFICATIONS

Geometric Die Head Size	Brown & Sharpe Mach. Applied to	Capacity			Shank
		Diameter	Length	Pitch	
5-16″ DS, B78390	00 and 00G	1-16″—5-16″	1. ¼″ or Shorter	18 or Finer	5-8″ x 1 5-16″
9-16″ DS, B76742	0 and 0G	1-8″ —9-16″	1-¼″ or Shorter	12 or Finer	3-4″ x 2 1-16″
3-4″ DS, B78240	2 and 2G	1-4″ —3-4″	1-¾″ or Shorter	10 or Finer	1″ x 2 3-8″

NEW SYSTEM OF WIRED WIRELESS PHONE SOON TO BE IN OPERATION

WHAT is said to be the first commercial installation of wired wireless in Canada is soon to be in operation between Edmonton and Calgary. The inauguration of this system is a new step in telephony in Canada, although the carrier sysem of telephony, as well as telegraphy, has been used quite extensively in the United States for the past two or three years.

The system will provide two additional telephone circuits between the two cities by superimposing high frequency currents on open wire lines which are now used for toll service, thus avoiding the necessity of stringing additional wire lines. For the benefit of those who are not familiar with the operation of carrier systems, it may be stated that multiplex operation is obtained by the use of carrier currents of relatively high frequency, with which the voice currents are combined. The voice curent for each conversation combines with or modulates a carrier current of a definite frequency which carries it over the open wire line to the distant station. The combined currents for a number of conversations are transmitted over the same wire, but at the distant end they are separated so that each conversation goes to the proper person.

Additional Toll Service.

The application of carrier systems to toll lines will not interfere with the ordinary use of the wires for telephone and telegraph purposes, but will provide additional toll circuits which will accommodate telephone traffic in the same way as ordinary circuits. The additional circuits provided by this means will transmit the characteristics of the voice with the same degree of clearness as ordinary circuits.

The Province of Alberta will, by the use of these carrier circuits, be able to extend its range of telephone communication to more remote points of the province than is possible at the present time. This is made possible by the fact that the transmission between Edmonton and Calgary will be somewhat louder by the carrier method than over the wire circuits as at present, and consequently the voice can be transmitted over longer circuits before becoming too feeble to be understood.

The Northern Electric Company Limited, who are furnishing this equipment, have been for some time past studying the adaptability of this system to the Canadian field and although they have not yet finished their studies, they say that the present indications are that, due to thickly settled yet widely separated areas, this means of communication is ideal to the needs. It may, therefore, be expected that other installations of this character will follow shortly.

HAMILTON SECURES NEW INDUSTRY

Hamilton has secured several additional industries, among them being the National Slag Products Co., which will utilize slag from the Steel Co. of Canada.

The officials of the new company have leased property on the C.N.R. and the beach line of the G.T.R. The company is capitalized at $300,000 and is headed by Edwin J Robertson, son of Senator Gideon Robertson.

VARIED ACTIVITIES IN WINDSOR PLANT

Windsor has a new industry in the Fournier Manufacturing Co., Ltd. This concern have a plant with floor space of 6,500 sq. ft., and are fully equipped with machinery, this including a large electro-plating establishment. They employ between 25 to 50 workers, are capitalized at $50,000 and have the following officers: R. M. Fournier, Windsor, president; S. J. Webster, Detroit, vice-president; N. F. Wray, Windsor, secretary; C. B. Smyth, Detroit, treasurer, and Col. E. S. Wigle, Windsor, solicitor.

This concern intend going into large production plating work, using their up-to-date equipment which is at present in thorough-going shape. They also manufacture the "Ideal" gas water-heater in two types, the cast iron disc for natural gas, and the copper coil for manufactured gas. Along with this line they are going to make a number of traps and other plumbing supplies. They are also taking a certain amount of production machine work from the automobile plants and other industries in the vicinity.

IRON IMPORTS FOR PAST TWELVE MONTHS

During the 12 months ending March, 1919, Canada imported iron and its products to a total value of $192,527,377, of which $185,116,309 represented the value of products of United States origin. During the next 12 months the total imports were valued at $186,319,876, of which $178,661,606 was spent for United States products. In each of the two years the value of iron and its products imported from the United Kingdom amounted to slightly more than $6,000,000. During the 12 months ending March, 1921, Canada imported iron and steel products from the United Kingdom valued at $16,698,085; $226,862,465 from the United States, and $2,065,903 from other countries, making a total of $245,625,453. Imports of iron and steel products for the year ending March, 1921, show an increase in value of 32 per cent. over the previous year and 22 per cent. over the valuation credited to the year ending March, 1919.

GERMAN COMPETITION VERY LOW PRICES

Inquiries instituted in iron and steel circles reveal a good deal of anxiety regarding Germany's threatened policy of price cutting as soon as there is exhibited the first sign of a trade revival in the United Kingdom.

J. E. Ray, trade commissioner at Manchester, says that already prices have been quoted on gas tubes nearly 50 per cent. below the quotations of British manufacturers. It is well-known that Great Britain found Germany in prewar days a most formidable competitor in foreign markets in connection with finished tubes of various kinds. Similar competition is again asserting itself, and it is feared that British producers, now seriously handicapped by greatly enhanced costs of production, will find the old rivalry in international markets resumed with added zest, while they on their part will be less fitted to challenge their German competitors.

Quotations are being received by some firms in the midland counties of England for steel billets, delivered, at $38.93 per ton 2,240 pounds; finished steel bars $51.10per ton, and gas strip at $60.83 per ton.

Not only are British makers unable to approach these prices, but even the French and Belgian producers are in some cases outquoted. If these German quotations are inclusive of import duty, and such is believed to be the case, the low prices become all the more remarkable.

PRESENTS ASSOCIATION CARLOAD OF MACHINERY

H. W. Petrie, Sen., of the H. W. Petrie Co., Toronto, performed a very useful service when he presented to the International Grenfell Association a carload of machinery for the industrial department of St. Anthony.

The machinery includes a ten-inch, four-sided moulder, a wood frame sticker, countershaft and parts, a portable forge anvil and blacksmith tools, a hacksaw, knife-grinder and shaper pulleys, belting and extra parts.

The Dept. of Marine will land the machinery at St. Anthony free of charge, so that in this way the Association will receive some very necessary and useful equipment at no cost.

OWEN SOUND PLANT WORKING FULL BLAST

According to a recent report, the Aluminum Steel Products, Ltd., Owen Sound, are operating to capacity. The plant is working full time, and is turning out various sizes of castings from the small brush holder in an automobile generator to the nozzles of vacuum sweepers. These brush holders are small but require to be very perfectly made and with the die casting machine the proportion that is spoiled is very small, almost negligible. They are said to be about 17% harder than the same class of goods made in sand moulds, are perfectly true and require practically no finishing.

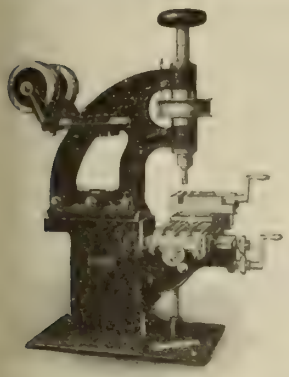
MOVING A TOWN.

They are going to move the entire town of American Falls, Idaho, with its population of 2,000, two or three miles to a new site higher than its present location.

This work is to be attempted within a few months by engineers working on a huge irrigation project involving the impounding of the water of the Snake River by a dam a mile long and 60 ft high.

GARLOCK-WALKER MACHINERY CO. LIMITED

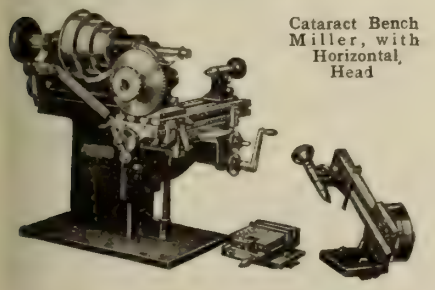
32 FRONT ST. WEST, TORONTO TELEPHONE MAIN 5346



Cataract Bench Miller, with Vertical Head. (Details in No. 15 Catalogue)



A wide range of drills, all capacities and sizes by foremost manufacturers.



Cataract Bench Miller, with Horizontal Head

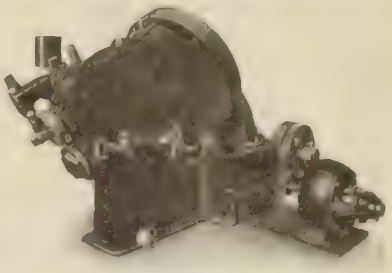
A "Keep Cool" Suggestion

With the thermometer determined to remain at the lofty heights of around 90 degrees, the workman toiling away at an old troublesome machine deserves your keenest sympathy. Perhaps if your job happens to be at a desk near an open window you are apt to forget that for every inefficient machine causing extra effort and extra motions production is dropping behind.

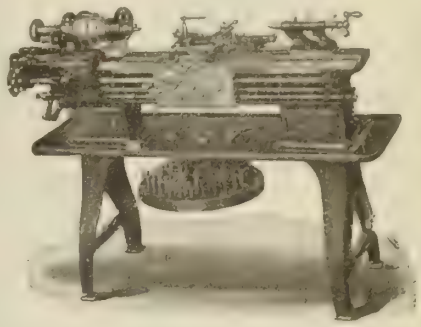
If you have one or two of these out of date "sweat boxes" why not get rid of them now—before they cost you more money. We can supply you with new motion-saving equipment that will get your work out on time and at least expense. Prompt deliveries; excellent shipping facilities.

Lathes, Gap Lathes
Turret Lathes
Screw Machines
Spinning Lathes
Shapers, Planers
Milling Machines
Drills, Power Hack Saws, Air Compressors
Punches, Shears
Presses.

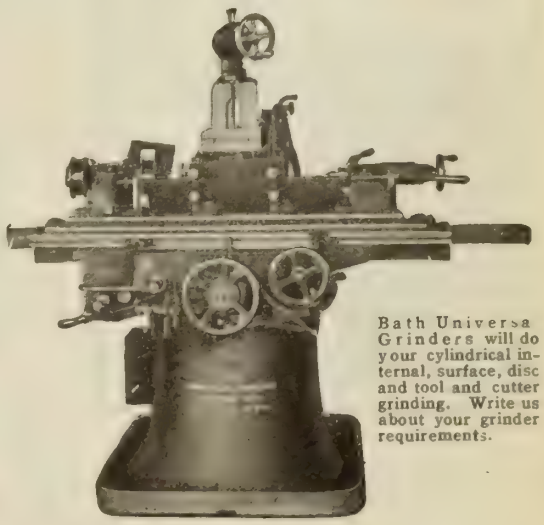
Write Us To-day



No. 3 Lennox Rotary Bevel Shear, belt drive. The most efficient machine now on the market for beveling irregular and curved sheets, boiler heads, flanges, dome sheets, plates, angles, etc.



Cataract Quick Change Swing Precision Lathe, with Cone Drive. (Details in Special Catalogue,)



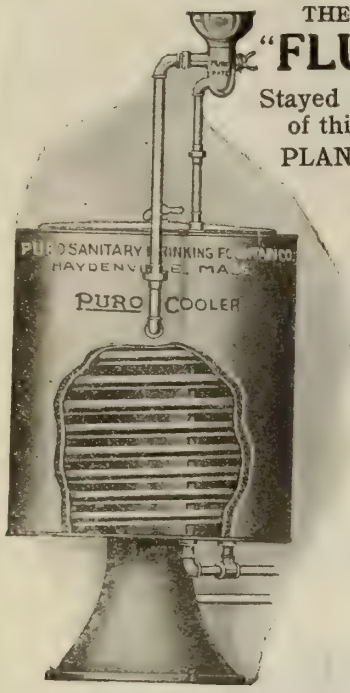
Bath Universal Grinders will do your cylindrical internal, surface, disc and tool and cutter grinding. Write us about your grinder requirements.

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METAL and WOODWORKING MACHINERY of all Kinds



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PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

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CANADA



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Rates (payable in advance): Two cents per word. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

COMBINATION GRINDER

The Grand Rapids Machine Co., Grand Rapids, Mich., has placed on the market a new machine said to combine the advantages of both thin drill grinder and tap grinder. This combination machine is made in two styles of two sizes each, and diamond wheel trueing mechanism, with diamond is standard equipment on all such machines. The drill grinding side of the machine is equipped with holder stop, which working in connection with the base of the diamond trueing device automatically places the drill holder in the proper relationship with the face of the grinding wheel.

ARC WELDING

Continued from page 33

welding with steel, and to remove the entire hardness of the entire section when welding with cast iron, the following procedure must be gone through. Where the piece is of such shape that it can be welded cold, reheating and annealing will make it machinable, i.e., any time after welding bring the weld and adjacent cast iron up to a little better than red heat and allow it to remain there from two to ten minutes depending on the size of the piece, then cool slowly by burying in warm sand, fireclay or limestone.

Where piece is of such shape that the cooling strains when welding quickly, as in electric welding, would warp or break the piece, preheating is necessary, but only to a small degree, i.e., less than red heat, in order to save the piece from breaking while welding. Directly after welding, bring the weld and adjacent cast iron up to better than red heat and anneal as before. This method results in either steel or cast-iron electrode applied to cast-iron being entirely machinable, and in the case of cast-iron electrode results in a weld which is not discernible from the original cast iron by either physical or chemical analysis.

In general, cast-iron containing small amounts of steel, i.e., so-called semi-cast iron, is much easier to weld than pure cast iron. Generally, the only welding done on cast iron, except in the case of accidents, is where the original cast iron is defective because of sand holes, porous spots or other troubles in casting: this slag must be entirely removed before satisfactory welding can be expected.

Usually the cast-iron electrode, while it becomes more fluid than steel under the arc, cools quicker than steel and from the outside inwards, because steel cools by the conduction of the heat in weld into the adjacent metal from the inside outwards, and hence with cast iron there is more chance of voids and gas bubbles being left in the weld and some sort of flux to prevent this is necessary in depositing cast iron. Desirable ingredients in such flux being:—

1. Quieting reagent. 2. Quick floater of dross to the surface. 3. Oxygen and nitrogen protector, so that bubbles, films or needles of oxide and nitride are not left in the weld. 4. Protection against rapid cooling of surface.

Such a flux is furnished with our electrodes beside especial care being taken that the C I welding rod is homogeneous and flows evenly through the arc.

Generally, careful spreading is the successful method to apply cast-iron electrode to cast iron; with steel electrode on cast iron, careful beading at the start and careful spreading as a finish.

The method of studding cast iron to give increased reliability and strength was developed by Mr. Joseph McAllister, of the N. Y. Central Railway, U.S.A., and under his direction was successfully applied to the maliciously broken cast-iron cylinders and other parts of the interned German ships in N. Y. Harbor, using the plant and resources of both the Erie and New York Central Railways.

AIR BLOWER

The New Jersey Motor Co., Plainfield, N. J., have developed a small blower which is said to transform a small volume of high pressure air into a large volume of low pressure air, this being used for the operation of rivet forges, and similar machines. A comparatively small amount of air is utilized through the compressed air line, as the greater portion of its air is drawn from the outside.

VERTICAL BULLDOZER

A vertical bulldozer, especially adapted for railroad steel car construction and repair work has recently been developed by the Beatty Machine & Mfg. Co., Hammond, Ind. This type of bulldozer is for the pressing and forming of such parts as stakes, sills, diaphragms, etc. Various sizes are built, up to a machine with 500 tons ram pressure.

COOLANT PUMPS

The Alemite Die Casting & Mfg. Co., Chicago, Ill., have developed a line of coolant pumps. These are made in five sizes with capacities ranging from ½ to 10 gallons per minute, when run at their rated speed of 300 r.p.m. The pumps have only four moving parts.

SQUARING SHEAR

The Niagara Machine & Tool Works, Buffalo, N. Y., have added to their line of shear a new machine to be known as the No. 8-H squaring shear. This machine is equipped with a set of gauges that insures the accurate squaring of sheets, thus making possible their convenient handling and welding. The cross-head is of a heavy box construction, is guided in liberally proportioned ways, and is counterbalanced. The main shaft and eccentrics are forged in one piece of a tough grade of steel. The clutch block is equipped with removable hardened and ground striking jaws, as well as with hardened backlash jaws. The clutch wheel also has removable hardened and ground striking faces and a backlash pin. Two center bearings are supplied for the main shaft, and these are placed as close as possible to the eccentric and hold-down cams, so as to obtain the maximum support.

The hold-down cams bear against hardened steel rollers which are lubricated through hollow pins, and the hold-down rods are provided with springs to compensate for various thicknesses of plates. Self-adjusting brakes lined with asbestos are supplied, these brakes being made in hinged halves and equipped with automatic springs which com-

ensate for wear. The knife chuck is ovided with pockets that enable the ife bolts to be easily removed from e top. The chuck has T-slots on top accommodate gauges, and on the ont for gauge brackets. A screw and t-screw on each end of the knife uck facilitate adjustments of this ember. The housings are of massive nstruction and do not require stay-ds for cutting to the maximum ca-city; however, stay-rods and stay-rod gs are supplied if desired.

The counterbalance weights are below e floor line to comply with the safety des of some sections of the country, d the capacity of this machine is mild eel up to 5/8 in. thickness. The ma-ine's nominal cutting length is 8 ft., d 30 H.P. is the power necessary to ive it.

MOTOR DRIVES.

C. C. Bradley & Son, Inc., Syracuse, ve developed a line of motor drives lapted for use on their particular style hammers. These motors are made r alternating or direct current and n be supplied in various voltages, ases, and cycles.

HARDNESS TESTING MACHINE.

The Alfred Herbert, Ltd., Coventry, ngland, with Canadian offices at 1-3 rvis St., Toronto, Canada, have placed the market a patent power operated rdness testing machine, which oper-es on the Brinell principle and uses 10 mm. ball. It employs the standard essures of 3,000 or 500 kg. as requir-d according to the character of the ma-rial to be tested. The outstanding atures of the machine are said to be: wer operation; pressure automatically plied; period of application or pres-re is absolutely uniform; no strain on perator; high output; accurate results; bust construction and suitable for orkshop use on production. Its lead-g principle is that it is a power-oper-ted machine by which the time re-uired to apply the load, the duration f the load and the time taken to re-ove the load are uniform for all tests nd do not depend on the personal equa-on of the operator or on his physical ffort. The operation of the machine by ower, enables the attendant, who may ven be a boy or a girl, to make tests ntinuously without fatigue and with-ut chance of error.

Apart from the main frame, which arries all the mechanism, the machine ay be said to consist of two elements, weighing element and a straining ele-ent.

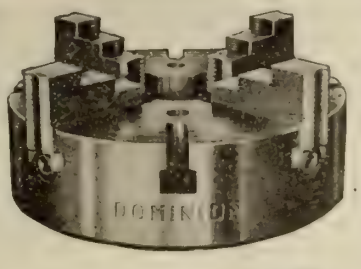
The ball through which the pressure applied to the specimen is carried by e lower end of a vertically moving lunger, the weight of which is neutral-ed by a light spring. This plunger oves upwards a small amount when e specimen to be tested is raised into ontact with the ball, the pressure be-ween the specimen and the ball being eighed by a pair of compound levers nd a weight which becomes poised hen the full pressure is reached.

The Straining Element.

The object to be tested is placed upon flat anvil or pressure plate resting on spherical seat on the top of a vertical crew which can be elevated by a hand heel to bring the work into contact ith the ball. The spherical seat has a ecess in the centre so that a vee block r any special form of support required or cylindrical or other work may have a projection which will locate it without risk of slipping.

The screw itself occupies an axial positon in a vertically moving cylindrical ram, the small upward movement of which forces the work against the ball and applies the pressure which is regulated and resisted by the poised weight of the weighing element. The lower end of the ram carries a roller which rests on a cam which makes a single rotation for each test. The cam is formed so as to apply the load gradually, to maintain it for the predetermined period and then to remove it.

The cam is rotated by a wormwheel and worm driven by spiral gears from a single driving pulley near the base of the machine. The motion is engaged by depressing a pedal and is automatically disengaged at the end of one revolution of the cam.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

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OVENS
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet
Brantford Oven & Rack Co. Ltd
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DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
THE KIMBER & HILLIER MFG. CO.,
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MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

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MOTORS WANTED:

1—25 H.P.—3 phase, 25 cycle, 220 volts.
1—5 H.P.—3 phase, 25 cycle, 220 volts.

THE BELL THREAD COMPANY, LIMITED, HAMILTON, ONT.

MOTORS FOR SALE:	R.P.M.	Starter	Price
1— 3 H.P. Westinghouse	1700	Switch Starter	$ 90
1— 5 H.P. Can. Gen. Electric	1800	Switch Starter	100
1—20 H.P. Fairbanks-Morse	1200	Auto Starter (no low voltage release)	250
1—25 H.P. Can. Gen. Electric	1000	Auto Starter (no low voltage release)	350
1—30 H.P. Westinghouse	945	Auto Starter (no low voltage release)	400

All 2 phase, 60 cycle and in good running order.

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SUPERINTENDENT OR MASTER MECHANIC. Experienced on locomoive, stationary and marine work. Thoroughly familiart with modern methods of production, plant upkeep and repairs. Box 785 CANADIAN MACHINERY. (c4m)

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT

Builders of Reliable Machinery.

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GENERAL MACHINE WORK

Turret Lathe and Automatic Screw Machine a Specialty. Let us quote on your work.

With: Garlock, Walker Machinery Co. 163 Dufferin Street.

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WIPING CLOTHS
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Prices on application

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Fattern Works, 49 George St., Brantford, Ont. (ctfm)

SALESMAN WANTED

WANTED — BY WELL-KNOWN AMERICAN manufacturers of pneumatic tools enterprising salesman for Canadian field. Reply giving full experience, present connection, etc. All replies will be treated in confidence. Box 782N, Canadian Machinery.

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1—18" x 8' Mueller Lathe.
1—24" x 24" x 6' Putnam Planer.
1—32" Bandsaw.
1—36" Foot Squaring Shear, Brown Boggs.
1—96" Power Squaring Shear, Brown Boggs.
1—No. 3 Greenard Arbor Press.
1—10,000 lb. Olsen Testing Machine.

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285 Beaver Hall Hill. Montreal

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

Used Belting, Pulleys, Etc.

We carry right in stock a large quantity of used Belting, Pulleys, Hangers, Shafting, etc., in good condition, which we sell at half the price of new. Inquiries solicited. In writing mention sizes wanted. L. S. Tarshis & Sons, 92 Wellington St., Montreal.

Machine Shop and Foundry for sale, St. Catharines, Ont. In the centre of the Welland Ship Canal and Hydro activities. Going concern capable of handling all classes of work. Turnover $60,000 a year. Good reasons for selling. Box 777, Canadian Machinery. (c5m)

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WANTED—BY AN ESTABLISHED CONCER Twelve to fifteen thousand dollars for a peri of from one to three years, to take care of bu ness expansion. This concern will stand the fu est investigation. 8% is offered with am security to principals only, with an opportun of becoming permanent associates with the pa ners, if mutually satisfied. Box 767, Canadi Machinery. (etf

FOR SALE

ELECTRIC STORAGE BATTERY LOCOM tives for sale. Two. 36-inch gauge. Co plete and in good condition. R. T. Gilman Company, Dept. "E," 211 McGill Street, Montre (ctf

ALMOST NEW 150 K. W. GENERAL ELECTR Generator, 25 cycle, type A. T. B., 550 or 23 Volts, 500 R. P. M., form B, class 5-150-500. Wr Gray-Dort Motors, Chatham. (c4m)

1—Single Acting Smart Turner Triplex Pump, 2 x 4

THE BELL THREAD COMPANY, LIMITED, HAMILTON, ONT.

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TOOL STEEL AND MACHINERY SALES R presentative open for connection. Sixteen ye sales experience in Canada and United States. Ha had practical machine shop experience and thoroug understand the metal lines. P. O. Box 539, Geor town, Ont. (c5m)

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Slightly used Davis Bournonville Welding and Cutting Outfit, perfect condition, will sacrifice. Box number 784, CANADIAN MACHINERY.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.

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CANADIAN MACHINE SHOP

Will handle medium Specialty Line — Manufacturing and Selling

Apply Quickly

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MACGOVERN & COMPANY INCORPORATED POWER MACHINERY

We have for sale the following

Small Sized A.C. Generators

3 Phase, 60 Cycle

	K.W.	Volt.	Make	P.M.R
	15	2300	Ft. Wayne	....
KVA	20	2300	Fairbanks-Morse	1800
	25	2300	Ft. Wayne	1800
	30	2400	Westinghouse	1200
KVA	30	2300	Fairbanks-Morse	1200
KVA	35	2300	Allis-Chalmers	1200
	37½	2300	Westinghouse	1200
	42	2300	Electrical Machinery	1200
	45	1150	General Electric	1200
	50	550	Crocker-Wheeler	1200
	50	2300	Fairbanks-Morse	300
	50	2300	General Electric	900
	60	2200	Warren	600
KVA	60	2300	Electrical Machinery	900

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COLD ROLLED STEEL

DEAD SOFT DEEP DRAWING

Suitable for Nickel Plating

Item	lbs.			
1.	265	.020" x 15/32"	coils	
2.	100	.025" x 1¾"	coils	
3.	10000	.028" x 2⅞"	6'-8'	Lens
4.	1900	.028" x 4"	8'	"
5.	5300	.028" x 6"	8'	"
6.	2100	.032" x 4"	8'	"
7.	4400	.032" x 8"	8'	"
8.	1550	.035" x 8"	8'	"
9.	3000	.050" x 4"	8'	"
10.	775	.050" x 6"	8'	"
11.	6400	.062" x 6"	8'	"
12.	3300	.062" x 8"	8'	"
13.	10000	.062" x 13"	104"	"
14.	6500	.065" x 6"	6'	"
15.	720	.073" x 6"	8'	"

Cold Rolled Flat Wire No. 3 Temper

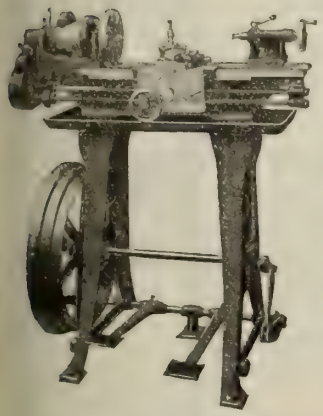
16.	200	.063" x ⅜"	8'	Lens
17.	125	x ½"	8'	"
18.	225	x ⅝"	8'	"
19.	225	x ¾"	8'	"
20.	225	x ⅞"	8'	"

ONTARIO METAL PRODUCTS CO., Limited

237 Dufferin St. TORONTO

"DALTON SIX"

Type B-6



"The Small Lathe for the Big Job"

	Inches
Actual Swing -	8¼
Between Centers -	18½

Large and balanced flywheel fitted on shaft with roller bearings. Easy operation.



Send for Bulletin BC-661

Also Manufacturers of Type B-4 Lathes

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Cable Address: "ALEDAL Stamford"

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work

AUTOMATIC TURRET LATHES
For Chucking Work

VERTICAL BORING and TURNING MILLS

UNIVERSAL TOOL GRINDERS

HORIZONTAL BORING AND DRILLING MACHINES

TOOL-POST TOOL HOLDERS

REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking

BORING BARS
With Adjustable Cutters

PERIODOGRAPH
For Time Recording in Factories

Separate Catalogs on each Product

Send for the ones you want

GISHOLT MACHINE CO.

1207 E. Washington Avenue

Madison, Wisconsin, U. S. A.

You Can't Row a Boat with One Oar



An unbalanced advertising campaign, like a one-oar boat, never gets anywhere.

Sound copy must be balanced by scientific space selection. Mediums deserve as much attention as merchandising.

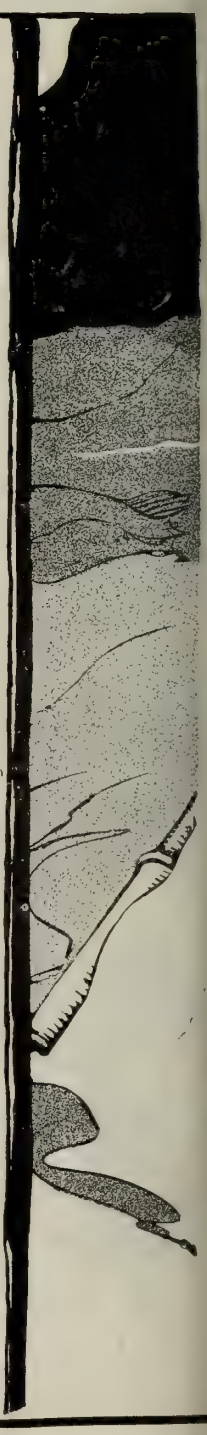
To buy space scientifically circulation must be *analyzed*—not merely counted.

Do you ask of a publication not only "How much?" but also "How did you get it?" and "Where does it go?" If you fail in these particulars you are trying to make an advertising campaign go with only one oar.

The answers to these questions can be obtained by studying the A. B. C. reports. To read the circulation figures only is not enough, even though they are verified by the A. B. C. audit. This is but the beginning.

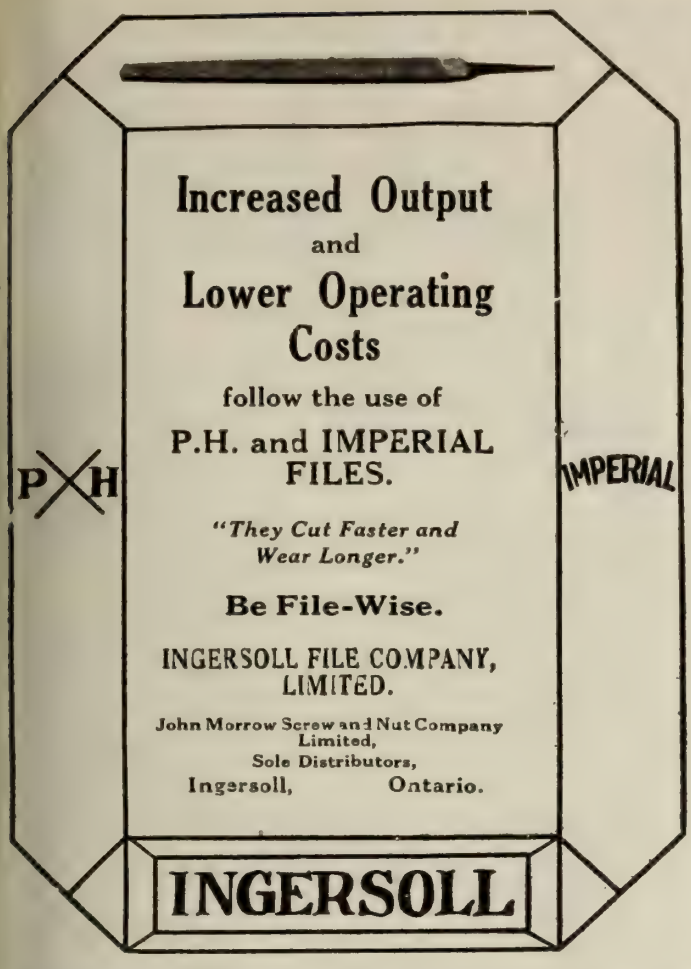
Advertising is being put to a test to-day, which it can meet if you put circulation to the test of A. B. C. reports.

Canadian Machinery is a member of The Audit Bureau of Circulations.



The MacLean Publishing Co., Limited, Toronto

EIGHT BRANCH OFFICES



Increased Output
and
Lower Operating Costs
follow the use of
P.H. and IMPERIAL FILES.

"They Cut Faster and Wear Longer."

Be File-Wise.

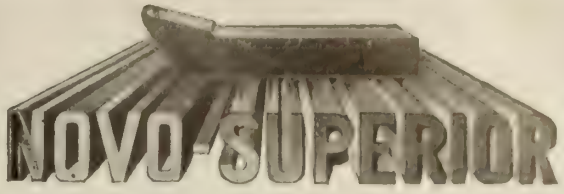
INGERSOLL FILE COMPANY, LIMITED.

John Morrow Screw and Nut Company Limited,
Sole Distributors,
Ingersoll, Ontario.

P H

IMPERIAL

INGERSOLL



NOVO-SUPERIOR

HIGH SPEED STEEL
INTRA STEEL GIBRALTAR STEEL
Tool Steel for Every Purpose
Swedish Lancashire Iron

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.; Music Wire for Springs, Steel Balls, Cold Rolled Tool Steel in Strips and Sheets, Circular Saws, Machine Knives.

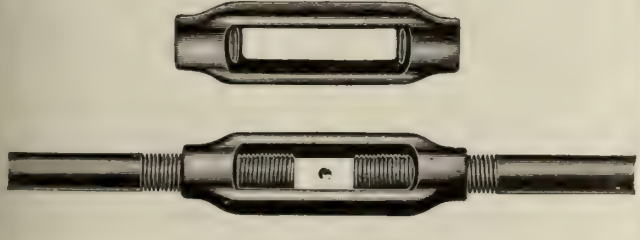
PILOT STEEL & TOOL COMPANY
LIMITED
332 St. James Street, Montreal

Sole Agents for
JONAS & COLVER, LIMITED
Novo and Continental Steel Works
Sheffield, Eng.

H. BOKER & CO., Inc.
New York, N.Y.

CANADA
FOUNDRIES & FORGINGS
LIMITED

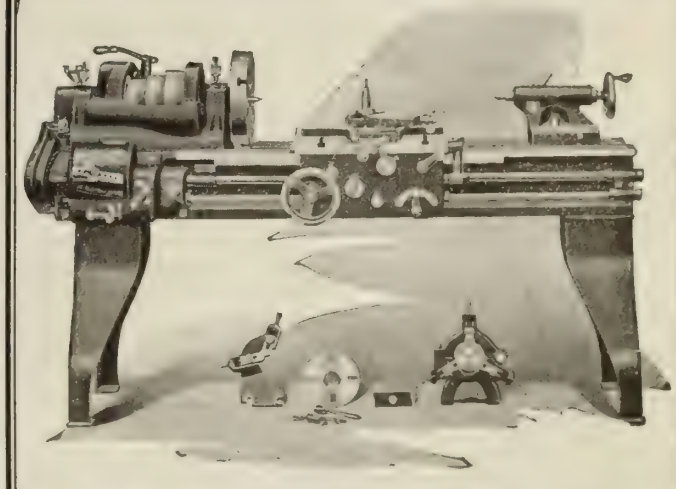
Drop Forged Steel



SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.



Sufficient Weight and Power to Handle Modern Production

Though small in size, the "Economy" Double Back Geared, Quick Change Engine Lathe is strong and powerful. Its extreme accuracy makes it particularly adapted to the tool room of the modern manufacturing plant. Made in 14 in., 18 in. and 22 in. swing.

Write for complete information of this small, heavy duty lathe, without delay.

Rockford Lathe and Drill Co.
Rockford, Illinois, U.S.A.

HINTS TO BUYERS

STEEL CASTINGS

ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.

PROMPT DELIVERY

Manitoba Steel Foundries, Ltd.

1204 McArthur Building

Winnipeg - - - Manitoba

For Hardness Testing

in shop and laboratory use the

Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.



THE PYROSCOPE

Heat Indication

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.



THE SCLEROSCOPE (Set)

Perfect constancy inexpensive, no electricity used. Built to stand rough usage, and upon common-sense lines. Used by the Government and best firms.

The Shore Instrument & Mfg. Co. Van Wyck Ave. & Carll St. JAMAICA, N.Y.

A. R. Williams Machinery Co., Ltd., Toronto, Canada

The Hughes Owens Co. Ltd.

MONTREAL TORONTO OTTAWA WINNIPEG

Manufacturers

Blue and Black Print Papers

Drawing Office Supplies for Students, Architects and Engineers.

Torrington MACHINE SCREWS



Brass, Nickle and Plated Washers

We also manufacture—in addition to our well-known line of Machine Screws—high-grade Rivets, from Brass, Copper, Steel, German Silver and Aluminum. Prices on request.

THE TORRINGTON COMPANY, LIMITED

UPPER BEDFORD, QUEBEC

FOR SERVICE ON

Jigs, Fixtures, Gauges

SPECIAL MACHINE TOOLS

SPECIAL MACHINERY

General Machine Work and Repairs

Write

The Crescent Machine Co.

LIMITED

20 Longueuil Lane Montreal, Que.

ATKINS Sterling Quality SAWS

When in need of Circular Metal Cutting Saws, Hack Saw Blades, Hack Saw Frames, Kwik-Kut Power and Metal Cutting Band Saw Machines we will be pleased to have your specifications.

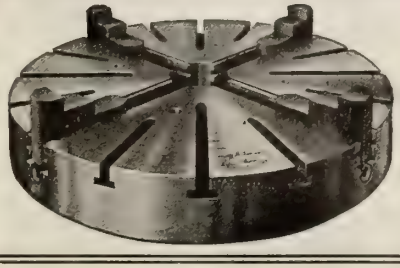
"A BETTER SAW FOR EVERY USE"

Address the nearest point below

E. C. ATKINS & CO.

Canadian Factory, Hamilton, Ontario

Branch House, Vancouver.



IRON BODY INDEPENDENT CHUCKS

They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

UNION MANUFACTURING COMPANY

New Britain, Conn. New York Office: 26 Cortlandt Street

IMPORTERS OF
INDUSTRIAL DIAMONDS
Goods Submitted on Memorandum if Desired
JOHN W. GORDON, Manager
James Street, ST. CATHARINES, ONTARIO

WHEEL TRUEING TOOL CO.
DETROIT



MANUFACTURERS OF
DIAMOND POINTED TOOLS
All Mountings Fully Guaranteed
Office and Factory:
88 West Pitt Street, WINDSOR, ONTARIO



Gear Cutting Machines
Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
THE D. E. WHITON MACHINE CO.
NEW LONDON. CONN., U. S. A.

VICTORIA Special Machinery
DESIGNS PATTERNS
CASTINGS FORGINGS
Send for Catalogue
Victoria Foundry Co., Limited, Ottawa, Canada

ENGINEERS PLANNING POWER TRANSMISSIONS
Secure Data and Estimates of "MORSE" DRIVES
SAVE Construction, Space, Light, Fuel. Producing More with Less.
MORSE CHAIN CO., - ITHACA, N.Y.
Engineering Service, Assistance, Bulletins

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Miller Bros. & Sons, Limited
Founders, Machinists, Millwrights and Engineers
120 Dalhousie St., Montreal

PRESSES and SHEARS
Sheet Metal Working Machinery
THE D. H. STOLL CO., INC.
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DARLING BROTHERS, LIMITED
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120 Prince Street, MONTREAL, P.Q.
Pumps for any Service—Steam Appliances—Freight Elevators—Webster Vacuum Heating System.

DIE-CASTINGS
ACCURACY—SERVICE
Fisher Motor Co., Ltd.
ORILLIA - ONTARIO



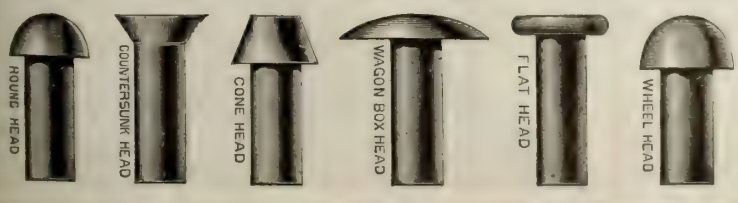
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FOR ALL KINDS OF HEAVY LIFTING
Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
Made only by A. O. NORTON, Limited
Coaticook, Prov. Quebec, Canada

CASTINGS
MALLEABLE AND GREY IRON
FITTINGS Limited, OSHAWA

THE FELLOWS GEAR SHAPER
is used by the Largest Manufacturers in the Gear Industry.
Catalog and Engineering Literature sent to those interested.
Address:
THE FELLOWS GEAR SHAPER CO.
SPRINGFIELD, VERMONT, U.S.A.

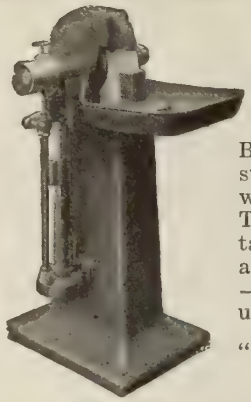
SHEFFIELD ENGINEERING SUPPLIES LIMITED
"DORMER" BRAND
H. S. DRILLS REAMERS STEEL
MILLING-CUTTERS FILES HACK-SAW BLADES
"Safety" Plastic Metallic Packing
230 CRAIG ST. W. MONTREAL, CANADA

Monel Metal Castings
For Anti-Corrosive and Superheat Service
Made in Canada by
CANADIAN DRIVER-HARRIS CO.
WALKERVILLE, ONT.
American Office and Works
Chicago-Detroit Harrison, N. J. England-France



WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller

PARMENTER & BULLOCH CO., LTD.
GANANOQUE, ONT.



Built to Give Satisfaction

BLOUNT Grinders are built to stand up under the hard service which is the usual lot of a grinder. They are just as good in every detail as we can make them. They are fast, accurate, strong and rigid —dependable in every sense. Let us send you full particulars.

"We will accept Canadian funds at par."

J. G. Blount Co., Everett, Mass., U.S.A.

Davis-Bournonville

Oxy-hydrogen apparatus for producing electrolytic oxygen and hydrogen. Equipment for compressing gases into cylinders for distribution. Gases of exceptional purity and efficiency produced by D-B electrolyzers at low cost and with perfect safety.

Hydrogen used in the manufacture of oils, greases and soaps may be made at low cost with D-B apparatus.

WELDING AND CUTTING DAVIS APPARATUS DAVIS-BOURNONVILLE CO.

Davis-Bournonville Company
Jersey City, N. J.
Branches in Principal Cities



NORTHERN CRANES

"MADE IN CANADA"

Electric Travelling Cranes, Hand Cranes, Electric Hoists, Air Hoists, Foundry Equipment, Cupolas, Ladles, etc., etc.



"Type D" Electric Hoist

NORTHERN CRANE WORKS LIMITED
WALKERVILLE, ONTARIO



Pneumatic Tools

Wire at our expense for a representative—or complete catalog describing

KELLER-MASTER—

Riveting Hammers	Valveless Drills
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KELLER-MADE MASTER-BUILT

KELLER PNEUMATIC TOOL CO.
GRAND HAVEN · MICHIGAN · U·S·A
BRANCHES EVERYWHERE



A BALATA BELTING

Which We Guarantee Second To None And Entirely Satisfactory

Try One And Be Convinced

J.C.McLAREN BELTING CO.
Limited
MONTREAL TORONTO WINNIPEG

TRADE MARK
THE J.C. McLAREN BELTING CO LIMITED



SPRING SHACKLE BOLTS

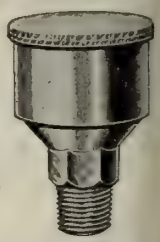
Complete Line of Oilers, Oil Cups, Brass Dowel Pins and Pressed Steel and Brass Grease Cups All Types

Write for catalogues and prices

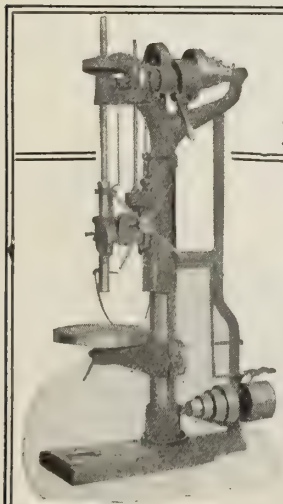
THE CANADIAN WINKLEY CO.
Limited
WINDSOR - ONTARIO



"D"



PLAIN



AURORA
Drilling Machines

How labor costs and quality production go hand in hand to the user of Aurora Drilling Machines. They are a guarantee of unusual strength, accuracy, speed and variability.

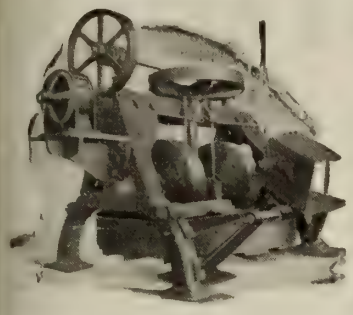
The Aurora Tool Works
AURORA, INDIANA, U.S.A.

OAKITE CLEANS

Put your Cleaning Problems up to us.

OAKLEY CHEMICAL CO
44 THAMES STREET · NEW YORK

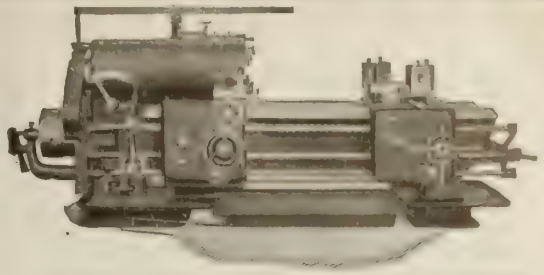
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WINNING FEATURES

Heavy Mullers
Unloading Device
Motor or Belt Drive

The Frost Mfg. Co.
112 W. Adams St., Chicago



TRY THE STEINLE

LET US TELL YOU ABOUT THIS MACHINE

Send Us Prints of Your Work

STEINLE TURRET MACHINE CO.
MADISON, WIS., U.S.A.



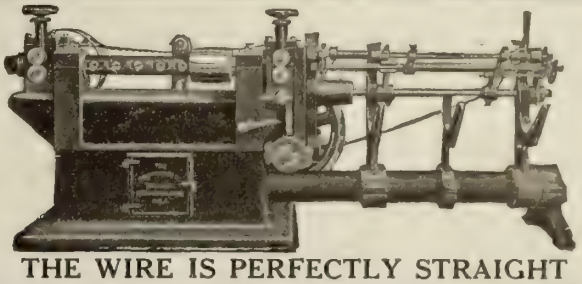
ALL KINDS
Spur, Bevel, Spiral, Herringbone and Intermittent Gears
in all metals, rawhide or fiber.

The best of service—try us on a Rush Order.

Distributors of Diamond Chains.

Our catalogue is full of gear data—yours for the asking.

PHILADELPHIA GEAR WORKS
Vine Street
PHILADELPHIA, PA.



THE WIRE IS PERFECTLY STRAIGHT
and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

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Formerly John Adt & Son. Established 1866.
Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.



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CAST Heat Treating Containers
Endure in High Temperatures
Manufactured under HENDERSON Patents by
CANADIAN DRIVER-HARRIS COMPANY
WALKERVILLE, Ont., Can.
CHICAGO DETROIT HARRISON, N. J. ENGLAND FRANCE

THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN U S A
SKINNER CHUCKS
LATHE - DRILL - PLANER - CHUCKS



IMPERIAL WELDING AND CUTTING EQUIPMENT
OXY-ACETYLENE PROCESS

A new mixing principle, a regulator that controls gases accurately, the greatest working range ever covered by ONE torch all exclusive IMPERIAL features. Write for catalog. Send name of your distributor.

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Armstrong Bros. Tool Co., Chicago, Ill.
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Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

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Underwood Corp., H. B., Philadelphia, Pa.

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
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Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
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Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

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Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
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Can. Consolidated Rubber Co., Ltd., Montreal, Que.
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Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
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McLaren Belting Co., J. C., Montreal, Que.
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Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
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Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
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Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

Bronze
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd. Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Can. Hanson & Van Winkle Co., Ltd. Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O

Bulldozers
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Burners, Oil and Gas
General Combustion Co. of Can., Ltd Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
MacKinnon Steel Co., Sherbrooke, Que

For list of Dealers see the last page of This Buyers' Directory

BUYERS' DIRECTORY

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Semi-Steel
Davidson Mfg. Co., Thos., Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Checking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Madison Mfg. Co., Madison, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Milling Machine Co., Cleveland
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Steelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can, Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd. Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S
Steel Co. of Canada, Ltd., Hamilton, Ont

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Ford-Smith Machine Co., Hamilton, Ont
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd Montreal, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd Montreal, Que.
Mechanical Engineering Co., Three River Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Ga
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrook Que.
Can. Fairbanks-Morse Co., Ltd., Montrea
General Combustion Co. of Can., Ltd Montreal, Que.
Mechanical Engineering Co., Three River Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealin
Brown & Sharpe Mfg. Co., Providence, R
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Three River Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, On

Gages, Comparator
Jones & Lamson Machine Co., Springfield, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
Johansson Inc., C. E., Windsor, Ont.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Chesterman & Co., Ltd., J., Sheffield, En
Crescent Machine Co., Ltd., Montreal,
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.

BUYERS' DIRECTORY

Ackworthic, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Johansson Inc., C. E., Windsor, Ont.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que
Crescent Machine Co., Ltd., Montreal, C.

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Engr'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Perry & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd. Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto Ont
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pig Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Teol Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strellinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Parrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Brass Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co., Chicago, Ill

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa

Steel Wire Rods
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrew Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.

Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield Vermont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, I
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The Jo
Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., L
Toronto, Ont.

Tools, Small (See Machinists' Sm Tools)
Armstrong-Whitworth of Canada, L
Montreal, Canada.
Armstrong Bros. Tool Co., Chicago,
Bertrams Ltd., Edinburgh, Scotland.
Burgess & Marchand, Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montre
Chesterman & Co., Ltd., J., Sheffie
Eng.
Foss Machinery & Supply Co., Geo.
Montreal, Que.
Geometric Tool Co., New Haven, Conn
Greenfield T & Die Corp., Galt, Ont
Hamilton neering Service, Ltd.,
Hamilton, t.
Keller Pneumatic Tool Co., Grand Hav
Mich.
Kimber & Hillier Mfg. Co., St. Cat
rines, Ont.
National Machine Tool Co., Racine, W
Rapid Tool & Machine Co., Lachine, Q
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockf
Ill.
Starrett Co., L. S., Athol, Mass.
Strellinger Co. of Can., Ltd., Chas.
Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toro
Ont.
Williams Machinery & Supply Co., A.
Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toro
Crescent Machine Co., Ltd., Montreal,
Ford-Smith Machine Co., Hamilton,

BUYERS' DIRECTORY

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glasco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Maple Leaf Mfg. Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

Trucks, Industrial Motor
Maple Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Tubing, Welded
International Nickel Co. of Can., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Tubing, Welded Steel
Tube Co. of Canada, Toronto, Ont.

Turbines, Water
Dominion Engineering Works, Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Vises, Metal Workers'
Aikenhead Hardware, Ltd., Toronto, Ont.
Columbia Hdwe. Division, Cleveland, O.
Charles Parker Co., Meriden, Conn.

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence, R.I.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kearney & Trecker Co., Milwaukee, Wis.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Barnes Co., Wallace, Bristol, Conn.
Diamond State Fibre Co., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Holden Co., Ltd., Montreal, Que
L'Air Liquide Society, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Davis-Bournonville Co., Jersey City, N.J
Holden Co., Ltd., Montreal, Que
Lincoln Electric Co., Toronto, Ont
National Electro Products, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont
Union Carbide Co. of Can., Welland, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.
Union Carbide Co. of Can., Welland, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

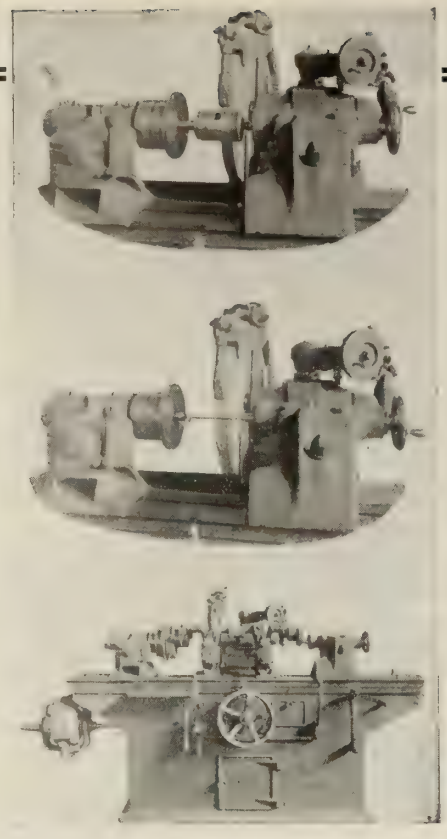
Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrenches, Tap
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont

Wrought Iron Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont

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143 UNIVERSITY AVE., TORONTO, CANADA

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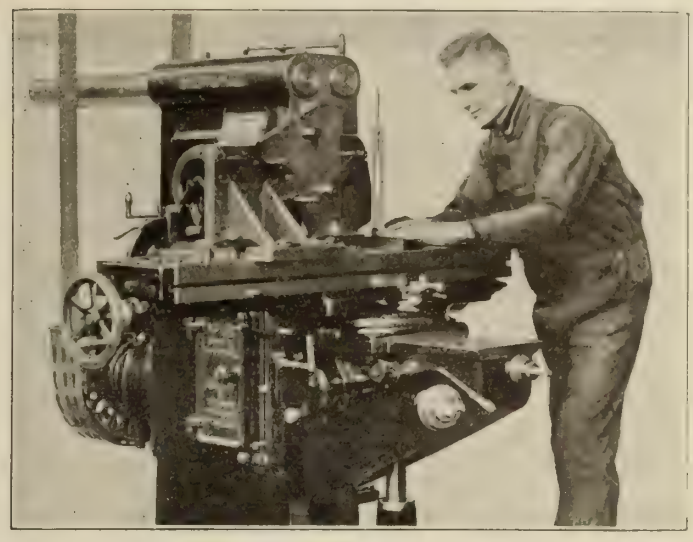
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MILWAUKEE MILLING MACHINES



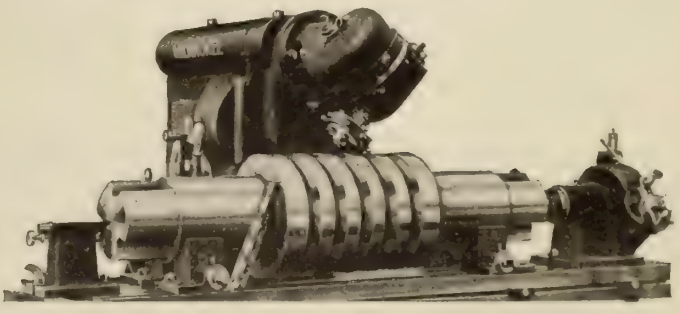
Efficient on Light and Heavy Milling

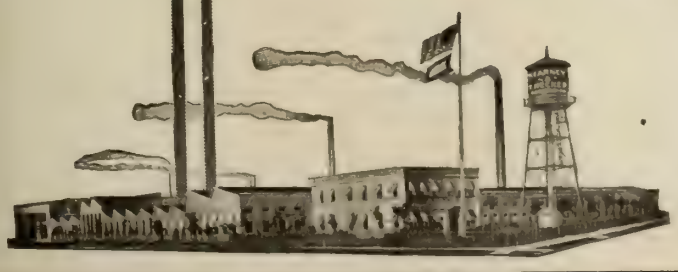
Heavy milling jobs are not unknown to Milwaukee Universal Milling Machines, while delicate and intricate ones are efficiently performed with little effort.

Both light and heavy milling operations are handled with such smoothness and accuracy that the finest results are obtained. Because Milwaukee Universal Milling Machines perform such a wide variety of work, they are particularly well adapted for the tool-room.

The jobs shown in the two illustrations are representative of "Milwaukee" adaptability. The upper illustration shows a jig being bored with a fly cutter. The lower illustrates the milling of a chilled roll with the use of a Universal Milling Attachment.

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Vol. XXVI., No. 3 | Published by the MacLean Publishing Company, Limited, London, Ont. | July 21, 1921 | $4.00 a Year Subscription Price

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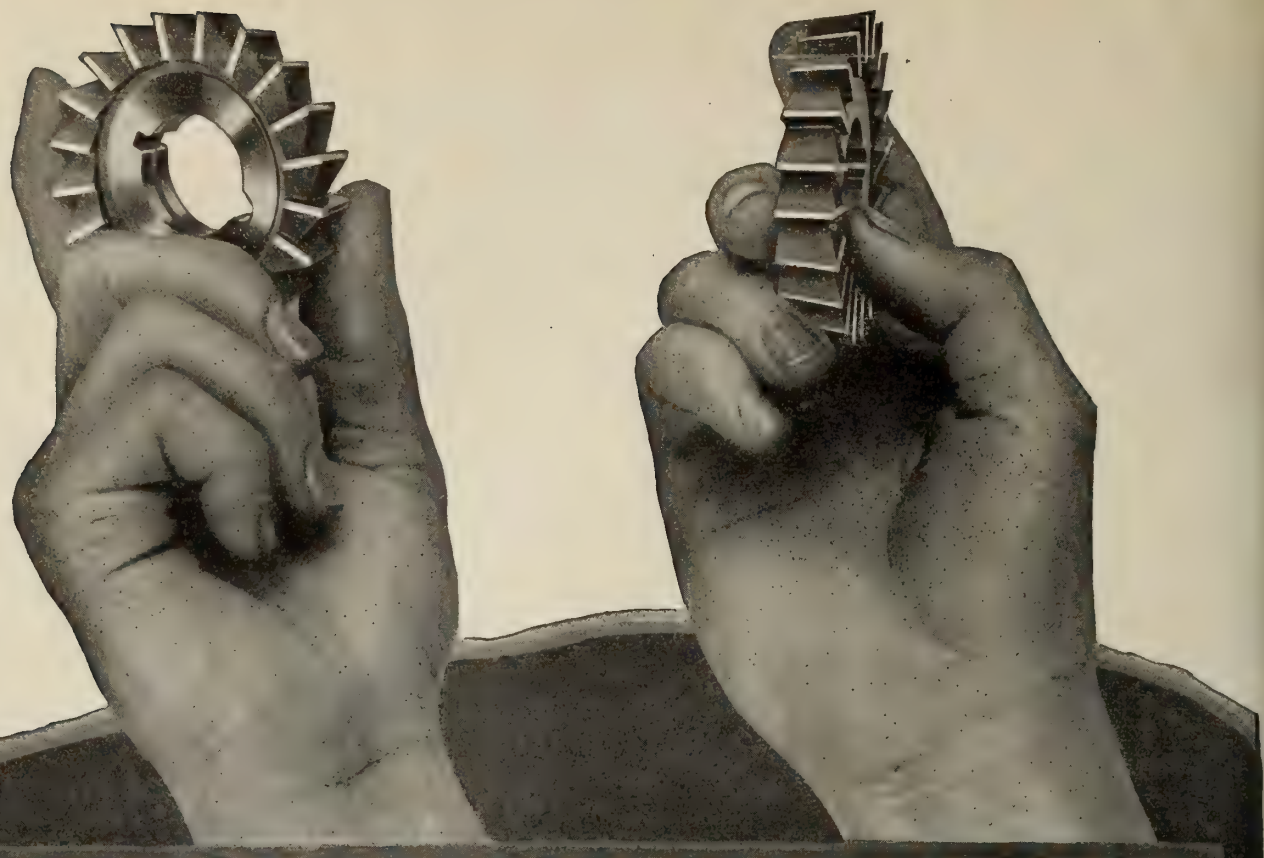
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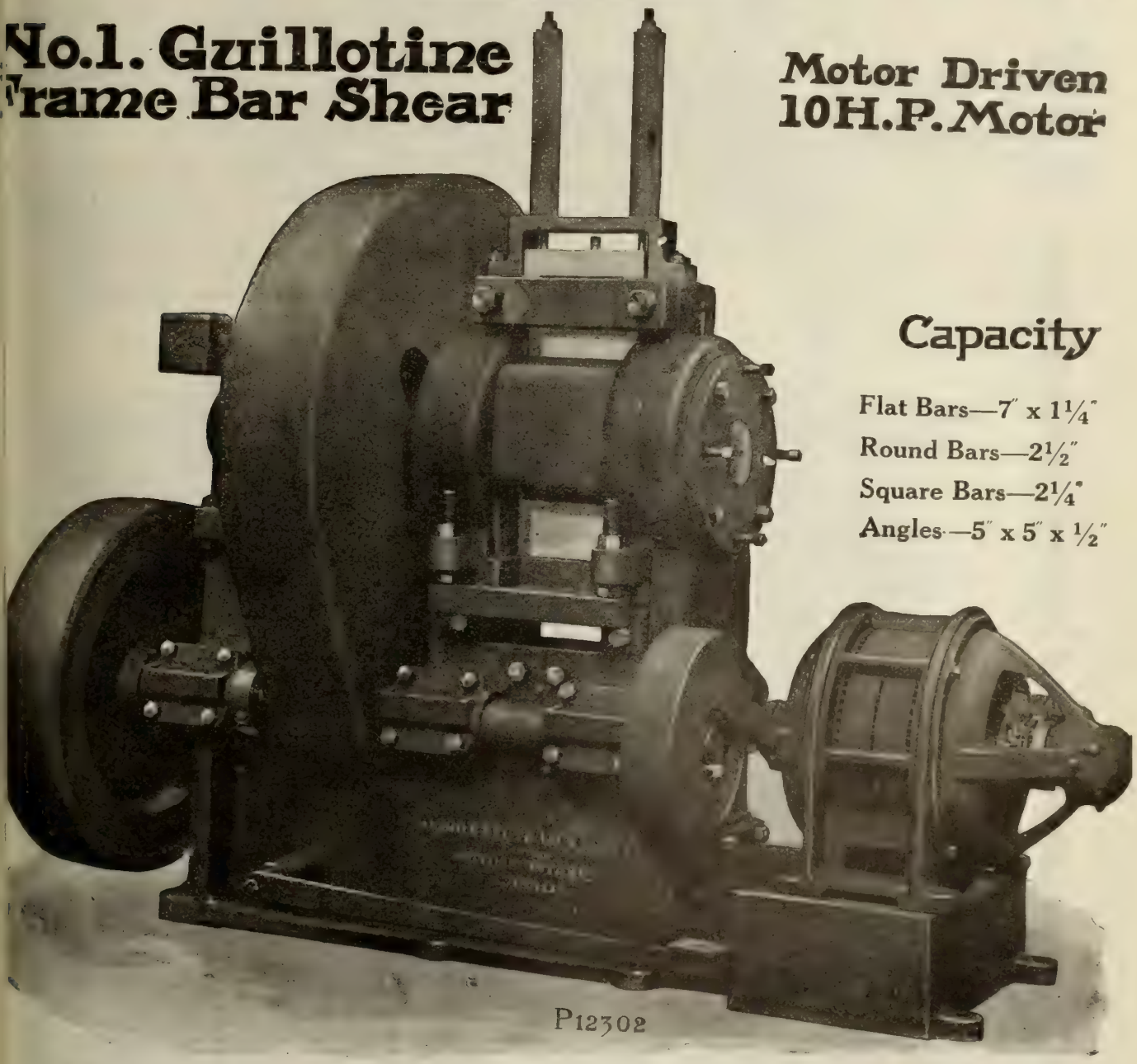
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The BERTRAM Page

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P12302

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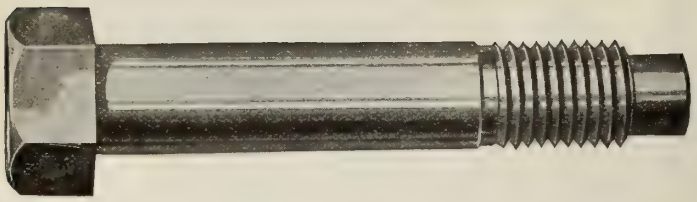
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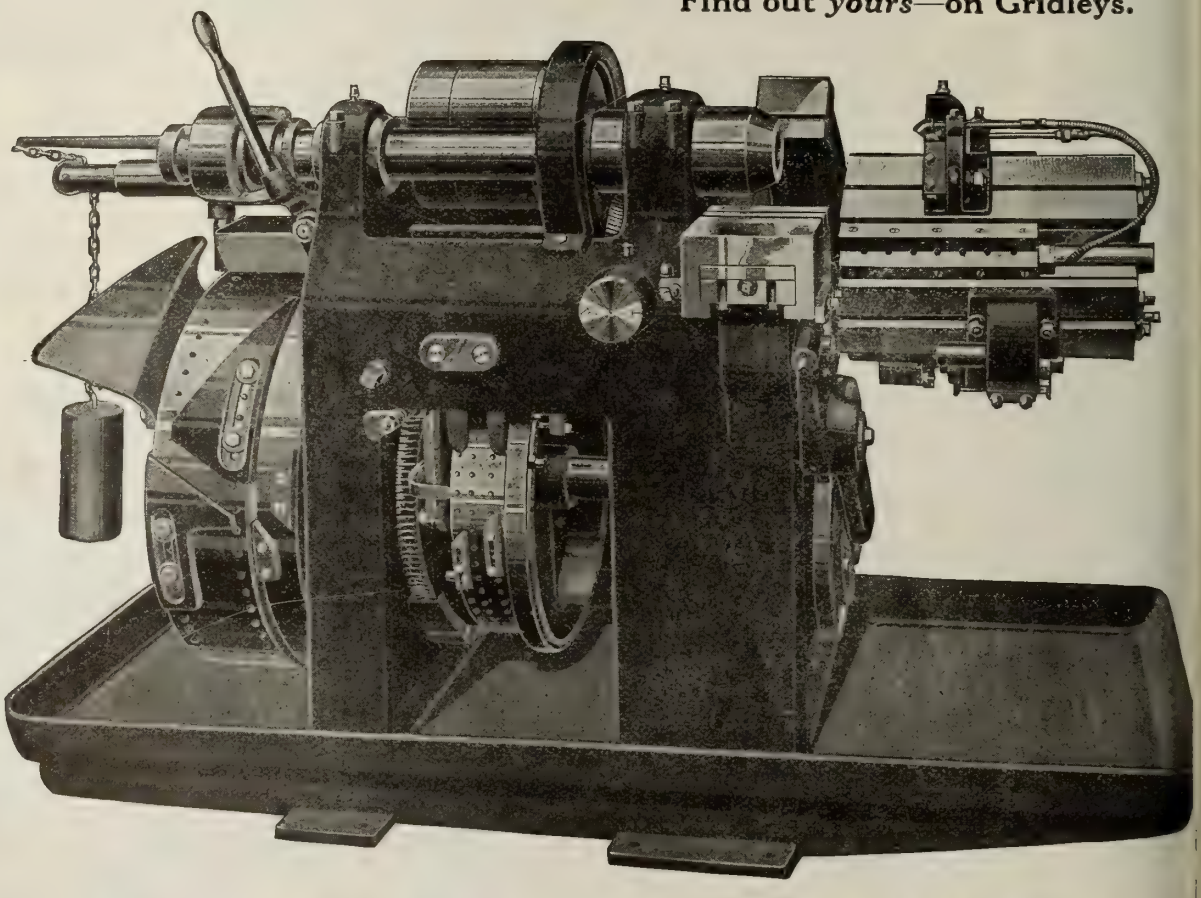
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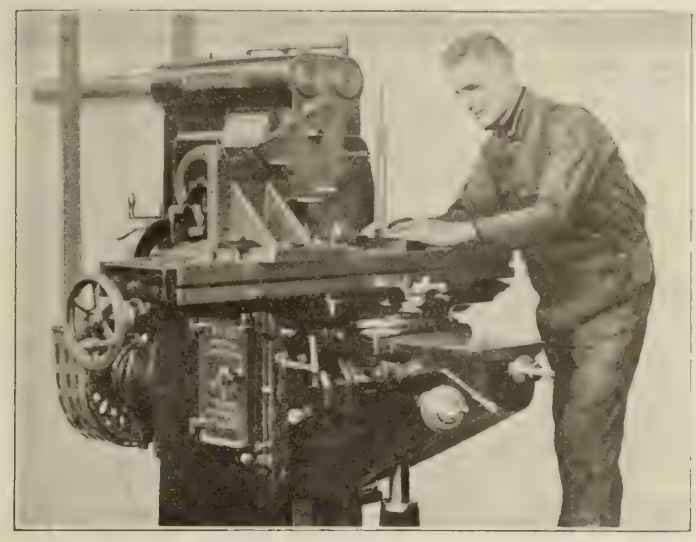
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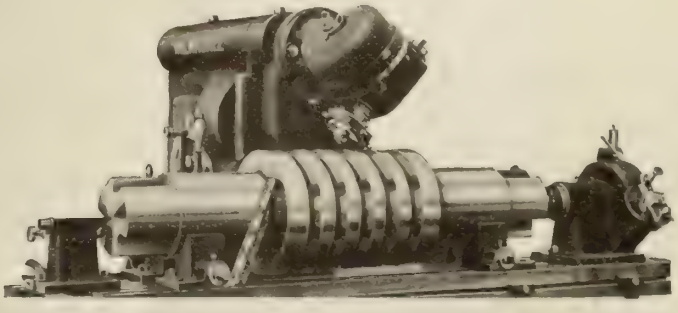
Efficient on Light and Heavy Milling

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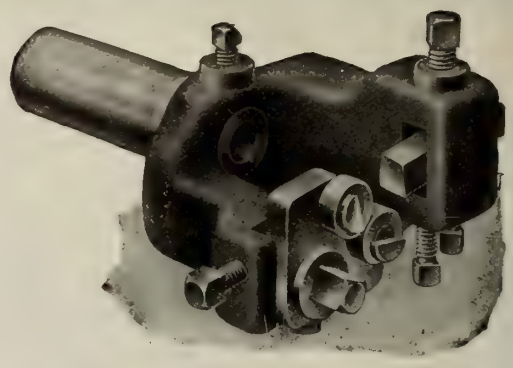
There are two important things to consider in buying firebrick—**price and quality.** When you buy ELK BRAND FIREBRICK we take a keen, unprejudicial interest in seeing that you get the class of firebrick you need. If a moderate-priced brick fills the bill we never recommend a brick of higher quality at higher price.

We make bricks in all standard sizes and shapes.

Elk Brands Firebrick are reliable. Specify them in your next order.

Elk Fire Brick Company of Canada
Limited
Sun Life Building, HAMILTON, ONTARIO

TURRET-LATHE
TOOLS & HOLDERS

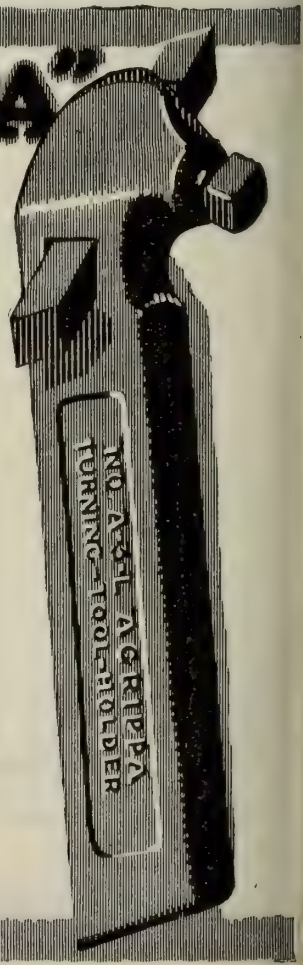


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WILLIAMS' "AGRIPPA" TOOL HOLDERS



When your work demands unusually heavy cuts, when the piece in process is particularly difficult to turn, when you hit hard spots, or when speed in production is required, you can depend upon Williams' "Agrippa" Tool Holders, "The Holders that Hold."

Made in a wide range of sizes for all regular machining operations—Turning, Boring, Planing, Threading, Knurling, Cutting-off and Side Work.

Ask your Dealer : Machinists' Tools Book on request.

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Metal stamping work of every description.

Precision work a specialty, no matter how difficult your work may be we are equipped to handle it.

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United States Electric Drills and Grinders



The "BUZ"

For all kinds of general drilling in metal up to 5/16"—name plates, cotter pin holes, oil holes, etc.

The "BUZ" is especially adapted to corner drilling—drills within ¾" of corner. Switch is located in handle; under absolute control at all times. Attaches to any lamp socket, alternating or direct current, 110 or 220 volts. Guaranteed the most powerful electric drill of its weight on the market.

Order a few to-day for trial. Their time and labor saving ability will convince you you need more!

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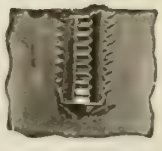
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THE UNITED STATES ELECTRICAL TOOL CO.

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Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.

Hartford, Conn.

THE JOHNSON FRICTION CLUTCH

The Case Against the Countershaft

The old familiar countershaft drive, through cross belts and tight and loose pulleys, stands accused of the following offences against efficiency:

1. Involves needless equipment.
2. Costs too much to set up.
3. Prevents economical and systematic use of space.
4. Operates sluggishly.
5. Multiplies belt troubles and the resultant cost of upkeep.

Modern practice has discarded the antiquated countershaft for the simplicity and efficiency of the clutch drive direct from lineshaft.

Adopt the Johnson Lineshaft Drive

The economical, efficient and durable method of power transmission through friction control.

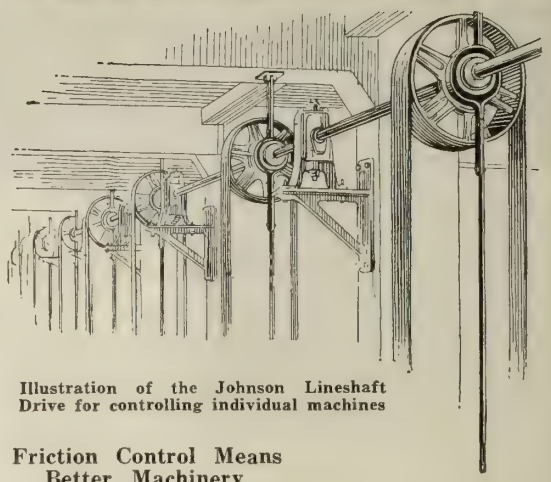
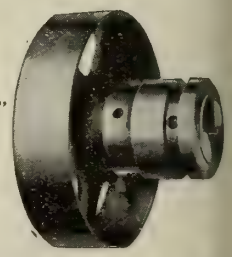


Illustration of the Johnson Lineshaft Drive for controlling individual machines

Friction Control Means Better Machinery

Whether it is applied overhead or in the machine itself.

Write for our Booklet "Clutches as Applied to Machine Building" and our Yellow Catalog.



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CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

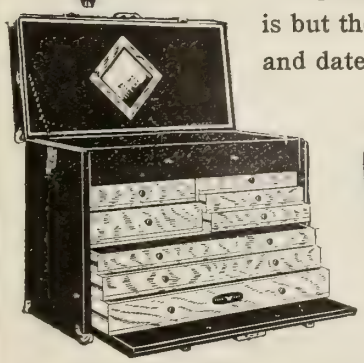
THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

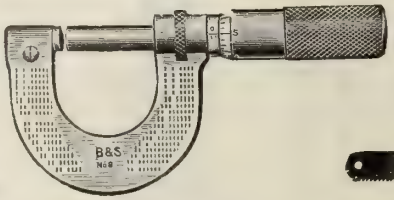


Supplies for Machine Shops, Foundries Factories and Construction Purposes

SET SCREWS, Cap Screws, Machine Screws, High Speed and Carbon Drills, Files, and a Complete Line of Machinists' Tools (Starrett, Brown & Sharpe, etc.), Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

The prompt, courteous service and dependable goods for which Rice Lewis is noted, is but the development of a policy commenced 74 years ago. Full particulars, prices and dates of delivery of any of our supplies are yours for the asking.









Rice Lewis and Son, Limited, Toronto

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AMONG OUR PRODUCTS

O. H. STEEL
- Bolsters
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- Draft Arms
- Locomotive Side Frames
- Machinery Castings
- Marine Castings
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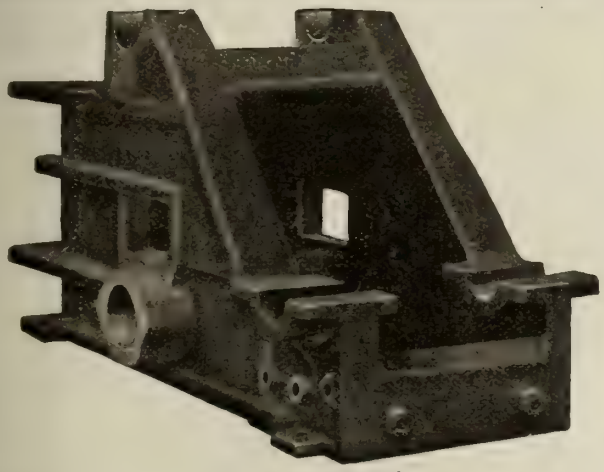
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TRACKWORK
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- Frogs
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- Complete Intersec tion

This list is merely an indication

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Cast Steel
Stone Crusher Frame

Machinery Parts
of every description
in
Cast Steel

Chrome-Nickel
and other forged gear blanks

Forged Shafts

Dominion Foundries & Steel Limited
Hamilton, Canada

If interested tear out this page and place with letters to be answered



Cab Tire Cable

The Cable De Luxe for Industrial Purposes

This advertisement illustrates:

A length of Northern Electric Cab Tire Cable
One Northern Electric No. 511 Marine Plug and Receptacle
One Northern Electric No. 300 Hand Portable

This combination is ideal for Industrial Portables. It is especially adapted for use in damp localities, or where gas or oil fumes abound, and where other types of cable would be subject to mechanical injury.

Because of its flexibility and durability, Cab Tire Cable is in a class by itself for industrial purposes, and the ever-increasing orders received from Machine Shops and Industrial Plants all over Canada prove its merit and popularity.

Our nearest house will give your inquiries immediate attention.





Northern Electric Company
LIMITED

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BROWN-BOGGS

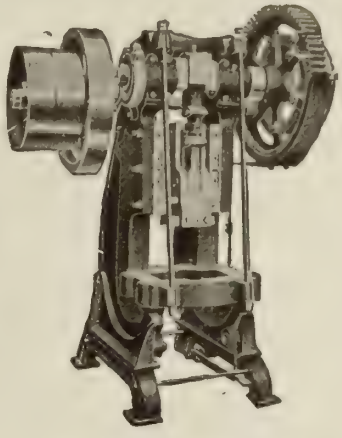
B B

Do You Find Ordering Hard?

We mean ordering a new machine—intended as a labor-saver and production-spreader.

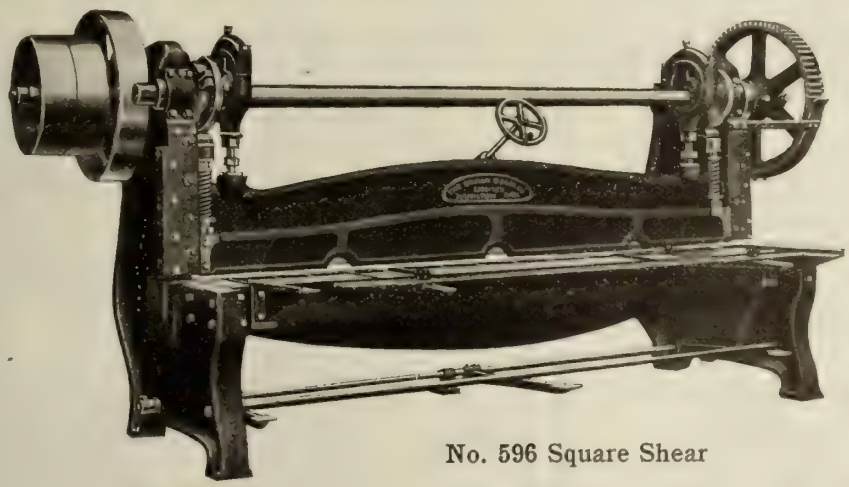
There was a time when it **was** necessary to send for sheafs of catalogues, spend hours of valuable time investigating and end up with a choice which was perhaps 90 per cent. guesswork.

Today things are different. It's a simple matter to order "B-B" tools. The "B-B" trade mark represents Sheet and Metal Workers' tools of proven worth plus an advisory and consulting service which is always at your command.



No. 215—Power Press

We are always ready to talk over your problems with you. If you wish advice consult us freely.



No. 596 Square Shear

A Complete Line of

Tinsmiths' tools and sheet metal working machines of all kinds; canners' and evaporators' machinery, shears of every description, power presses for punching, forming, embossing, blanking.

B B

THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.



Which is yours?

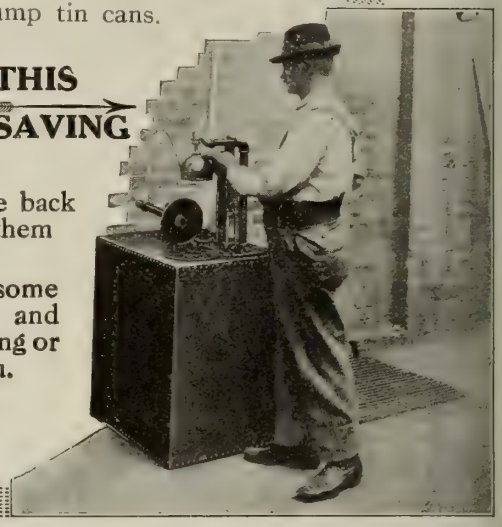
THIS ← WASTE

and fire hazard go hand in hand where the oil is slopped around "any old way."

Handling your oil in any old way, just because it is oil, or putting it in a safe like the real money it is? On the left is shown a picture of what daily happens where oil is stored in faucet or "jigger" pump tin cans.

BOWSER ESTABLISHED 1885

THIS → SAVING



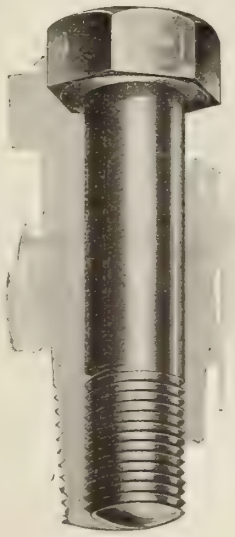
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meet with the most particular insurance exactions—they have back of them over thirty years' pioneer work and study built into them—they are an investment and not an expense.

Send for illustrated descriptive literature—Give us some of the facts—the way and kind of oils you store and handle—whether volatile or non-volatile—lubricating or paint oils—and we will gladly co-operate with you.

Absolutely No Obligation Incurred in Writing

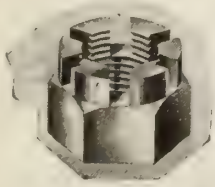
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TORONTO, CANADA



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Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



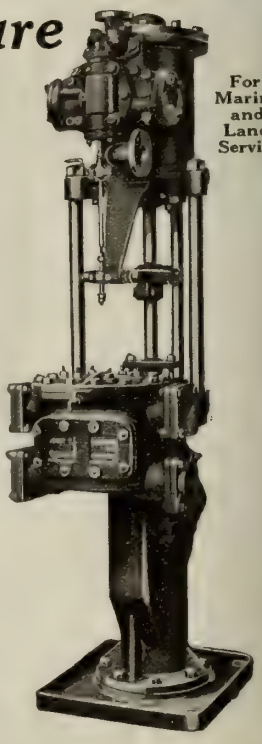
The Galt Machine Screw Co., Limited

GALT, ONTARIO

Eastern Representatives:
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Mr. D. PHILIP
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High Pressure Pumps!



For Marine and Land Service

Note the construction of this Hepburn "Special" Vertical Ram Feed Pump. We claim it is the most efficient pump on the market and we stand ready to prove it. It is of the outside-packed type, operating with Outside Lever Valve Motion. The Pump Ram works in a brass Sleeve and has only one gland to be packed. Full strokes maintained at variable speeds.

Get full particulars; also on Vertical Engines, Compressors, Winches, Cut Gears.

JOHN T. HEPBURN, Limited
Engineers and Iron Founders
18-60 Van Horne St., Toronto

HEPBURN

"Special" Vertical Ram Feed Pumps

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GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

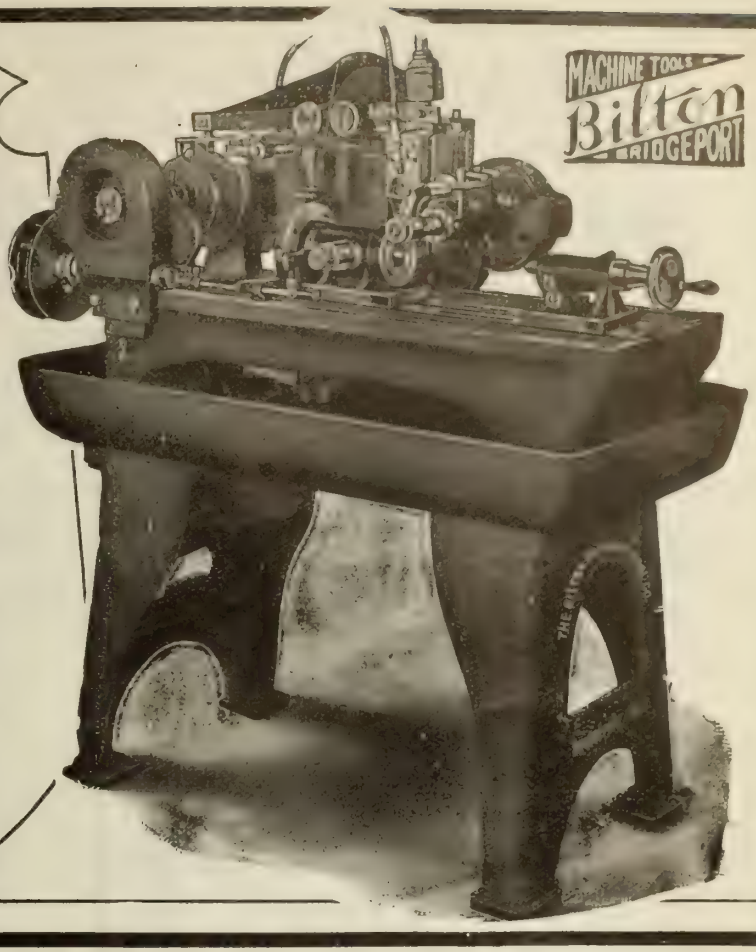
Big business everywhere is adopting the Bilton for high production on accurate work.

May we send you our catalogue?

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Foreign Agents:
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Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

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La Salle, Illinois, U.S.A.

Represented in Canada by

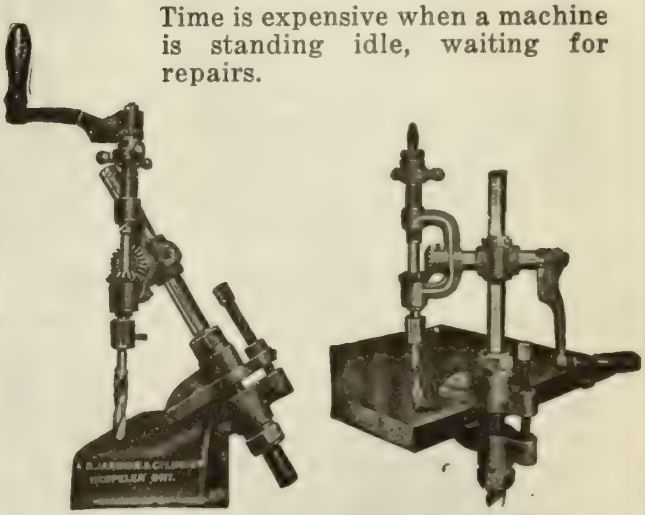
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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

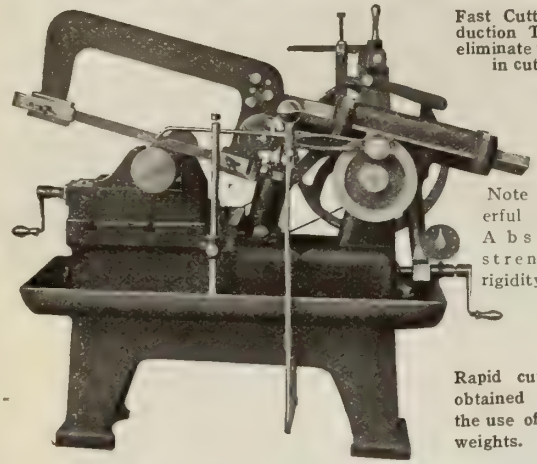
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Sold by all Machinery and Supply Houses.

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SAWING MACHINES



Fast Cutting Production Tools that eliminate the waste in cutting.

Note the powerful design. Absolute strength and rigidity.

Rapid cutting is obtained without the use of heavy weights.

FEW Sawing Machines can compare with this "Rapid" for fast cutting ability, length of life, up-keep and cutting-economy. On most work it is a decided advantage over circular or band saws.

The simple, rigid construction and minimum of working parts is an insurance of cheaper and better work. 3,000 of these machines giving satisfaction.

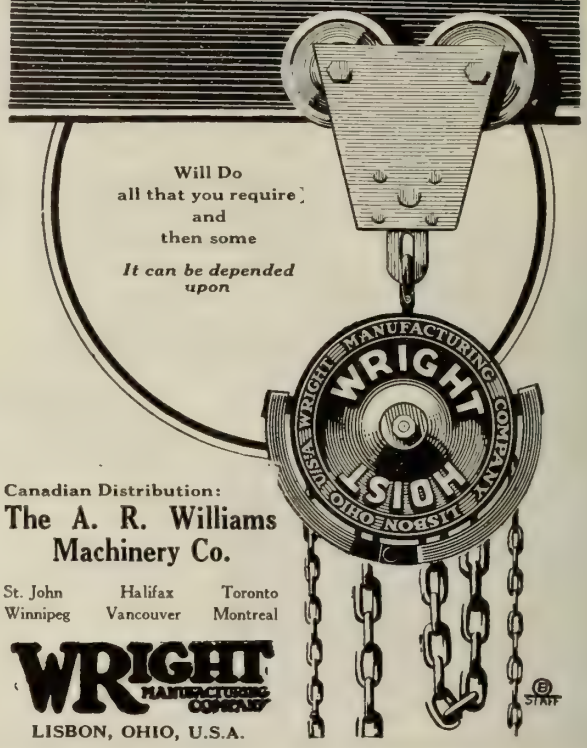
Made in various sizes to take bars from 6 in. up to 26 in. diameter

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Will Do
all that you require
and
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It can be depended upon

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"ROYLITE"
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Cleans All Metals

Made In Canada

Oil, Grease, Paint, Varnish, Enamel
All Quickly Disappear before "ROYLITE"

Ask any man who has ever used "Roylite" Cleaner, why he prefers it and this is what he'll tell you. "Roylite" is the fastest, most effective cleaner we have ever used. It lasts longer and costs less than any other.

Here's the reason "Roylite" is different to most cleaners. It emulsifies or lifts grease from the work and does not lose its strength in saponification like Caustic Soda, Lye, Soda Ash, etc. by creating a soap in the solution. This enables the use of both with less additions of this cleaner than others.

"Roylite" is easy to apply. All chemicals are soluble, quickly dissolve in water, and are ready for immediate use, "Roylite" is guaranteed not to discolor or tarnish the brightest surface.

Order a barrel to-day on approval

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TORONTO, ONTARIO, CANADA

HERE IS THE DRILL

that will help you do an honest day's work



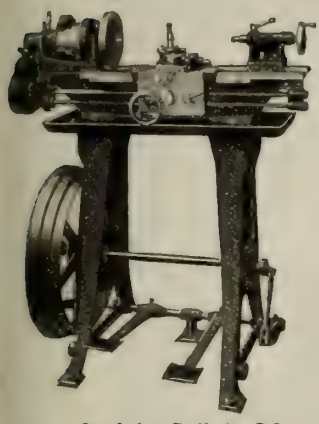
Their is no More Dependable Drill than the

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Morse Twist Drill & Machine Co., New Bedford Mass. U. S. A.

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Type B-6



"The Small Lathe for the Big Job"

	Inches
Actual Swing -	8¼
Between Centers -	18½

Large and balanced flywheel fitted on shaft with roller bearings. Easy operation.



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TURRET LATHES
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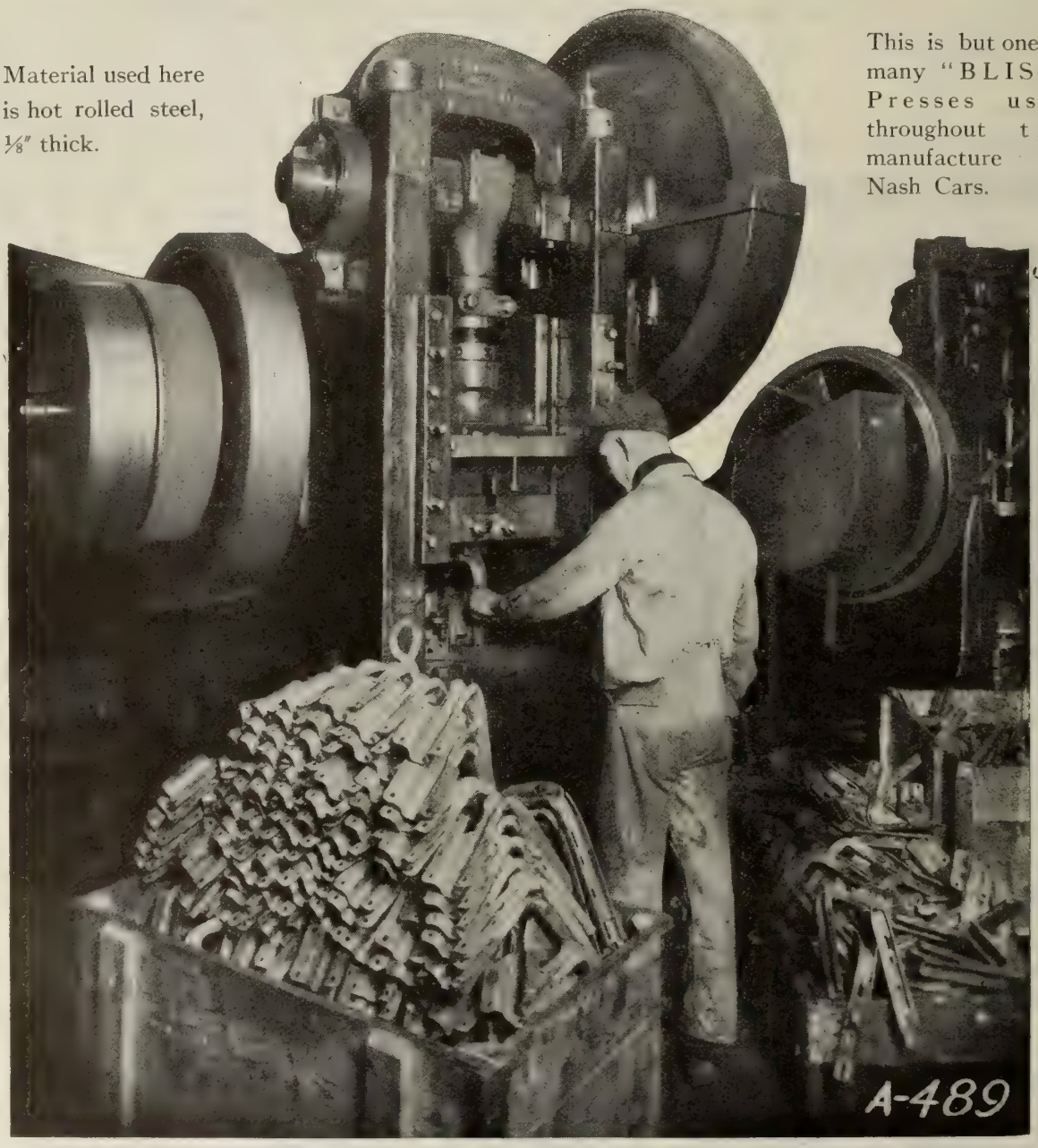
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Spring Run-Board Hangers

This "BLISS" No 74½ Straight Side Press, at the Nash Motors Co. plant, Kenosha, Wis., forms the clearance on 350 of these spring run-board hangers per hour.

Material used here is hot rolled steel, ⅛" thick.

This is but one of many "BLISS" Presses used throughout the manufacture of Nash Cars.



BLISS 1857

E. W. BLISS COMPANY

BLISS 1921

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American Factories: BROOKLYN, N.Y.; HASTINGS, MICH.; CLEVELAND, O.; SALEM, O.

SALES OFFICES

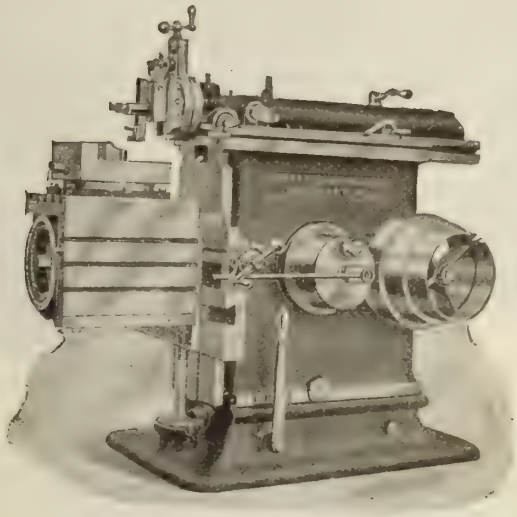
CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg.
CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURG, Keenan Bldg.

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No special vises or fixtures needed: the Universal features of these machines take care of everything, making them particularly adapted to--

Die Work

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Machines regularly furnished with--

Swivelling Graduated Table
Auxiliary Tilting Side for Compound Angles

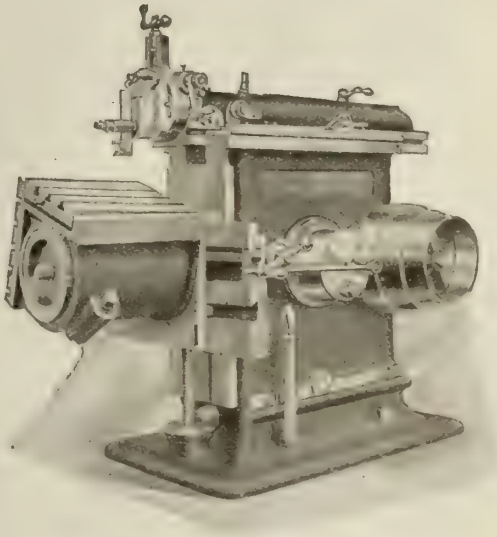
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Swivel Vise and Graduated Base

Table raised and lowered by power on 24 inch size,



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On the way back to "normalcy" first make sure you are right and then go ahead with a will.

Never before has there been a greater need for that comfortable assurance of accuracy which goes with Johansson Gages—blocks of unquestioned reliability and permanence.

As reference standards or as working gages in your tool room and inspection department, they give your **results** in the most direct way and in the shortest time.

Ask these Johansson dealers for details of standard sets, plug gages, snap gages and other Johansson tools.

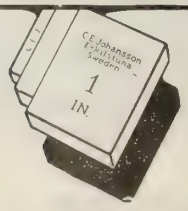
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Canadian Hart Wheels

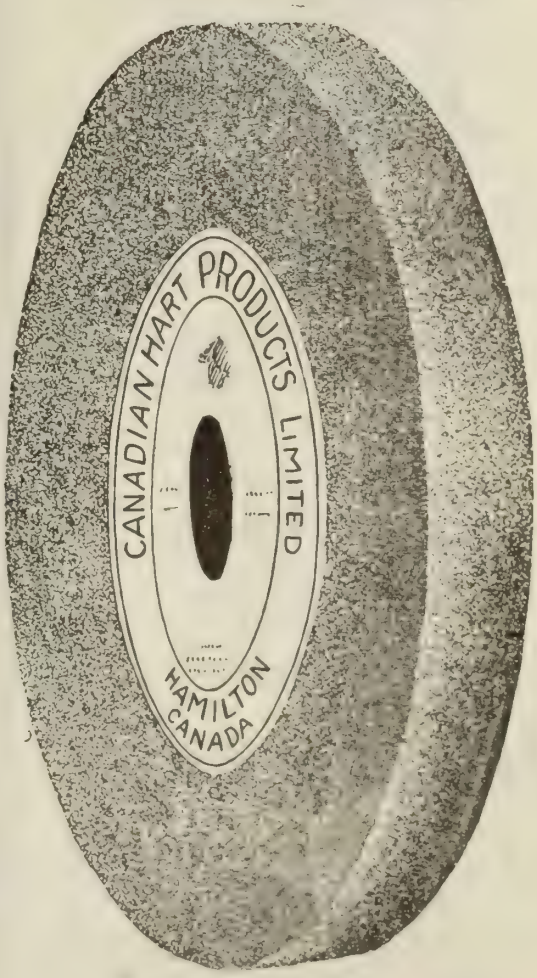
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Canadian Hart Vitrified Wheels—recommended for the majority of grinding jobs. May be used wet or dry; give better all-round satisfaction and have a longer life.

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Made In Canada



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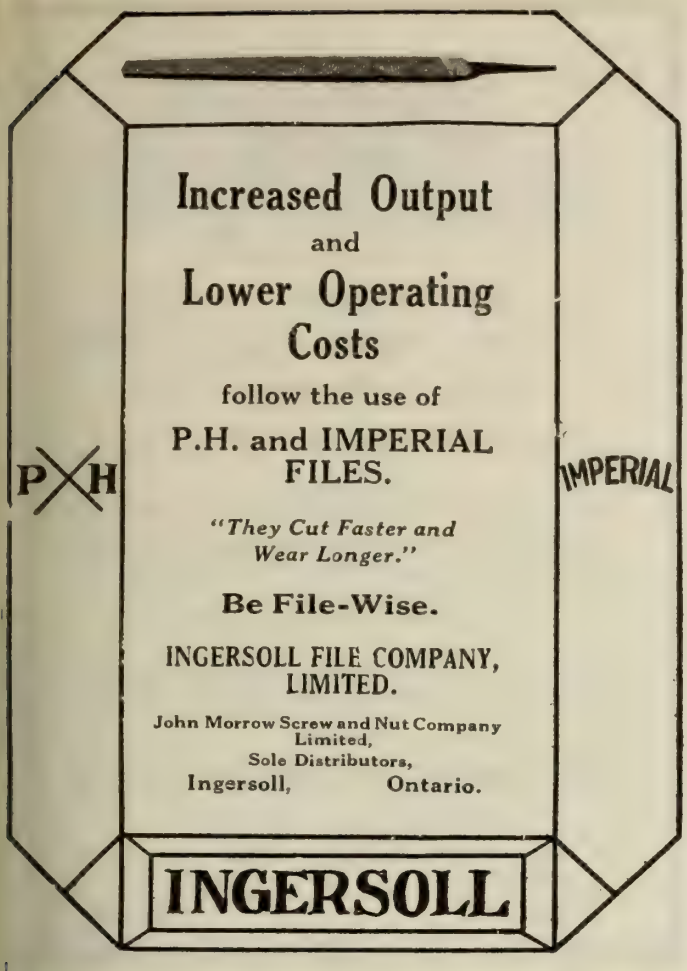
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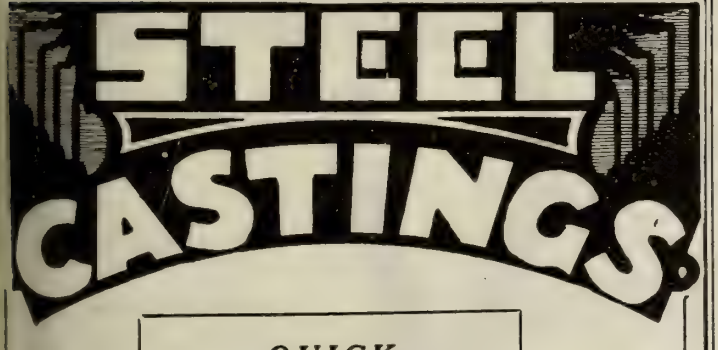
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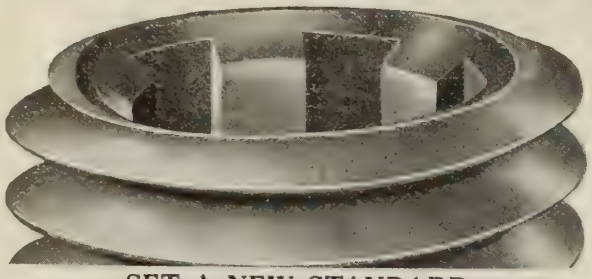
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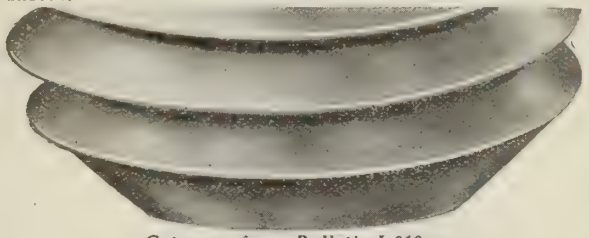
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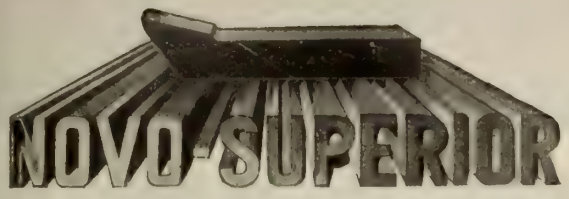
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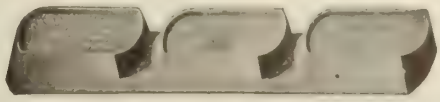
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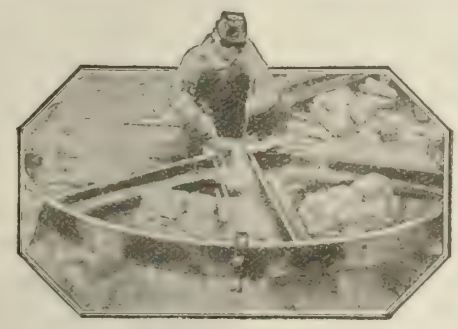
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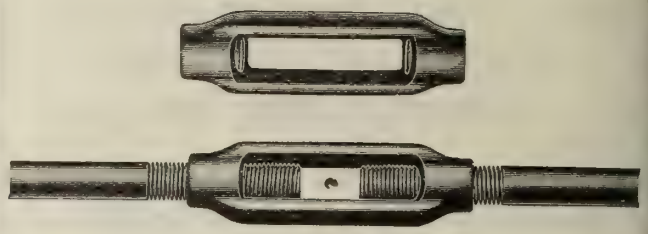
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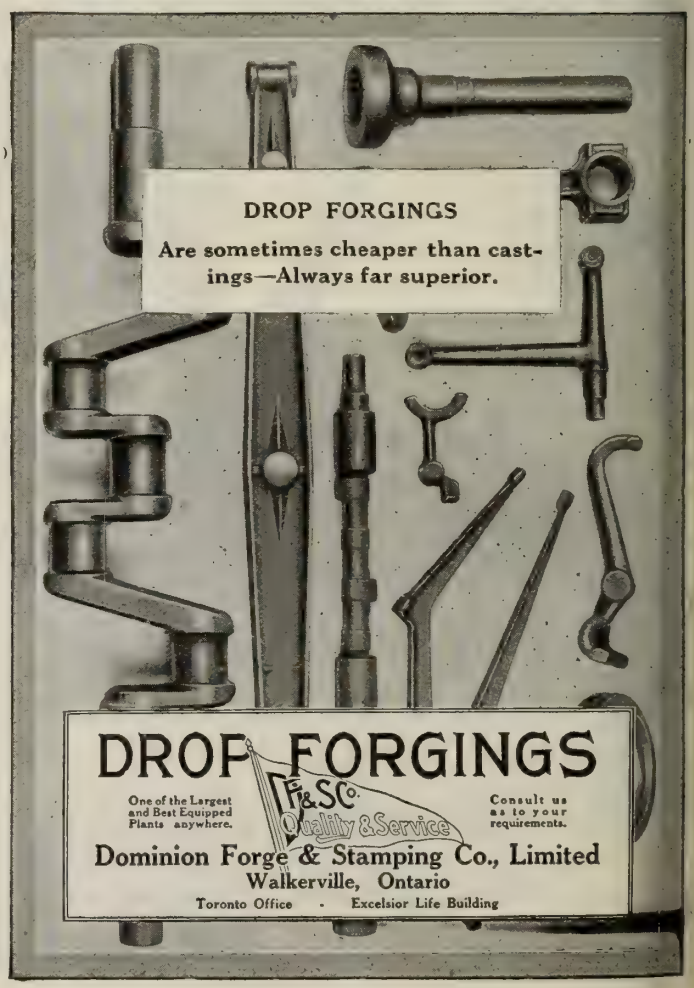
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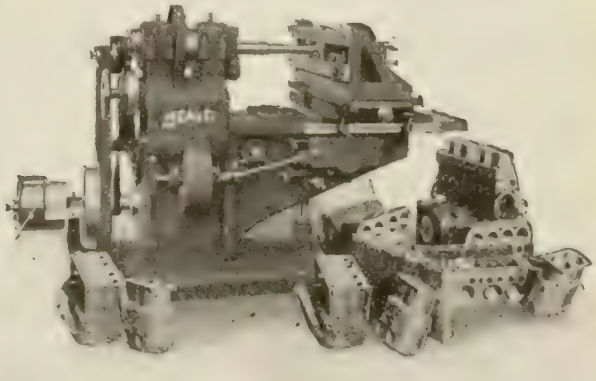
It does not require a large amount of capital nor expensive equipment. Small machine shops, auto repair shops and welding concerns are particularly adapted to this work. They are equipped with lathes, drills, etc., so it only requires one or two additional machines to start in immediately on work, which is just lying around waiting to be picked up.

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All sizes are handled on the Heald Style No. 55

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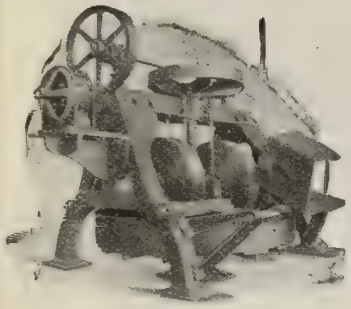
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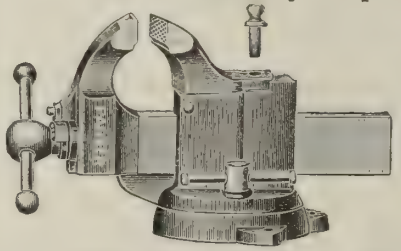
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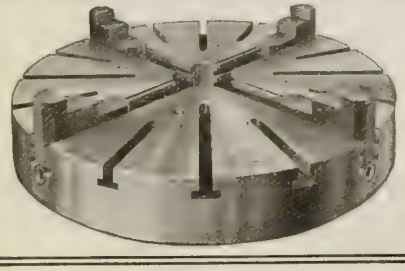
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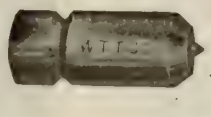
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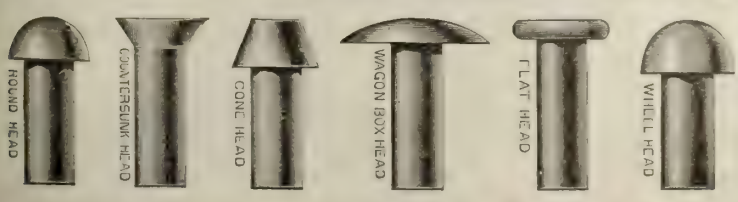
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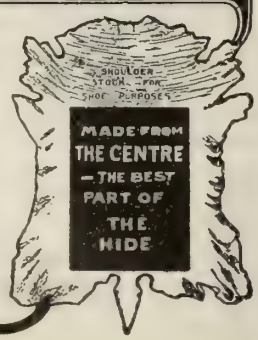
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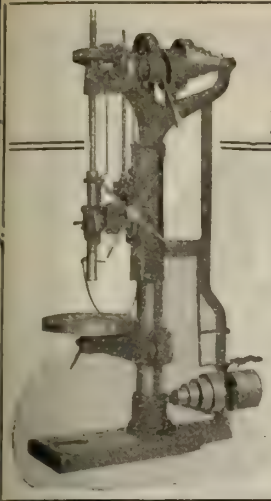


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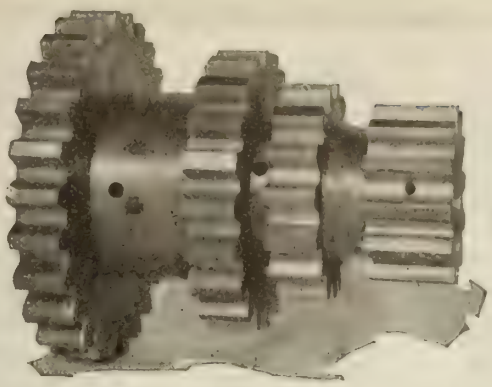
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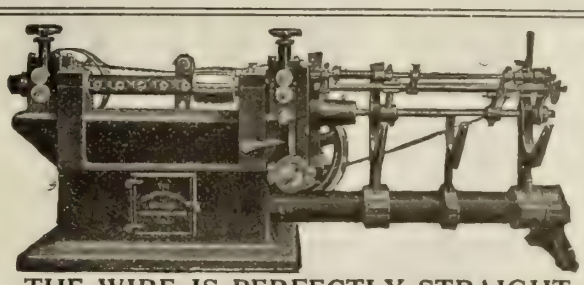
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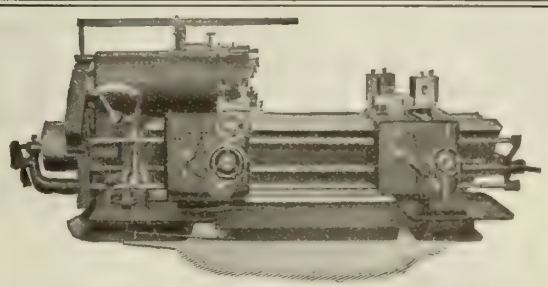
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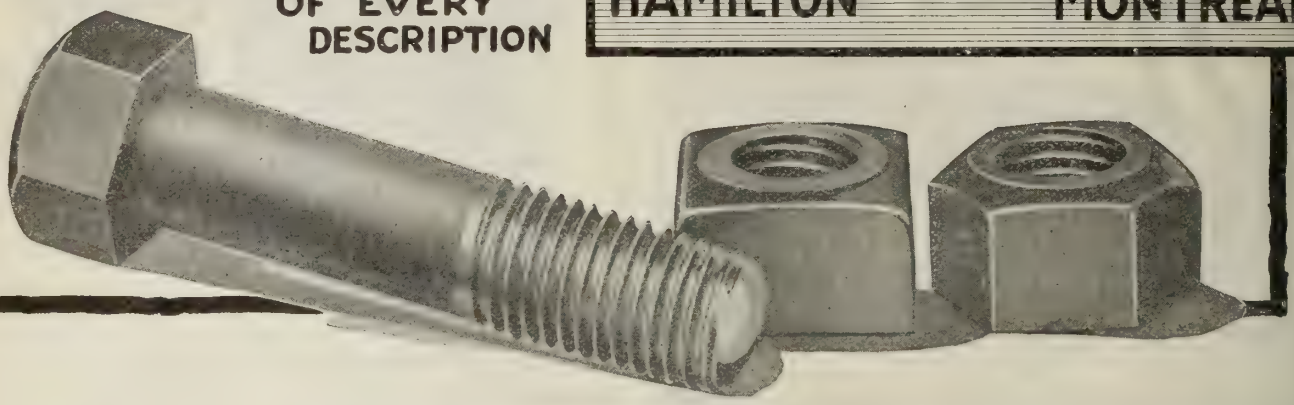
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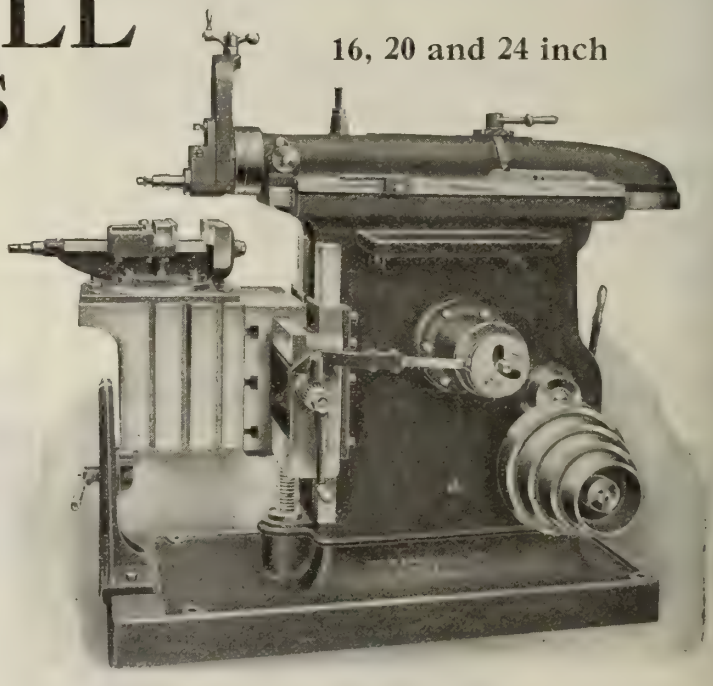
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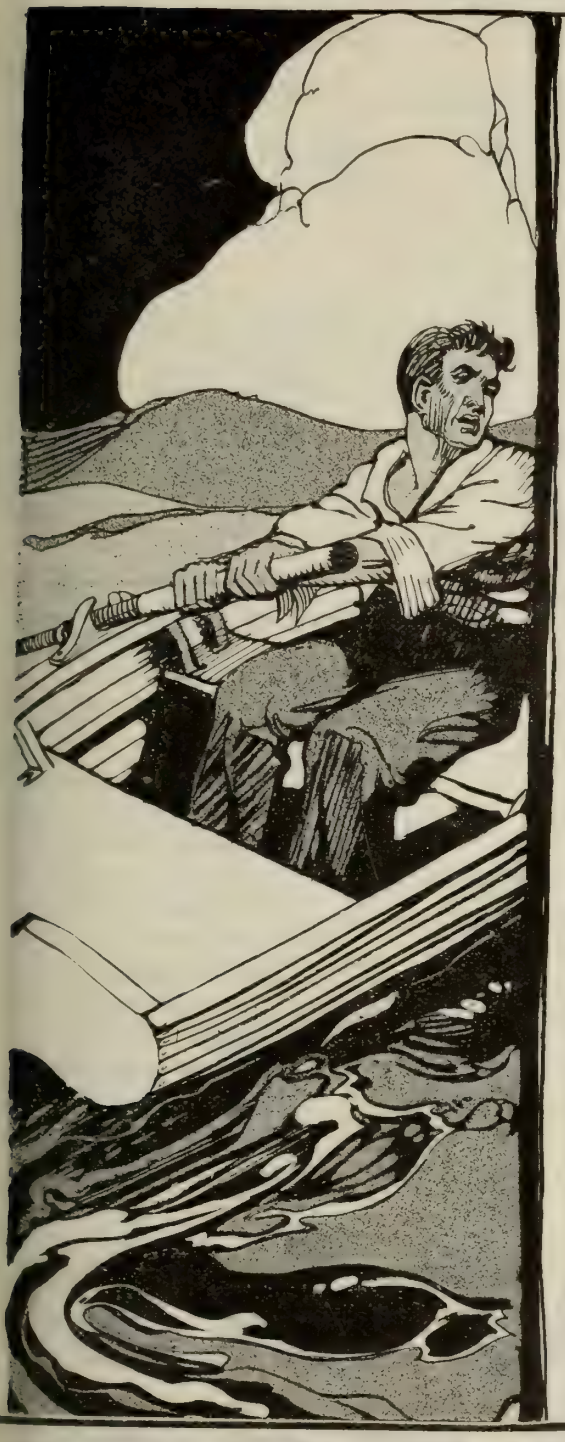
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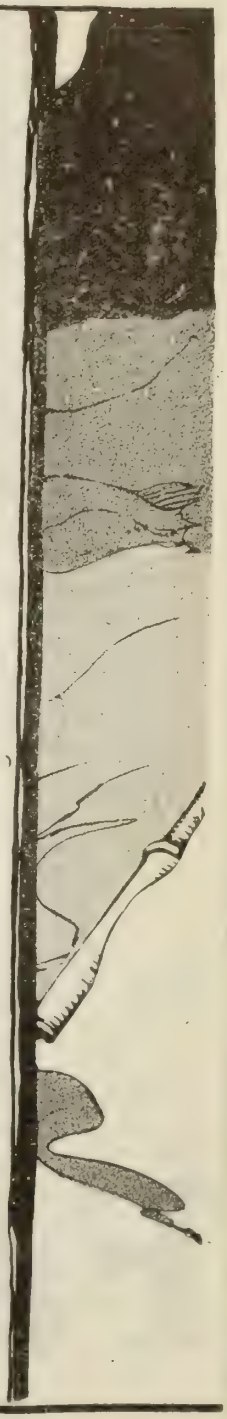
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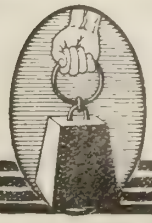
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CANADIAN MACHINERY
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)L. XXVI., No. 3. July 21, 1921

Design of Lathe, Planer, Shaper and Slotter Tools

The Factors Which Decide What Shape of Tool Will Prove Most Efficient for Any Given Cutting Operation—The Ideal Tool to Use For a Known Combination of Factors—Effect on Shape of Tools Due to Vibration

THE design, manufacture and use of lathe, planer, shaper and slotter tools is a subject for careful consideration in every large machine shop. The suggestions for making the most efficient forms of tools and for maintenance at least expense, as embodied in the following matter, are based upon years of thought and experimenting by men who have devoted their time exclusively to tool production.

Other discussion of the subject take it for granted that tool grinding and regrinding are lengthy and laborious operations. They therefore devote the greater part of their remarks to the question of tool forging, which is to be done in such a manner that subsequent grinding shall take as short a time as possible.

Forging is at best a rough and ready, inaccurate and inefficient process, and if without detriment to the tool, it can be largely eliminated, an important stage in progess towards efficiency is reached.

It is sometimes claimed that tools should be forged because the cutting properties of the steel are thereby improved. This may conceivably be the case with steels of poor quality, but is certainly not true of any recognized brands of high speed steel. On the contrary, there is always considerable risk that the steel will suffer through being worked at too low or too high a temperature. The hammering at heats outside of certain heat limits is most destructive to high speed steel.

By the method about to be discussed, the shaping of the tool is done in the majority of cases by grinding instead of forging. This grinding, which is done dry before hardening, has been proved to have no deleterious effect on the steel, nor is it conceivable how intelligent grinding could possibly cause any injury.

If, therefore, by means of grinding, a tool can be made to a definite predetermined shape in a fraction of the time required for forging the advantages should be investigated.

Tool Design.

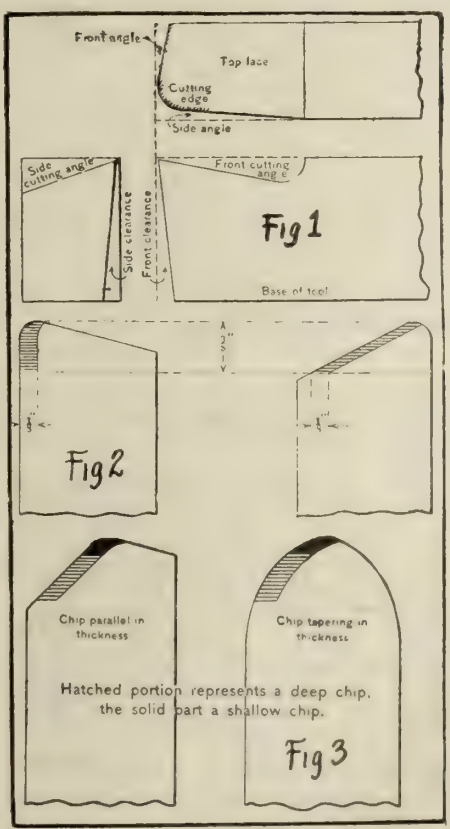
If every lathe, planer, shaper and slotter operator were allowed to design or control the design of the tools he used, there would be such a multiplicity of tools in the shop that confusion would be inevitable, and the result would be inefficiency, reduced output, increased power charges and considerable waste of time.

It behooves those in authority therefore to tackle the tool problem in real earnest. The first item in the programme is to carefully consider the machines which use tools of the lathe type and the nature of the operations performed thereon. Using in the first place the experience of others, supplemented, when necessary, by experiments, those who desire to improve their tool system will soon realize the necessity of a set of standard tools applicable to every machine and every operation concerned. They will also see the desirability of making such a set of standard tools small, yet with enough flexibility to cover every requirement.

When the term "Standard Tool" is used, a tool of fixed and unalterable shape is not meant, because according to the nature of the operation on which it is to be used, two or three variables will enter into its makeup.

A standard tool is one with a standard profile, but the rake of the top face, the radius at the cutting point, the inclination of the cutting edge to the tool shank, and the clearances of the cutting sides should be varied to suit the machine, the material being machined, and the nature of the cut.

None of these variables, however, need affect our decision to lay down certain standards; they merely influence the question of flexibility in suiting the standards selected to the needs of the shop.



Figs. 1 to 3. Fig. 1. Terms used in defining shape of tool.
Fig. 2. Effect on the chip thickness when the cutting-edge is lengthened, while the depth of cut and rate of feed remain the same.
Fig. 3. The difference in the chip section cut by a straight-edged and a round-nosed tool.

Definition of Tool Parts.

Before proceeding further, it is desirable to define the terms used to designate the various parts of a tool. A tool consists of the shank and the nose. Unless otherwise stated the shank will be presumed to be rectangular. See Fig. 1.

Rake is the angle at which the top which bears against the support that takes the pressure of the cut. The top face is that which takes the friction of the chip as it is cut from the work.

Rake is the angle at which the top face is presented to the work. It is usually a combination of side cutting angle and front cutting angle, though it may in some cases consist of either of these separately. The profile is a plan view when looking at the top face from a point at right angles to the base. It is determined by the combination of the side and front angles and the radius of the cutting point.

Clearance is obtained by grinding away that part of the tool nose which would otherwise rub against the work during the cut. According to whether it is measured from the front or the side of the tool nose it is called front clearance or side clearance.

The radius of cutting point is the amount the corner between the front and side angles is rounded off. In determining a set of standard tools, Profile, Clearance and Rake must be considered.

Standard Profiles.

It is not often realized what an in-

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portant bearing the profile of a tool has on its efficiency as a cutting instrument. In Figure 2 is seen a representation of two tools performing the same work at the same depth of cut and at the same rate of feed.

The cross sectional area of the chip is the same in both cases, yet the one on the right is obviously a much thinner chip than the other. The cut being spread over a greater length of cutting edge, this tool will be therefore much more durable than the one on the left. On the other hand, if the tool on the left will stand up to the work imposed on the short length of cutting edge in action, it follows that, with the tool on the right, the rate of feed can be increased, until for an equal length of cutting edge the same cross sectional area of chip is being cut from the work. Suppose the length of cutting edge in the one case to be twice the length of the other, twice the amount of work can be done in the same time. The first rule, then, in selecting a tool profile is that:—The maximum length of cutting edge must be in action for any given depth of cut.

Whether the portion of cutting edge in action should be straight or curved depends somewhat on circumstances.

A straight-edged is easier to make than a round-nosed tool and deserves consideration accordingly. It also distributes the cut evenly over the cutting edge at any depth of cut.

A round-nosed tool has a certain advantage in that it lends itself to a greater variety of operations without material alteration. Where the depth of cut is constantly varying, as in turning a hammer forging, the cut is distributed over the cutting edge in a varying amount more proportional to the strength of the tool nose. The choice between the two is perhaps more one of preference than of efficiency.

A study of Fig. 4 reveals the fact that the chip from a straight-edged tool consists of a band of metal with straight serrations across it, while that from a round-nosed tool has curved serrations across it.

This would seem to point the moral that the metal in the chip is more distorted, therefore more power is consumed, when using a round-nosed tool than when using a straight-edged tool, for the following reasons.

Each portion of the width of the chip passes away from the cutting edge at right angles to a tangent at the point of cut. With a straight-edged tool the chip passes over the top face freely because the directions of motion of every portion of the chip are parallel to each other. With a round-nosed tool the extreme edges of the chip are, while passing across the cutting edge, running towards each other, therefore extra work is done in forcing the chip away from the cutting edge owing to the rubbing action that must take place between the particles of metal forming each chip section. It may therefore be assumed that in the main the preference would seem to lie with a tool having a straight cutting edge. Any advantage which the round-nosed tool may be considered to possess can easily be given to the straight-edged tool by grinding a large radius on the point.

So far is has been assumed that the metal to be cut is homogeneous. That this is not so every lathe hand knows. Frequently the cut must be taken just under a hard skin, which very soon destroys that part of the cutting edge against which it bears. Again the surface of the work may be scaly or gritty, which is equally as bad for the tool.

These things must influence choice of a suitable tool. It is logical to assume that the shorter the length of cutting-edge in contact with the skin, the less damage will be done to the tool and the easier it will be to repair what damage is done. The shortest distance through the skin is at right angles to the surface, therefore where the tool comes in contact with the skin, the cutting-edge should be as nearly as possible following that shortest distance.

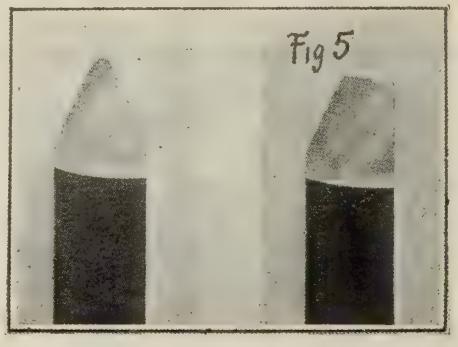


Fig. 5. Two similar tools, the one on the left being a very commonly used roughing tool, the one on the right being ground to conform to rule three.

This leads to the statement of a second rule, which is:—The least amount of cutting edge must come in contact with the skin of the work, if this is liable to damage the cutting-edge.

The third point to be considered is the absorption of the heat generated by the cut. This heat can be dissipated very largely by means of a copious bow of lubricant, but this will not prevent damage to the point of the tool unless there is a sufficiently large amount of metal in the tool nose to prevent the extreme point from becoming overheated. Any lubricant of coolant, which flows past the cut without touching either the tool or the work, is wasted from a cooling point of view. Therefore the broader the tool nose the greater will be the chance that plenty of cooling fluid will fall on it. It is a mistake to consider that any metal not directly concerned with the cutting-edge, should be ground away. All non-essential metal that can be left on the tool nose should be left, as it assists materially in absorbing and dissipating the generated heat.

The third rule, then, resolves itself into:—

The maximum amount of metal must be left on the tool nose behind the cutting edge to absorb the heat generated by the cut.

This rule is aptly illustrated in Figure 5, which shows two precisely similar tools as far as the cutting angles are concerned. The one on the left is a very common tool for rough turning and is to be found in many tool rooms at the present time. If, however, such a tool is ground as shown on the right, that is, with all possible metal left on the nose behind the cutting-edge, the life of the tool will be greatly increased, while the actual turning will not be affected in the least.

The three rules already discussed may be summarized as follows:—

(1) Maximum length of cutting-edge in action.

(2) Least amount of cutting-edge in contact with the skin.

(3) Maximum amount of metal behind the cutting-edge.

They do not apply to every case without exception, but should be adopted in the selection of tool profiles wherever possible. The exceptions will not be numerous, only presenting themselves when the cut is unusual or the work is frail and liable to spring under the cut

To illustrate the application of these rules, it will not be out of place to consider a specific case—say the turning of a forged shaft or spindle. How shall a tool be selected for the purpose? The decision will depend on several factors which may be stated thus:—

(1) Hardness of the material to be cut, and whether the work is annealed or not.

These affect the rake as much as the profile of the tool, and should therefore be taken into consideration when deciding on the rate of feed that it is possible to adopt.

(2) Whether the work has a hard skin or not. This has considerable influence on the choice of tool, as will be shown later.

(3) The strength, rigidity and power of the machine to be used. This will govern the depth of cut and rate of feed

(4) The solidity of the support the tool will have in the tool-rest. The single swiveling tool-post offers a poor support to the tool. The pattern with four clamping bolts and no overhang gives plenty of support to the tool and allows a much heavier cut to be taken than any other type.

(5) The frailty or otherwise of the work. If the work is liable to spring away from the tool, light cuts with a more or less pointed tool are necessary, otherwise the work will not be true and will be full of chatter-marks

As a first assumption the following combination of the above factors may be taken. The forging to be turned is 0.30 carbon steel, tough but annealed, therefore fairly easy to cut. The skin is clean and will not affect the tool very much. The machine to be used is one with plenty of power and strength, so that it will not be possible to overload it with the ⅜-inch depth of cut and ⅛-inch feed we intend to adopt, while the forging is also strong enough to take such a cut without spring. The machine will carry a tool of 1¼-inch by 1¾ inch section.

Rule 2 does not apply here as the forging has been annealed and skin hardness is unimportant. Rules 1 and 3 decree a long cutting-edge and a mass of metal behind the cutting edge.

Draw two parallel lines ⅜-inch apart to represent depth of cut, and two more parallel lines at right angles to these 1¼-inch apart to represent width of tool, as shown in Figure 6.

Next draw the line "AB," the intersection with the side of tool at "A" come about ⅛-inch outside the work, while the intersection with the top line at "B" should leave, say, ½-inch of metal to the right to comply with rule three. The tool shape is then completed by drawing a radius of, say, ¼-inch at "B" and a tangent to it at about 5 to 7 degrees so as to clear the work as the tool feeds along. We now have a tool profile as indicated by the lines shown in Figure 6. This tool profile gives a long cutting edge with an allowance for small variation in depth of cut, while plenty of metal remains at the back of the cutting edge to absorb the heat.

Such a tool is ideal for the class of work outlined. The angle which "AB" makes with side of the tool, side angle, Figure 1, is 55 degrees.

Now what changes, if any, are required necessary by variations in the factors previously mentioned. Suppose the forging is unannealed and has a s

.hat is hard enough to quickly wear away the cutting-edge. All three rules come into operation now, that is, in addition to the cutting edge being as long as possible, it must cut through the skin at, or nearly at, right angles to the surface of the work.

Turning to Figure 6 again, this means that "AB," instead of at 55 degrees to the side of the tool, must be very much steeper, even as steep as 5 degrees, while the long cutting edge is obtained by making radius of the point very little less than depth of cut. The resulting tool is similar to that on the left of Figure 7.

An alternative tool with exactly the same profile is shown on the right of Figure 7. This tool, however, has been sent to give an overhung cutting edge, allowing all the metal indicated by the shaded portion to be ground away by resharpening, before the tool is unfit for further use without re-making. This is a case where,owing to adverse conditions, we are forced to go against our better judgment by accepting a Round-nosed tool where we would use a straight angle tool similar to Figure 6, had there been no skin to contend with.

Our next supposition will be that the machine is not over strong and vibration set up under a ⅜-inch cut- ⅛-inch feed. Is it possible to maintain such a cut and feed by variation in the cutting tool used? The first point that arises is that the machine, unless there is something radically wrong with its design, must obviously be smaller than the one previously under consideration. It will therefore require a smaller tool section. Assuming this to be ⅞-inch by 1¼-inch, and following the method depicted in Figure 6 for determining its shape, it is obvious that the side angle cannot be 55 degrees; it will be about 35 degrees, as shown in Figure 8. It will be seen that with such a tool the cutting-edge is not so long, and end thrust on the tool will not be so great.

It is possible therefore that the tool depicted in Figure 8 will, on the weaker machine, take a ⅜-inch cut at ⅛-inch feed. If not, vibration can be overcome only by reducing the feed or the cutting speed, or both. It would not be wise to reduce depth of cut, if this can be avoided.

This exhausts the variations in the combination of factors previously named. It will be noted that all the tools developed to meet these variations are of the straight-edged variety. Exponents of the round nose will probably say this reasoning is faulty, that while admitting the straight-edged tool has some advantages, the round nose has more, especially where the work is excessively hard, as in turning shrapnel shell forgings. The reply to this is, that the obvious advantages of the straight-edged tool are combined with all those that the round nose can possess by grinding a radius on the point. The chip then tapers off to nothing at the point, while the thickest part is of even thickness and tends to curl away from the tool without absorbing more power than need be.

The importance of selecting the right profile of tool for any operation can be appreciated when it is realized that the right tool will

(1) cut at highest possible surface speed;

(2) need less re-grinding for work done;

(3) always be more durable;

(4) help materially to increase output;

(5) when ground with the correct rake, use up the minimum amount of power.

Clearance.

The subject of clearance on cutting tools has, in the past, received scant attention from tool users. Everyone knows that clearance is necessary, though if asked why, most of them would be at a loss to give their reasons. If asked how much clearance a tool should have, they give the airy reply, "Oh, so much," as if the matters were of no moment and did not warrant any time being wasted on it.

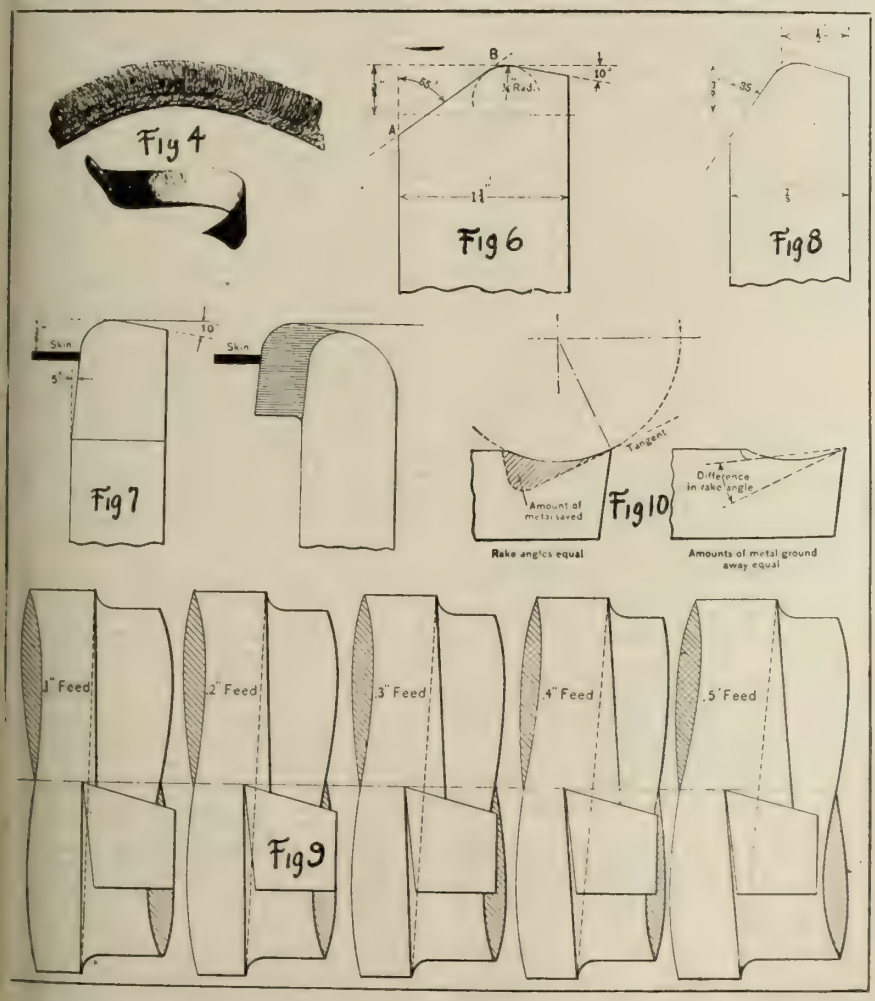
Those, however, who have made a careful study of tools, realize that clearance is almost as important as profile or rake. Consider first these questions: "What is clearance for? Is it necessary? If so, how much clearance shall we adopt on different tools?

What is clearance for? To answer this, consider one or two concrete cases. Imagine a planing tool at work; if it has no front clearance underneath the tool, it will start cutting on the end of the work, but as soon as the cut has been started the tool will rub along the cut surface. Without having actually tried planing with a tool having no clearance, it is easy to imagine what will happen. Bits of chip get under the tool, terrific heat is generated and the tool becomes useless in a very short time.

This seems simple and logical, but when the action of a turning tool is considered there is a difference. The work being round, recedes from the cutting edge as soon as it passes it, therefore the tool action cannot be compared to that of a planing tool.

Then there is the question of side clearance, or clearance on that part of the tool which faces in the direction of the feed. In a planing or shaping tool precisely the same principles govern both side clearance and front clearance. In a turning tool, if the lathe is stopped in the middle of a cut and the ridge traced between the turned and unturned surfaces, it will be found to follow the path of a screw thread. In one complete turn round the work it strikes a point some distance behind the cutting edge of the tool as shown in Figure 9. It is obvious then that clearance on the tool is necessary, otherwise the side of the tool will not only rub along the ridge formed by the cut, but will actually prevent the tool from cutting at all.

Given then that clearance is not only desirable but necessary, what amount of clearance should be adopted as standard? On this point there are many different opinions. A little thought, however, will enable anyone to realize that the old proverb, "A miss is as good as a mile," holds good here. In other words,



Figs. 4 to 10. Fig. 4. Two pieces of chip, both made at same depth of cut and rate of feed. The upper chip was made by a round-nosed tool, the other by a straight-edged tool.
Fig. 6. Method of arriving at the profile of a tool when the conditions are all known.
Fig. 7. A suitable tool for rough turning when the work has a hard skin.
Fig. 8. A tool similar to that developed in figure 6, but having a smaller section.
Fig. 9. Relation between side clearance on a lathe tool and rate of feed. The tool shown has six degrees of clearance—ample for much more than the highest feed rate any tool would stand.
Fig. 10. The difference between a tool ground with curved top face and one with straight top face.

as long as the parts of the tool which should clear, do clear, that is all that is necessary.

As stated previously it is desirable that as much metal as possible should be left in the tool nose to assist in the transmission and dissipation of the heat generated. Further, the more metal that is ground away underneath the cutting edge, the less support the edge will receive to enable it to resist pressure of the cut.

This leads us to the logical conclusion that clearance must be as small as possible

Varying conditions would seem to indicate that under this rule, as stated, different clearances should be adopted for every different combination of factors. Can a standard angle of clearance be designated for each kind of tool and still conform, within reasonable limits, to the rule stated? Will any such tool, ground to standard clearance angle, adapt itself without alteration to all conditions to be met?

Perhaps the widest variation of circumstances will be differences of feed. In Figure 9 is seen the digrammatic representation of a 3-inch bar being turned at five different rates of feed. The tool angles are the same in each case. If then a tool can be found which will be equally suitable for the extravagant rate of a half-inch feed per revolution and the more ordinary rate of 0.100 inch per revolution, then the above question is satisfactorily answered. The tool shown in Figure 9 has six degrees of side clearance, which is the standard clearance for the majority of the tools included in the Lumsden chart. It is recommended, however, that five degrees be adopted as the actual standard in the finished tool, the six degrees being ground on in the roughing before hardening. In subsequent hand sharpening, it is then easy to just touch up near the cutting edge, when standard of five degrees or thereabouts is at once obtained.

There are many cases where even a smaller clearance than five degrees is desirable, especially in delicate tools such as parting tools. A parting tool is an example of clearance being reduced to a minimum. The sides of the tool nose taper from front to back one degree only each side and from top to straight top face or a curved top face.

Rake.

Watch a tool at work in any lathe, or planer; trace the path of the chip as it curls away from the cutting edge. A straight line drawn in the direction of that path from the cutting edge gives the rake of the top face of the tool. This applies whether the tool has a straight top or a curved top face.

Now there are as many different ideas on rake as there are men using cutting tools. One man likes a very keen rake; he takes the precaution of having two tools for each job, so that as soon as one is dulled he changes them and has the used one reground. Another prefers a smaller rake angle because his tool lasts so much longer. Still another prefers to use a tool with very little rake; chips come off in short curls all blue and violet, and it looks as if he were doing such a lot of work. The kind of tool for which a man shows preference is a fairly good criterion by which to judge his character.

Theoretically, the question of rake is extremely complicated. Practically, it resolves itself into a long series of compromises. It is intimately concerned with the nature of the metals being cut; thus, a different rake on a tool of any one profile is required for cutting hard and soft steels, cast irons, brass, bronze, copper, aluminum, etc. The theory of rake involves a problem that could not be exhausted in many articles of this description. while in the end the establishment of a set of standard tools would be no nearer than at the beginning.

The following statements on the subject are based on the experience of every tool user. Metals divide themselves naturally into a number of groups, summarized into those which are:

(1) Soft and tenacious, including very soft steel, and copper.

(2) Tough, but fairly easy to cut, including the majority of low carbon steels and certain kinds of bronze.

(3) Very tough and difficult to cut, including carbon steels, tool steel and most alloy steels.

(4) Brittle, including ordinary unchilled cast iron and some grades of bronze.

(5) Very brittle, including most brasses and chilled cast iron.

Each one of these groups requires a different rake, those in Class 1 a very keen rake, those in Class 5 little or no rake at all, while Classes 2 to 4 require varying degrees of rake in between the two extremes. The great majority of tools are required for Classes 2 and 4, therefore, if standards can be so framed that they cover the requirements of these two classes, while, with very little alteration, they can be made suitable for the other classes, the desirable quality of flexibility is introduced into the standard set of tools, the standards have been reduced to the smallest possible number of variations.

This matter will be gone into more fully upon consideration of what shall be included in the standard set of tools. The next subject for discussion is the relative merits of straight and cured top faces.

Curved Face Tools.

When the Lumsden oscillating tool grinder was first brought out in Europe, it was not fitted with any attachments by means of which tools with curved top faces could be produced. This type of tool was in such general use, all being united in insisting on its manifold advantages, that it became necessary to design an attachment which would enable such tools to be quickly and accurately produced. This attachment, however, now forms part of the standard equipment.

That the hollow-curved face has many advantages has been amply demonstrated already in many European plants. What are these advantages? They may be stated as follows:—

(1) They cut easily with the absorption of less power than straight-faced tools require.

(2) They permit the use of keen rake angles without weakening the tool nose.

Both these statements require proof, but the first cannot be proved on paper; it can only be demonstrated in the shop. It is a statement of fact, nevertheless, and anyone can easily verify it for himself by taking two tools of precisely similar profile and grinding one with a straight top face at the maximum rake angle he thinks the tool and the work will allow. The other he should experiment with, first by grinding a shallow curve in the top face and trying that; then he can grind the curve a little deeper and a little deeper still, trying it each time until he finds the cutting edge is so keen that it will not stand up to the cut. The experimenter will be surprised at the results he can thus obtain and will gain useful knowledge of properties of cutting tools.

The second reason can easily be demonstrated by a sketch. See Figure 10. The rake at the extreme cutting edge on a curved face tool is equal to the angle made by a tangent to the curve at that point; a tool, therefore, to have the same rake as the curved face tool shown on the left in Figure 10 must be ground to the absurd shape indicated by the non-shaded portion.

On the other hand two tools from which an approximately equal amount of metal has been removed are shown on the right hand in Figure 10. Here the extra keenness of rake obtained by grinding the top face wtih a hollow curve instead of straight is clearly shown.

This leads naturally to whether such a keen rake is desirable. The experiments mentioned above will prove that wherever rake is desirable at all, a curved-face tool will give better results and more efficient cutting than a straight-faced tool. The curved face seems to lend itself to the curl of the chip, which comes away more freely and with less effort than from a straigh face.

That the curved face is more natura is also shown by examination of an straight-faced tool that has been use for taking heavy cuts in steel. If th tool has been used for a reasonabl length of time and is still cutting well it will be noticed that at the extrem edge a small portion of the steel bein cut has fused itself on the tool, whil immediately behind the chip has carve a curved face by wearing the metal c the tool away.

In conclusion, years of experience de voted entirely to the manufacture an application of tools for use on hundred of different machines under a very larg variety of conditions, have demonstra ed that wherever a curved face can b given to a tool, it makes a better too for all-round general use than is eve possible with a straight-faced tool. Th amount of rake to adopt for all tools varied and dependent upon each sepa ate tool shape. In a later article, th question will be further discussed.

AN ALL OIL NAVY.

Naval experts and shipbuilders in a parts of the world have been much in pressed by the decision of the Briti Admiralty to build only oil-burnin ships in future. Many reasons ha combined to bring about this decisio Among them are the convenience transporting oil and storing it at strat gic points, the small space which occupies on board ship, the ease wi which oil may be taken on board sh from tanks or tank steamers, the sim plification of stoking, and the high ef ciency of the fuel. It is calculated th even at present prices oil is cheap than coal as a fuel, apart from t other economies enumerated. This of cial decision is likely to give a fill to the movement, already taking pla rapidly, for the conversion of lar liners and other merchant vessels flyi the British flag from coal-firing to oi firing. One benefit of the change w be to do away with the terrible con tions to which stokers, on coal-fir ships are subjected, especially on t pical seas.

A Talk on Gauges And The Art of Guage Making

Mechanics Are In a General Way Familiar With Gauges But The Details Incorporated In Such Tools Are Not Understood—Various Types of Gauges—Their Purpose And Constructional Details.

By F. SCRIBER

THE subject of gauge making is one in which interest of late years has become quite general. Regardless of the class of work handled or manufactured some limits must be established to control one's product within a reasonable degree of uniformity. In addition, where a high class of interchangeable work is wanted, high-class gauges must be employed.

In a general way mechanics are familiar with gauges but it has been the writer's experience that the same mechanics are not familiar with many of the finer details which are incorporated in these tools by manufacturers who specialize to some extent in their manufacture. It would of course be attempting too much to attempt to enumerate all the details which occur in diversified gauge manufacture, and it is therefore my object to present in this discussion simply a line of thought with a few illustrations emphasizing the points at issue. One of the most common types of gauges is the plug gauge which enters a hole to measure its diameter. These are often made with "Go" and "Not Go" diameters, varying a few (or even less than one) thousandth part of an inch.

Figure 1 illustrates three types of the plug gauges, the one in the center being of the type most commonly used. In this construction the center portion is knurled for convenience in handling as this makes a rough gripping surface. The knurled portion has a flat milled in it which provides a space for marking the tool with part numbers or other information, including the word "Go" at one end and "Not Go" at the other. The smaller diameter A, which is the "Go" end is made longer than the B diameter, which is the "Not Go" end. The object of this is to allow of grinding the end of the A diameter, as the corner of this becomes rounded or worn through use. It is seldom necessary to grind the end of the B diameter as it does not enter the hole of the work except when the work is oversize. This gauge is necked to provide clearances for the grinding wheel which grinds both end diameters accurately to size.

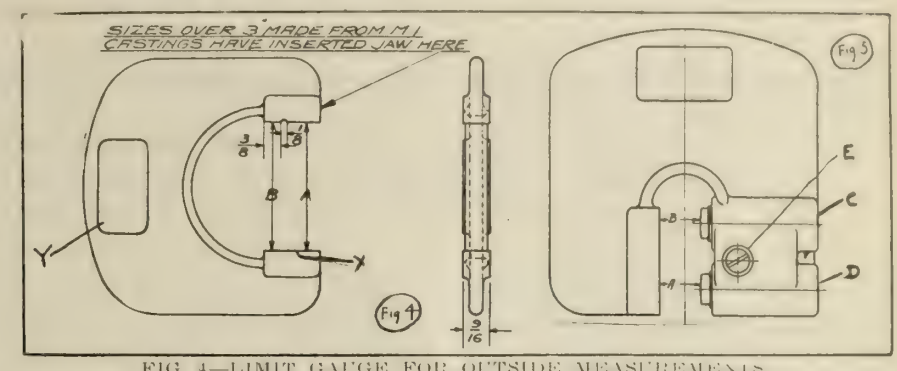


FIG. 4—LIMIT GAUGE FOR OUTSIDE MEASUREMENTS.
FIG. 5—EXTERNAL GAUGE WITH ADJUSTABLE PLUGS.

Other Types.

The upper illustration shows a gauge used for the same purpose except that its ends are drilled and reamed, while plugs are soldered in place for the "Go" and "Not Go" diameters, this eliminates to a large extent the difficulty encountered when hardening a small diameter integral with a large diameter due to breakage, while it facilitates replacement as the plugs can be removed from the handle by heating, when new plugs can be substituted.

In the lower view is shown a gauge which has both the "Go" and "Not Go" diameters at the same end. This gauge is built on the principle that the A diameter will go into a hole, while the B end will not go into it. It of course is used without reversing. This complete gauge drawing is made up with letters in the dimension lines and a chart to be filled in is provided in the lower portion of the sheet. The first column in this chart is for filling in the number of gauges required while under "Go" and "Not Go" are spaces which are filled in with dimensions as required. Under the word "Blank" is filled in the style of gauge required, this being one of the three shown, while the style required number also indicates a stock diameter of blank carried in the stores department for grinding to the size wanted. Under the word "Mark" is placed the designation which must appear on the flatted surface of the gauge.

Figure 2 illustrates two other types of plug gauges, the essential difference between these being that in general they are used for larger sizes of holes. They consist of handle X, upon which are placed bushings Y, held thereto by a screw Z. Type 1 has a bushing having one diameter only. This is used where it is desired and have the plug a ringing fit in the hole, or for any other purpose where a single diameter gauge is sufficient. Type 2 represents a "Go" and "Not Go" gauge having a minimum gauging diameter B, and a maximum gauging diameter C. This has the same general characteristics as one of those shown in Fig. 1.

Still another type of plug gauge is shown in Fig. 3. This consists of a holder A having a long bushing B, which is made with a small or "Go" diameter, and a short bushing C, which is made with a "Not Go" diameter. This type of gauge is very economical on large holes as one handle can be used to accommodate a number of gauging bushings, thus enabling one to build up a suitable gauge at a minimum of expense.

Two types of external gauges are shown in Figs. 4 and 5; the first of these, Fig. 4, is made from a steel forging, or in the case of the larger sizes from a malleable iron casting. These

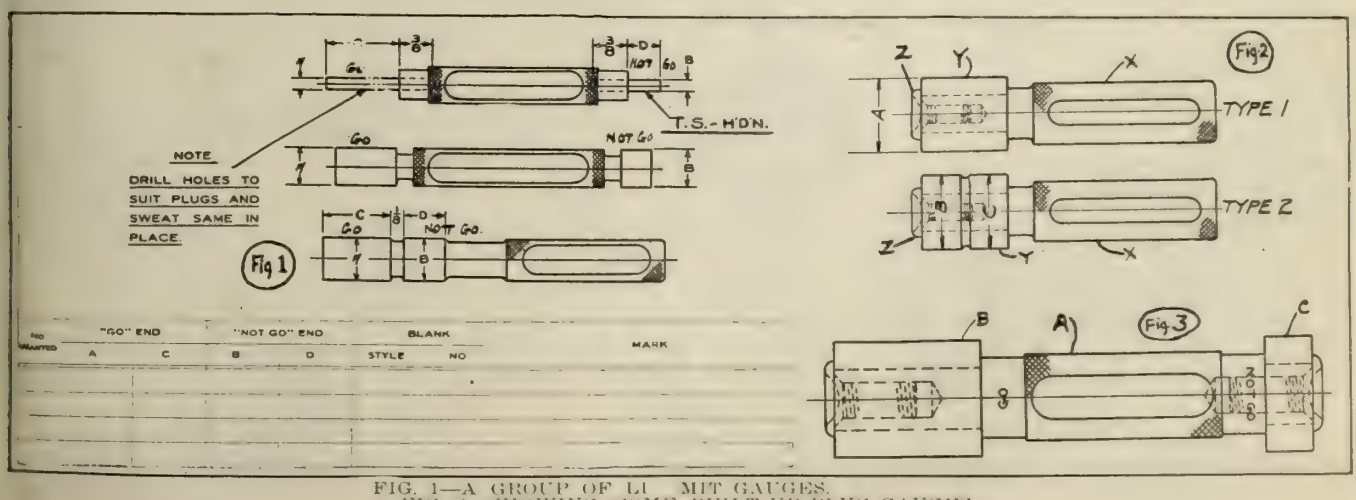


FIG. 1—A GROUP OF LIMIT GAUGES.
FIG. 2—SHOWING SOME BUILT UP PLUG GAUGES.
FIG. 3—DOUBLE END BUILT UP PLUG GAUGE.

gauges have two diameters A and B, these being the "Go" size, A, which will go over a piece of work, and the B size which will "Not Go" over a piece of work. The lower gauging surface X (as will be noticed) is made flat and all of the difference is obtained by grinding a step in the upper gauging surface. It will be noticed in this connection that the length of the "Go" step A is much greater than the length of the "Not Go" step B to allow for wear of the "Go" step. A finished surface Y is provided for marking the gauge.

In Fig. 5 is shown a gauge for the same purpose having buttons inserted in its right hand portion. The work being measured would "Go" through A but would "Not Go" through B. Such gauges are adjusted with a screw behind the plugs at C and D, while a screw E is used for locking the plugs when they have been adjusted to the required dimension. Gauges for this same purpose are often made of flat stock while in the case of the gauge shown in Fig. 4 steel inserts are put in the gauges where indicated if malleable iron castings are used.

Some Essentials of Modern Pyrometer Equipment

Subject is Divided Into Three Distinct Parts—Important Factor is Simplicity of Design—Internal Cold Junction Compensation Details—Cost of Thermocouple Upkeep—and Other Interesting Points.

*By H. G. HALL

IN a pyrometer steel treaters have been asking for an instrument that is accurate, but the tendency seems to be to sacrifice considerable in the other features to obtain accuracy. While it is admitted that accuracy is of prime importance, other features are to be considered. The subject naturally divides itself into three distinct parts: (1) The instruments; (2) the leads and (3) the thermocouples. It has been found that the instrument to give the most satisfactory results should have a resistance of about 250 ohms across binding posts. This is for plant use of course and seems high enough to eliminate the troubles due to changes of external resistance. Careful tests have shown that just as accurate results can be secured with this amount of resistance as is found in the higher resistance meters, thus it is not necessary to sacrifice further ruggedness for the additional ohms resistance.

The indicating instrument should have a very clear and readable scale, instruments supplied with a spotter being advantageous for shop work, particularly when the temperature is to be maintained constant. An instrument void of chamber error certainly is one of the very important features to be remembered in making the selection because of the fact that some meters have a chamber error amounting as much as 40 degrees which makes them useless to the steel treater.

The discussion might be carried further as to whether the instrument should be of the suspension type or of a double or single pivot movement. The fact is, that it is necessary to have an instrument that will stand the ordinary amount of vibration found in a shop. The highest grade of double pivot movement has answered the requirements very well as it seems to be least affected by vibration. Careful tests show that this type of instrument gives the desired degree of accuracy.

The chamber error has been found to be one of the important causes for trouble. This is a very annoying situation because many do not know what is causing the inaccuracy and it is difficult to correct without replacing the meter.

While the recording type instrument is used in some cases as an indicator as well as a recorder, the most important factor is simplicity of design. It must at the same time make clear and readable records. Obviously, a steel treater does not want a recorder that will require constant supplying of repair parts and in this way, take his attention from other work, which involves considerable annoyance and added expense.

It has been found that recorders giving the continuous automatic records are to be preferred to those that give numbers from which the curve can be drawn later. The charts made should be easy of access and easy to file, thus the principal feature in connection with the use of the recording pyrometer should be simplicity of construction. Surely the simplest mechanism, other parts being equal, will require the least care and the least amount of rechecking.

In considering leads or couple extensions one must consider the proper kind of insulation for the wire to meet the plant conditions. In many cases it is necessary to use asbestos-covered wire where rubber-covered wire would not be satisfactory, and vice versa. The couple extension is one of the important features of every pyrometer equipment. A number of steel treaters using pyrometers have installed in their plants what are called "compensated leads" although the term is not commonly understood.

Certainly this term should be defined clearly, thus possibly the term flexible couple extension carries the idea more clearly than compensating leads. The latter seems a misnomer because these leads do not actually compensate. This brings us to the consideration of the error due to the cold junction variation in temperature. On some pyrometer equipments the cold junction is buried in the ground and on others it is put in the hot water or steam jackets; and on still others it is put in regulating boxes controlled by lamps. Recently some steel treaters have put the cold end in a box of a special powder in which the cold end does not vary more than plus and minus 5 to 10 degrees Fahr. While it is true that these methods of installation have been satisfactory under certain conditions, they have not met the universal requirements for eliminating the error due to the cold end. It is very expensive under many conditions to bury a cold end for blasting in rocks or concrete often is required. Water jackets will leak in time and cold end regulating boxes are just an additional part of the equipment to require care. It must be borne in mind

[4]Paper presented by Title at Philadelphia Convention of the A. S. S. T.

*Development work carried out by W. H. Bristol of the Bristol Co., Conn.

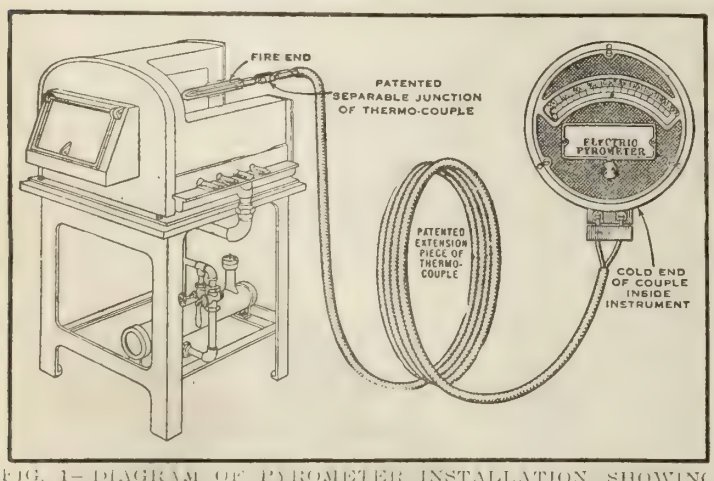


FIG. 1—DIAGRAM OF PYROMETER INSTALLATION, SHOWING THE FIRE END OF THE THERMOCOUPLE INSERTED IN THE FURNACE.

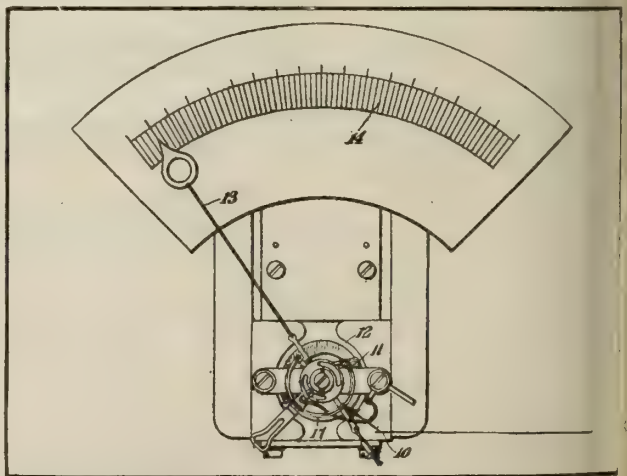


FIG. 2—DETAILS OF CMPENSATOR CONSTRUCTION.

onstantly in using the pyrometer that he electromotive force developed de-ends upon the difference in tempera-ure between the cold junction, which s outside the furnace, and the hot junc-ion, which is in the furnace.

Cold Junction Compensator.

An internal cold junction compen-ator has been developed and tried hich operates automatically and does way with the necessity for burying the old end in the earth and eliminates the se of any other outside means for regu-ting the temperature at the cold end. t is enclosed in the instrument itself, ne end of the internal spiral compen-ator—for such it is called—being at-ached to the pointer while the other nd is securely fastened to the instru-ent. The method of using the compen-ator is illustrated in Fig. 1. It is satis-ctory for use on either base metal or recious metal couples.

Of course, in using this compensator is necessary to run the same kind of aterial that is in the base metal couple the instrument itself. In the case of n installation of an instrument with a ompensator for a manufacturer of ank shafts for automobiles, the tem-erature of the oven was maintained at 0 degrees Fahr, and readings were aken across the entire scale, the read-gs being within ¼ to 1 per cent. Many her companies are using this compen-tor with similar accuracy.

It is also very gratifying to find that is *compensator has worked out so tisfactorily because it is the result many years of experimentation on a itable device for accomplishing this sult. Elimination of the chamber er-r in the instrument and the error due the cold end temperature, overcomes o of the chief objections to the use the thermoelectric pyrometer, and akes it possible to use this instrument r very low ranges of temperature with high degree of accuracy. Accuracy well within 1 per cent. for ranges of temperature is secured over the entire scale where the maximum reading of the scale is only 600 degrees Fahr.

In cases where a previous metal couple is used, the platinum wires are not run to the instrument but substitute patent alloy wire is used that carries the cold junction to the instrument and serves the same purpose for shop use as if the platinum were used for the entire length. The steel treater interested in accurate results from his pyrometer can obtain a great deal of satisfaction in knowing that his cold end errors are entirely eliminated. In other words the equipment is operated as though it had no cold end.

In Fig. 2 the details of construction of the compensator are more clearly shown. The indicating arm 13 is operated by the usual moving coil 11. A small portion of the control spring 12 is shown, but instead of the end of this spring being secured to the abutment, it is attached directly to the end of the spirally curved piece of thermostatic metal 17 and the other end of this thermostatic coil is carried by an adjustable abutment allowing for initial adjustment of the indicating pointer, to make its position on scale agree with that of room temperature.

The temperature variations of the room cause the thermostatic spiral to wind up or unwind, maintaining the correct position of the indicatng arm, regardless of room temperature. When the thermoelectric couple with extension-piece, as illustrated in Fig. 1, is carried into the compensated instrument, no corrections are necessary for the thermocouple cold end temperatures at any point on the scale. The compensator also may be made to serve a double purpose, since by a slight variation of its length it may be made to correct automatically for the temperature coefficient of the wire forming the moving coil of the millivoltmeter.

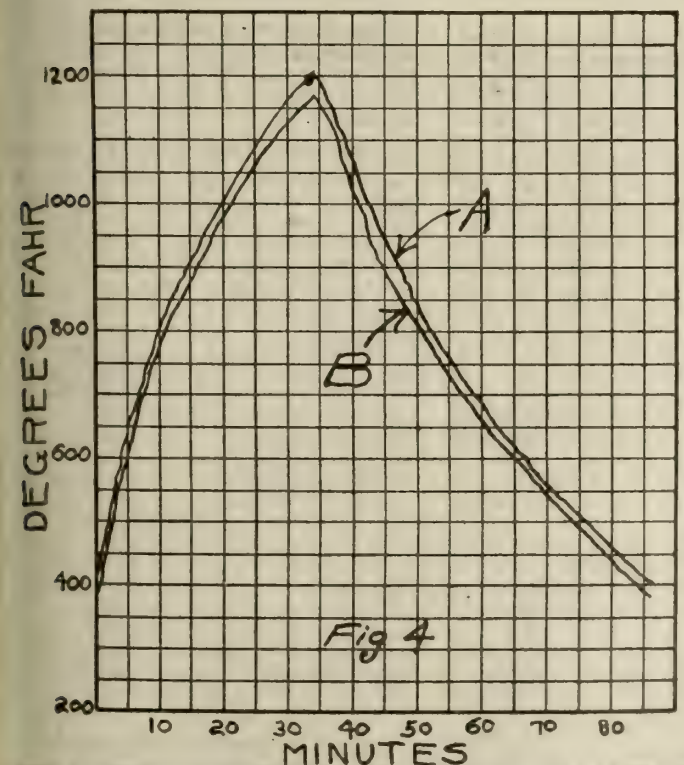
Comparison of Readings.

Fig. 4 shows curves A and B and is a comparison of readings of a laboratory potentiometer and a compensated pyrometer. The platinum couple was used with the potentiometer with the cold junction maintained at 32 degrees Fahr. in the bath. The temperature of cold junction of the pyrometer was maintained constant at 70 degrees Fahr. In Fig. 5 the temperature of the cold junction of the pyrometer was maintained at 130 degrees Fahr. in the oven while the cold junction of the potentiometer was maintained at 32 degrees Fahr. as in the case of Fig. 4. These readings were taken by an automobile manufacturer and illustrate the accuracy of the compensated pyrometer, the difference between the two instruments being practically constant throughout.

It is very important in the use of proper thermocouples that the couples produce the same electromotive force although the wires may be almost burnt off. Of course, in case the thermocouple does not give the same electromotive force, an error will occur in the readings, but with the advances made in manufacture of thermocouple alloys, this source of error has been overcome.

Although shunted thermocouples have been used with some success, the practice of using this idea as universal is not advisable because of the errors which are certain to result. The chief difficulty is that under most conditions the fire end is not always inserted the same distance into the furnace or tempering bath. With the advances made in developing alloy metals it has been found more practical to use base metal couples of selected material. These can be secured easily with a guarantee that readings will be within plus and minus 3 degrees Fahr.

The cost of thermocouple upkeep is, of course, important but this can be reduced very appreciably by making a thorough and careful study of the con-



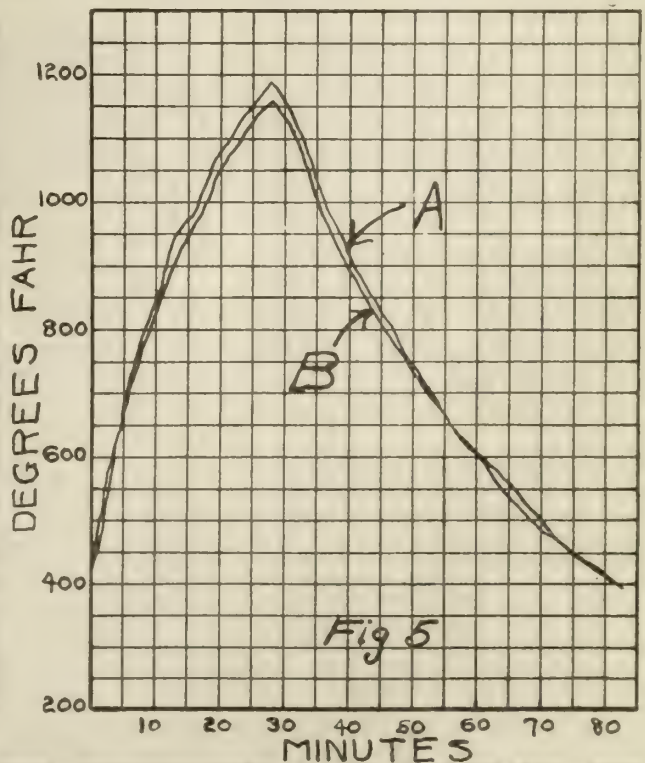


FIG. 4—COMPARISON CURVES OF READINGS OF LABORATORY POTENTIOMETER A, AND COMPENSATED PYRO-METER B. IN THE FIRST CURVE COLD JUNCTION MAINTAINED AT 32 DEGREES FAHR., AND IN SECOND, CURVE MAINTAINED AT 70 DEGREES FAHR. FIG. 5 SAME AS FIG. 4, EXCEPT COLD JUNCTION OF PYRO-METER IS MAINTAINED AT 130 DEGREES FAHR. BOTH FIGS. 4 AND 5 SHOW AN ALMOST CONSTANT DIFFERENCE BETWEEN THE CURVES.

ditions. This includes study of the gases that are emitted from the fuel, as the oxidization of the steel or other articles in the furnace takes place. One prominent automobile manufacturer whose couple expense on about 500 couples constantly in use was about $1.00 per month, by very careful investigation of the conditions and proper protection of the thermocouple reduced this cost to $0.27 a month. In this case, the manufacturer was using precious metal couples.

A manufacturer of roller bearings, who is using the potentiometer system, states that his couple upkeep was $12 per year, which is not excessive for platinum couples. This cost includes only maintenance expense for the couples and not the maintenance on complete pyrometer equipment whereas the case just mentioned of 27c per month includes maintenance on the entire ou fit. In the former instance the upke of the entire equipment is include Here the galvanometer system was use From all the data the author was ab to obtain, it is evident that the upke on the potentiometer systems were f in excess of the maintenance cost on t galvanometer system especially whe potentiometer recorders were in use.

A Recital of Casting Troubles. What is The Remedy

What Is The Remedy For Such Expensive Troubles? Do Others Have Similar Troubles With Machine Shops, or Is The Foundry Turning Out a Low Grade of Work?

By DONALD HAMPSON

OUR shop accomplished manufacturing work of a wide range. The lightest piece we sold weighed three ounces, the heaviest 1,200 lbs. There were a total of nearly a million a year of the former of various shapes and sizes, about three hundred of the latter. All were made in grey iron and most of them had to be machined all over. The small work had been gated and metal patterned in the most approved style. Our large pieces were cast from wood patterns with metal ribs judiciously distributed, and there were about twenty of the patterns, all of the same shape and thickness but of different areas. These were the simplest kind of pieces to mold. All we required was true, clean castings; a difference in size did not bother us if it did not exceed a quarter of an inch. There was not a core in a single one of our castings.

This recital briefly covers our foundry needs. We buy all our castings because we want to devote our attention solely to making and marketing a satisfactory product. I would say that I never have known a line of either small or medium sized work that was so simply and easily molded—and it ran into so much weight at the same time! It was the kind of work a foundryman would dream of. We paid about the market price for similar work but we protested this price nevertheless on the grounds of the losses we sustained from the castings and from the fact that it was steady work the year around.

Most ships' requirements are bunched in one busy season and fall off during the rest of the year, they have patterns with deep "draws" and many cores to set, and their work includes those few-piece jobs and awkward specials on which a foundry loses but says nothing because they have to take them to keep the other work.

Anyone would have thought that foundries would have fought with each other to get such a line of work. They do not. We would have preferred to put our larger work all at a local foundry and our smaller, strictly manufacturing, parts at a foundry equipped for just such a line. But we learned from bitter experience not to depend solely on one source of supply. Then, too, we never struck any foundry that would produce the quantity we needed. And all the while the price of castings would keep going up—first it was on account of sand being high, and then labor and then pig and then coke; we paid all these increases grudgingly because every twenty per cent. raise meant a loss for us, who had competition to meet and could not possibly raise more than five.

We would get our prices all fixed up and would put in an order for ten thousand casts from the G-12 gate, delivery to begin in a week. At the end of a month we would be out of these pieces and would have had no response to our letters. Why is it that foundries are so lax about their correspondence? If I can't do a piece of work or keep a delivery, I say so like a man and do not build up false confidence in a customer's mind. He is at least given a chance to get the work elsewhere. But not your foundry. The first wire after the third letter may bring a small bag of G-12's by express. That's your first response.

Then there's the zig zag casting. We've gotten thousands of castings in a shipment (and had to make them go by a long costly process of filing and grinding because we had no other) that looked as if the moulder had been blind or had closed his eyes and pasted two halves of the casting together in the dark.

What Became of Our Hopes in the Automobile Field.

It was just after the war and we felt free to at last develop an automobile specialty that we had been holding up. We had reached the point where our patterns were completed but to our surprise found that none of our foundries would take any more patterns. That stumped us but we shopped around through a wide radius, finally learning that the malleable iron Co. had the only grey iron foundry in the country that wasn't busy. We soon learned why.

A representative came to see us. We explained our specialty to him and showed him our patterns. Yes, they could make us the finest kind of castings—castings that would sell our product on sight—they would probably cost about 20 cents a pound, but he would quote exact figures on his return to headquarters.

We displayed a few castings made locally, along with the patterns. Mr. Representative proceeded to pick flaws in each. "Now we wouldn't send out any castings like this—that sand flaw there, that sunken spot, that place where the checkerboard isn't perfectly filled out, that sprue that wasn't ground off—why, our inspectors would throw all those out on sight." (Thank heaven, we had found a foundry at last that understood its business). "And your patterns, they need a lot of fixing up. That pin hole, and that, and that, will have to be filled up and that line where the solder shows would leave its mark c the castings and I don't think they a gated level. We can't turn out castin from such poor patterns—our men can do a good day's work unless they ha somethings to work with." (We thoug our patterns were the best metal pa terns we had ever seen).

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A few days later we got the "quot tion." They wanted 22 cents a pou for the castings and they would ha to make a pattern charge of $120 to r make our patterns. We accepted th extortion because all other foundri were full; and we breathlessly await the castings. Anyway, we would sa money through not having to grind a chip and file. They came—four barre with 500 pieces in each. Imagine o chagrin to find them hardly up to t quality of the local jobbing foundry' sprues and gates left on, sand holes a air holes, checker creases entirely fill up, etc., etc. For once we forgot o first grade credit rating and gave ve to our feelings. We had Tony whe the four barrels to our scrap heap a dump them, then we wrote the partic lar Co. in choice terms, telling the where they could get their castings they wished and to go ahead and t to collect.

Why Store Away Broken Patterns?

Another annoying practice is the r turn of broken patterns. You write phone to the foundry to hurry a tho sand three-inch plugs. A week later package arrives with what you thi might be the first three hundred, ju to get you started. Imagine your su prise when the package proves to co tain the plate with parts of several pa terns broken off. You had every reas to think you could complete the ord of a thousand in two weeks and y wrote your customer to that effect aft wiring the foundry to hurry the j through. Instead, the foundry nev replies at all and your first intimati that they "register interest" is the a rival of the broken patterns; instead wiring immediately or repairing the themselves, the foundry disregar hurry requests, and in its own swe time, dumps the stuff flat on your hanc An incident of that kind makes the ha assed executive long to read that typ mistake over an obituary of some fou dryman, "Gone to His Long Roast."

Another Big Foundry Qualifies.

One more example and I rest the ca The steel foundries solicited our larg work of a part that we used two hu

Continued on page 59



WHAT OUR READERS THINK AND DO



MAKING A PUMP ROD.

By J. H. M.

Considerable interest has been taken in the articles written around the manufacture of a pump rod, the original drawing of which appeared in the April 15th issue of Canadian Machinery. On May 26th we published a complete story of how the Jones & Lamson Co., Springfield, Vt., would suggest making such a rod, and in this article we gave a production time of 11 pieces per hour.

Since that time, another reader of Canadian Machinery, who is specially interested in machine tools, wrote Ralph E. Flanders, manager of the Jones & Lamson Co., suggesting that the time given was theoretical rather than practical. The result was that Mr. Flanders, to satisfy both the readers of Canadian Machinery, and himself ordered the piece to be set up on the machine once more to make sure the production figures were correct.

The Result.

The result of the test has been forwarded to our office for inspection, and the rod as forwarded is assuredly a good commercial job. The finish is good and the dimensions accurate. Mr. Flanders gives us some interesting figures regarding the test. He states as follows:—

The pump rod was made in four minutes and 32 seconds, or a production rate of slightly over 13 per hour. The piece sent is one of several made at that rate by three different operators. The turning operation, which is the most spectacular part was accomplished at the rate of 150 ft. per minute surface speed, or 280 r.p.m. The feed was .030 in. per rev. and the tool used was stellite No. 4, as high speed steel would not stand up to this speed.

Mr. Flanders then goes on to state that while the figures he gives are actual production ones, he is inclined to believe that for general estimating a somewhat slower time should be considered. An operator who is attending to business, according to Mr. Flanders, should turn these rods out at from 6½ to 7 minutes each.

SOLVING RIGHT ANGLED TRIANGLES.

By JOHN S. WATTS.

Both in the tool room and in the drawing office, it is often required to determine the length of one side of a right angled triangle, given the lengths of the two other sides, and in practically all cases, these dimensions are given in fractions.

The calculation includes the squaring of the length of the two given sides, and taking out the square root of their sum, as is well known, but the tables of squares and square roots are given only for whole number, and to use them gives us only an approximate answer.

Take for example the solution of the triangle shown in the accompanying figure, we first convert these into decimals, as 11.375 and 6.625, and looking up our table of squares of numbers, we find that it only gives numbers up to four digits, and we have to take the nearest, by taking the squares of 1137 and 663. These are respectively 1,292,769 and 439,569, the decimal point being two places to the left in 11.37 and 6.63, will be four places to the left in the squares, (that is twice as many) and the square are 129.2769 and 43.9569, the sum of which is 173.2338.

To get the square root of this number, we have to look in the column of squares, and find that the nearest square is 1731856, which is the square of 1316. Noting that the decimal point is four places to the left in the square, we place it two points to the left in the number, and find that the square root is 13.16, which will be approximately the length of the unknown side in the triangle.

A much shorter and more accurate method is to convert the mixed numbers into improper fractions, having the same denominator, the numerators then being full numbers, their squares can be exactly determined from the table of squares, and adding together these squares, we have a full number, whose square root can be determined approximately from the table, (exactly in cases where this number is less than the highest number in the table) and this square root is the answer required.

Working out the example taken above by this method we have:

$$= \frac{11\frac{3}{8} \times 6\frac{5}{8}}{8} = \frac{91-53}{8}$$

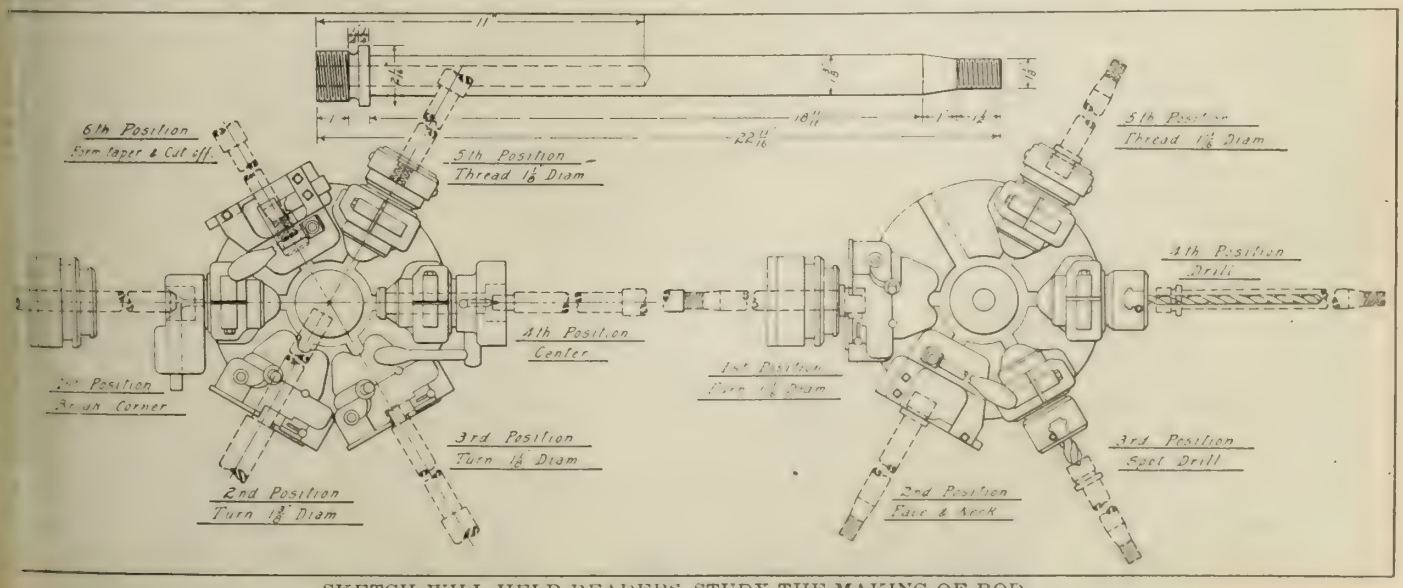
$$= \frac{8281-2809}{8}$$

$$= \frac{11090}{8}$$

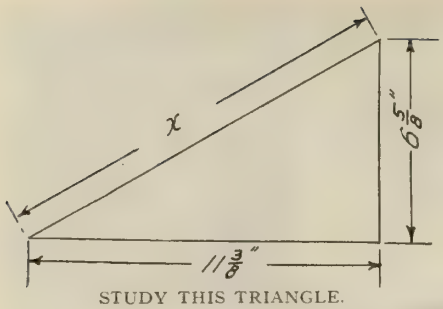
$$= \frac{105.3}{8}$$

= 13.1625 or 13 5/32 to the nearest sixty-fourth.

If accuracy to a thousandth of an inch is needed we must work out the square



SKETCH WILL HELP READERS STUDY THE MAKING OF ROD.



STUDY THIS TRIANGLE.

root of 110.90, which is equal to 13.1636, which shows that the error when worked out to the last method is only one thousandth of an inch. whereas by the first method we would be out three thousandths, due to having to approximate three times in the first method against only once in the last.

The greater accuracy of the second method is due to the fact that we get whole numbers to work with, the squares of which can be got exactly from a table, and the sum of these squares is also an exact whole number, and being a larger number than by the first method, the square root can be approximated from the tables more accurately, and if need be can be calculated with any desired degree of accuracy.

If the same degree of accuracy is to be had, the calculations by the first method will be much more laborious, as the square of the two sides would have to be calculated, because no table is comprehensive enough to take in figures having so many digits. Furthermore the first method takes a longer time, even when only approximate results are desired.

CROSS INDEXING MECHANICAL INFORMATION.

(By F. M.)

A very convenient method of indexing miscellaneous information, such as is usually accumulated from catalogues, notes and magazines, is shown by the accompanying chart. This chart may be used where the information indexed is placed in regular letter files, cabinets or most anywhere that a letter of numbered system is used.

Referring to the chart it will be noticed from the title that this index refers to "File number 1," from January 1918, to a date which is to be filled in when a new index sheet and additional file is developed. Below the title in the diagonal spaces are major titles such as Lathe, Milling, Planing, etc. In the column at the extreme left are a number of sub-titles. Intersecting lines running from both of these titles form spaces in which letter or numbers are placed and reading down from one column along the top and across from a column on the side; by noting the letter in the space which they form where they intersect, it is apparent that the subject matter so designated is filed under that letter or numeral.

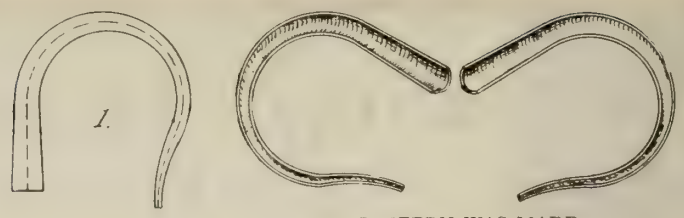
For example, we will presume that it is desired to look up information that has been accumulated under "Advertising Forms." Looking along the top we find the word "Forms," and glancing down the left hand column we find "Advertise," while in the square where the two intersect, is the letter "V." One would therefore look into the file "V" for the information desired; likewise if it was desired to find information in regard to drilling machines, one would look along the top to the word drilling; along the left to the word machines, and at the intersection of the two is the letter K indicating the file to be looked up,

A chart of this nature can be easily compiled to suit individual requirements and may be more or less extensive. It can be pasted on a card and makes a very handy visible index,

FILE No. 1. CROSS INDEX FOR MECHANICAL INFORMATION FROM JAN. 1918 TO ——

SUB TITLES	LATHE	MILLING	PLANING	DRILLING	CALCULATG.	CONSTRN	MANUFRE	FORMS	TOOLS	MEASURG.	EQUIPMENT	CASTINGS	DRAWINGS
GENERAL							A	B					
HEAD		M		M									
CARRIAGE					C								
GEARING					C								
TOOLS									D	E		D	
ATTACHMENT	F		F										
KINKS						G							
NOTES						G							
MACHINES	I	J	K	K					L		L		
ELECTRIC										M			
PRICES	N	N	N	N						N	N		
CHUCKING								P					
BEARING					Q								
PULLEYS						S		R					
ADVERTISE							V					V	

A DETAILED VIEW OF THE CROSS INDEX.



SHOWING HOW THE PATTERN WAS MADE.

IMPROVISED CASTING PATTERN.

By CHAS. E. HALL.

A jewelry manufacturing concern, having secured an order for a bishop's crozier in sterling silver 6 ft. 6in. high, which was to be made according to a specified design, and such articles not being in every-day demand, it was essential that the cost be kept as low as possible, particularly on account of the difficulty of estimating on a first order of this nature.

The crook section was about 18" over all, and a gradual taper from 1" in diameter at the large end, to ⅜" in diameter at the other. A local patternmaker quoted $35.00 for a core box and pattern, a price which the estimate made prohibitive. It was decided to make the pattern in the shop, and the method adopted may help out in other fields.

A tracing was made of the outline of the crook from the drawing, with a center line drawn the entire length, as in Fig I., and primed down on the drawing board. A piece of wire was bent to conform to the center line to obtain the exact length, and a straight tapered wooden pattern turned up, the length of the wire, ⅞" thick at the large, and ¼" at the small end. In other words, less two thicknesses of metal or ⅛". A piece of 2" pipe of suitable length, was used as a moulding box, and the wooden pattern rammed up in sand, and a lead cast taken. This was filed smooth and bent to conform to the shape of the crook, and lightly coated with beeswax. Strips of paper were wrapped round the lead core; shellaced, and allowed to set. There happened to be on hand a few bolts of damaged silk ribbon about ½" wide which came in very handy.

This was then wound on, shellacing each layer, till it was built up to the diameter of the crook. Two or three layers of paper were now added, to allow for filing and polishing, and when perfectly hard, was cut into two halves with a sharp knife—as shown at Fig. 2, and lifted off the lead core, the bees-wax preventing it from sticking. Using these as patterns, the two halves were cast in silver, filed flat on the edges, hard soldered together, and the crook filed up.

By this method the whole job of making the pattern only occupied about three hours, which was a decided saving on a pattern and core box at $35.00.

LARGE CASTING.

One of the largest, if not quite the largest steel ingot mould ever made was recently cast in Great Britain. It is over 15 feet long and its diameter is over 9 feet. This mould, which will be used for the casting of steel, was so huge that it was almost too large to be conveyed on the railway, and great ingenuity was exercised in arranging it for transport. It was carried on a huge steel girder which rested on two 8-wheeled trucks, between which the mould hung. The weight of this record casting was 87½ tons.

Development In Machine Tools Has Been Stimulated

Automobile Industry Has Influenced the Design and Construction of Machine Tools—Motor Demand Has Made Possible Continuous Production—Lubrication the Big Problem.

By F. K. HENDRICKSON.

DURING the years 1910 to 1913 the automobile industry began to exert a great deal of pressure on machine tool manufacture and design, and about this time several concerns found it necessary to make extensive and expensive changes in their systems of production to meet the rapidly increasing demand for cars. To arrive at the best conclusions and in order to secure the most modern installations, they invited many of the best engineers and machine tool manufacturers in the country into conference with them. Each individual piece was considered separately and at times in the presence of two or more representatives from different firms, with the result that highly specialized machines were rapidly developed.

Every mechanic is fully aware of the extremely rigid construction which has been demanded, due to the strains to which machines are subjected. In addition to the extra weight thus entailed, materials of high tensile and torsional capacity have been substituted. Lathe spindles originally of 0.30 to 0.40 per cent. carbon steel are now made of 0.15 to 0.20 steel, being carbonized and hardened to produce glass hard surfaces. The diameters also have been greatly increased. Lathe centers formerly quite small, unhardened and of low-grade tool steel are considerably increased in size and hardened at the point on both head and tail stocks; in fact, centers are now produced commercially having high-speed hardened points, either inserted or welded to the shank.

High Speed Tools.

High-speed cutting tools generally supported in special rigid holders are replacing almost entirely carbon steel lathe and planer tools, twist drills, reamers, milling cutters, taps and dies. Babbitted journals or bearings are rapidly being replaced by the best quality bronze metals, and the tendency is toward the application of ball bearings. Certain types of machines have already been forced to incorporate them on their main spindles and with success, which indicates that the same conditions will ultimately obtain in other machines.

In addition to producing gears of wear-resisting qualities, it has also been necessary to develop their efficiency and to produce much quieter running. To accomplish these conditions, several machines are to-day equipped with helical or herringbone gears to produce smooth action and silent running under high speed and strain. New forms of spur gears are also being developed which are claimed to successfully meet the requirements.

Precision and Specialization.

Grinding machines have been brought to a high state of perfection and produce a truer and finer quality of work in all revolving and sliding parts much more rapidly than ever before. Closer limits and tolerances have been demanded, with the result that the all-round mechanic has been replaced by the present specialized expert, in order to obtain the highest grade of precision in quantity.

Along with the added strength and rigidity of the machines must necessarily be considered their power. Extra large driving pulleys; cones; single, double and triple back gears; and worm and worm gears, all of which have been increased in excess proportion to the actual power required, are now in common use.

It is apparent, however, that the automotive industry has accomplished much in the direction of insisting that the drive shall be either of the geared or silent-chain type to prevent slippage, usually prevalent when machines are belt-driven. The individual motor installation has also come into common use, and at the same time the horsepower of the motor has been increased sufficiently to care for the extreme loads. For example years ago a 14-inch geared-head lathe was equipped with a ¾-horsepower motor, while to-day the machine must be provided with a motor of 2 horsepower at least and preferably 3 horsepower. This proportion may not be general for all classes of machines, but is a fair criterion of the condition at present. One of the essential features demanded in present day machines by the automotive industry is easy manipulation and the convenient location of the operating levers, handwheels and cranks. Speed and feed changing mechanisms must be located within easy reach of the operator and must not cause him any undue exertion or unnecessary delay.

Where there is a sufficient quantity of pieces and the parts lend themselves to magazine or hopper feed these must be included in order to assist in the handling of work. If the parts are heavy or bulky, mechanical or electrical handling devices must be provided in order to secure high production.

Several years ago speed bosses were practically unknown, but with the advent of the automobile era has come this type of functional foreman and with him a demand for readily obtaining in a given machine the proper speed and feed for the work. To meet this demand machine tool manufacturers have in general incorporated mechanical speed-change heads and quick change gear boxes for feed variations in their machines. Motors of the variable speed type are used when mechanical changes are not available.

Use Single Purpose Lathes.

It is interesting, however, to note certain specific conditions which, although contrary to the general demands, have worked out in the most gratifying manner. During 1912 and 1913, in a well-established automobile plant in Detroit, the production of transmission parts was receiving the most careful consideration as to the best method to adopt to materially increase their already heavy production. The concern at that time was using automatic machines of established reputation which had incorporated in them speed and feed changes, and it was finally decided, after several conferences, to adopt a single-purpose lathe having one speed and one feed, properly calculated to obtain a maximum production for each individual piece. Much to the satisfaction of all concerned the production was increased from 25 to 50 per cent. The theory in establishing a single speed and single feed was to eliminate the judgment of the operator and to predetermine the day's output. If this was not obtained the cause was readily detected and almost as readily as it had been remedied.

A very simple but most efficient method for securing quantity production is to use several arbors, some for loading while the others are working. Also, when applicable, a punch press is used for an arbor press, simultaneously loading one arbor and unloading another, this of course being used only where a battery of machines are operating on the same kind of work and call for a number of arbors of the same size, and where a conveyor is used to carry the work from the press to the lathes and return. Air cylinders and quick-action, mechanically operated chucking, or gripping devices are used wherever possible. Magnetic chucks and plates are also used extensively in various operations.

Lubrication Big Problem.

Central lubrication has been given considerable thought and study, for the seriousness of having 25 to 100 separate oil holes spread out promiscuously all over a machine is beginning to be realized. The neglect of any one oil hole invariably causes a hold up of production and may mean the entire dismantling of the machine. Therefore it becomes obvious that to control the lubrication from one point is decidedly advantageous. This is accomplished either by supplying a reservoir having gravity feed, by gear pumps delivering lubrication to the various bearings, by the use of the splash system, or by use of force-feed oilers.

The working forces of automobile factories comprise many who never saw a machine tool prior to their employment, and it is this class of help that has made it necessary to safeguard every moving part of a machine, to prevent them from getting injured. Years ago gears were left exposed and shafts allowed to run in the open, but the machines of to-day must include guards over every part that is in the least dangerous. Projecting shafts must be guarded and where it is impossible to supply guards as part of the machine, rails or nettings must be secured around the machine to prevent any possibility of injury.

The author is with the Reed-Prentice Co., Worcester, Mass., and presented this material before the recent A.S.M.E. meeting at Chicago.

SECOND EDITION.

The first edition of the Skinner Chuck Co. booklet, "Chucks and Their Uses," is entirely exhausted. We understand that a second edition is now ready for distribution. This booklet tells how to use chucks, gives illustrations of certain applications and can be secured for the asking.

Adjusting The Speed To Suit The Conditions

Different Work Must Be Performed at Various Speeds—Description of a Motor That Has a Device Which Makes The Speeds Adjustable —Mechanical Details Are Given.

MANUFACTURING conditions are always changing more or less, and naturally the problem is to approach as closely as possible the maximum output which each machine is capable of producing under ideal conditions. A change in materials, tools, or in the size of the work requires a corresponding change in machine speed. and it is in such circumstances that a variable, or adjustable speed motor is very useful.

The adjustable speed motor which we are about to describe is made by the Reliance Electric and Engineering Co., Cleveland, Ohio. Following are some details of its mechanical construction:

The speed adjustment is obtained by gradually shifting the motor armature endwise, along its axis, away from its normal position under the main field poles, this resulting in a gradual change in speed. In changing the speed the electrical circuits of the motor are not disturbed.

The shifting of motor armature does not alter the position of the driving pinion or pulley, so that the drive can be arranged in the same manner as with any other type of motor. With the armature in any given position, the motor practically becomes a constant speed motor, until the operator changes the position for some specific reason. The motor is said to have exactly the same horsepower capacity and will develop the same overloads with the armature in the high speed position as in the low speed position, or at any point over the entire range. The operation of starting and stopping is entirely separate from changing the speed. Automatic starters can be used if desired.

Mechanical Details.

Referring to the cross-section view, of this A. E. type as it is called, it will be noticed that the armature shaft (29) at the driving end of the motor slides within a revolving sleeve (18) on which a pulley or pinion may be mounted in the usual manner. A keyway is cut in the inner bore of the sleeve and a feather key firmly imbedded in the shaft, slides along this keyway and transmits the power from the shaft to the sleeve. The sleeve does not move laterally as the armature is shifted for speed adjustment, but is held in position by a shoulder at one end and a circular nut (15) at the other, bearing against the two end faces of the bronze bearing bushing (17). These shoulders take up any end thrust imparted to the sleeve by the shifting of the armature.

The back bearing bracket (20) is provided with an oil well, using the ordinary oil ring arrangement (19) for lubrication. The bearing bushing has spiral grooves to allow free and equal distribution of the oil, both to the sleeve and to the thrust shoulders at the end faces. The sleeve is provided with grooved oil throws to prevent the creeping of oil along the sleeve and shaft beyond the limits of the bearing box.

At the commutator end the armature shaft is supported by a combined radial and thrust ball-bearing (4) completely enclosed and protected from dirt. The inner race of this bearing is clamped between a shoulder on the shaft and nut (5) at the end of the armature shaft. The outer race is prevented from moving endwise by cap (6) and a shoulder in thrust bearing box (3). The brush yoke (21) is mounted on the inner end of this box. It is evident that any lateral movement of the sliding thrust bearing box imparts a similar movement to the armature (25) and that the thrust bearing box, brush yoke, brushes ar armature move in unison.

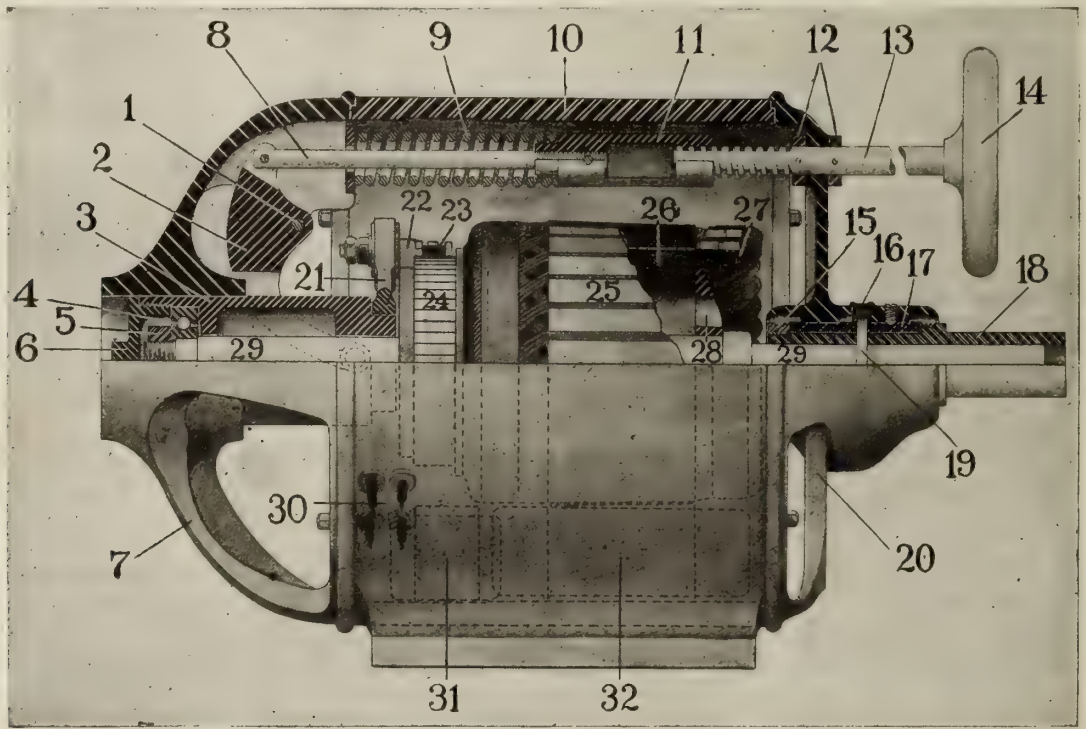
A forked lever (2) pivoted betwe two lugs projecting from the inner fa of one arm of the bearing bracket e gages on each side of the thrust beari box at the end toward the armatu The outer end of this lever is pinn to a short rod (8) which in turn is s curely fastened to one end of the spe adjustment nut (11). A small sha (13) on which a handwheel (14) mounted outside the back beari bracket passes through an arm of t bracket and engages at its thread inner end with the speed adjustme nut. This shaft is prevented from mo ing laterally by collars (12) both insi and outside its bearing in the brack Turning the handwheel, therefore, i parts lateral movement to the spe adjustment nut, and this, in turn, means of the rod and lever, imparts similar movement to the thrust be ing box and armature.

The number of revolutions of t handwheel required to shift the arm ture throughout the entire range speeds depends upon the frame size a speed range. This number will va from 3 turns for a 1:4 speed ratio the small frames to 16 turns for a 1: ratio on the large sizes.

The movement of the armature wi a slight turn of the handwheel is har perceptible, and it is therefore possi to adjust the speed with any degree accuracy desired. With the turning the handwheel there is a smooth, gra ual and continuous change in the spe of the motor throughout its ent range.

A special feature of the design is t use of a helical compression spring (

Continued on page 58



SECTIONAL VIEW THROUGH THE MOTOR.



Modelling Composition for Patterns

FOR some patterns it is desirable to have a material capable of being modelled while in a somewhat plastic state, nd which when hard will stand varnishing and the pres- ure of the sand when the mould is rammed up. Probably ne of the two formulae given will provide suitable material ut it must be warm when moulded, but the patterns when one with can be broken up, softened by steam heat, and ga.n kneaded and used. Take 6 lbs. of good glue, break p into small pieces and cover with water for twelve hours; ien add 4 lbs. rosin and 1 pint raw linseed oil and boil to- e'her with frequent stirrings until the rosin is dissolved.

When ready, continues "Practical Engineer," add to a ffi ient quantity of dry sifted whitening and knead together into a tough dough or putty, and while warm mould nto shape. Or, take 7 lbs. best glue and break into small ieces, then add 3½ pints cold water and boil until the lue is dissolved. At the same time dissolve 3 lbs. white osin in 3 pints raw linseed oil by heating, and then mix nd gently simmer the two solutions together for about half n hour, stirring well from time to time. Add to a sufficient uantity of dry sifted whitening as before and knead into a ough dough for moulding. Either of these compositions hen cold and hard can be rectified in shape by scraping, if e essary, the portion scraped off being, of course, saved, nd when completed the pattern or model can be varnished ith shellac varnish to resist moisture. For flat ornamental ork a composition such as that described works well, proided it is used while plastic, and with a quick worker it ssesses advantages over wax, as it can be moulded from irect. Of course, wax has to be used for some kinds of ork, particularly where there are a lot of fine details, the rocess of preparing patterns in this case being somewhat roublesome, but in such cases probably the cost is repaid y the results obtained.

Profiting by Noon Hour

THE regular method of posting information on the bulletin board is not sufficient for Dayton Engineering aboratories Co. They found that in a short time workers ost interest in this system; that a bulletin board was silent nd uninteresting; so they decided to use a lantern slide rojector as a medium to keep up the interest in efficiency.

Every noon the machine is moved to a different depart- ent, and all sorts of information is thrown on the screen, his including such matters as new construction, new deigns of apparatus, new machines, features of interest in roduction, recreational activities, products in manufacture ith an explanation as to the purposes and uses of those roducts, results and activities of the product out in the eld, athletic activities, and all other points that could posbly be of interest to the employees.

Everything shown has an educational value, yet is kept nteresting. The idea is that every worker who looks at hat slide is getting a more definite idea of what relation is work bears to the rest of the plant's work and he sees he reason for doing better work and producing more—for is own ultimate good. According to the educational diector, the company have found this scheme a decided suc- ess.

Preparing Steel for Painting

THE careful cleaning of steel before repainting has been found to be of as much importance as the painting itself. When steel is new, the rust is in light yellow spots and can be removed with scrapers made from old files turned over at the end and retempered and sharpened. Stiff scrapers and putty knives are also useful at this time. Steel brushes are not of much real value except to clean off dirt and loose mill scale.

Any heavy seed rust which has formed cups down in the steel, continues L. E. Smith in a recent issue of "Factory," should be chipped out with a hammer, and the greatest care should be taken to be sure and get all the rust out of this cup so that the clear steel shows in the bottom. Care should be taken to avoid cutting the steel unnecessarily with the sharp edges of the hammer. The sand blast is a very thorough way of cleaning steel at this time, but it should be followed at once with the first coat of paint, as the surface starts to rust again very soon after the blast is used.

The tools needed for cleaning the work before repainting are about the same as for new work. Light chipping hammers are indispensable for getting off the rust scale. For cleaning the dirt off, a small bunch of broom corn wrapped with twine makes a very handy tool. After the dirt has been loosened with the broomcorn, it can be brushed off easily with the duster. This saves considerable scraping with the putty knife.

Training The Employees

THE Norton Co., Worcester, Mass., have a course for training salesmen that should interest every plant manager. Here is the plan:—

The object of the course is to prepare men for field work, as service men, demonstrators, and salesmen. The course is also open to salesmen employed by agents of the company, or to men employed by customers of the Norton Co. In this way everyone interested gets a chance.

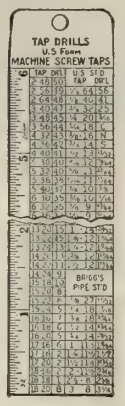
The candidate is first examined, and if he has the proper qualifications the supervisor gives him an outline of the work involved in the training course, explains to him the rules and regulations of the department, gives him a general idea of the necessary safety precautions, and explains what will be expected of him in the line of personal contact. He is then taken through the entire plant by a competent guide, who explains the general manufacturing operations.

In subsequent talks, the applicant is told about the origin of the company, its founder, its growth, its present officers, its products, its administration and general policies, and its standing in the industrial world.

When beginning the course, the applicant is taken to the foreman of the department in which he is to work. The foreman explains the operations for which the department is responsible and the dangers to be guarded against. A competent instructor is then assigned to the student, who progresses from one department to another, the routine being the same.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

There is no winner to report in this panel, as the contest was left out unavoidably in the June 30th issue. However, two prizes are being given for the July 7th contest, so watch for the results next week.

CONTEST FOR JULY 21ST ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

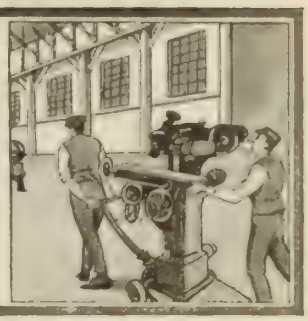
1—What to do if you want speed.
2—Something to brag about.
3—Two widely different bedfellows.
4—A combination said to be ideal for I—
5—Something that will meet with insurance exactions.
6—A case where you're asked to **note** something.
7—Something that lends itself to productive ability.
8—A product said to do all you require and then some.
9—Something small for something big.
10—A product that can be made in 24 hours.
11—A case where breathing counts for something.
12—Something made in 50 styles.

Watch for the list of answers to questions in next week's issue.

Closing Date for This Contest is Aug. 11th



DEVELOPMENTS IN SHOP EQUIPMENT



CYLINDER RE-BORING MILL.

The Hinckley-Myers Co., Chicago, Ill., have marketed a power cylinder reboring mill. The cylinders are automatically set to a perfect center by means of a hardened tapered centering fixture. Adjustable cutters are used, these being easily set to size. This reboring mill will rebore any open head cylinder block the extreme over all height of which does not exceed 20 inches and cylinders from 2 13/16 inches to 5 inches in diameter. The bed of the reboring mill is only a few inches above the floor so that the motor block can be easily placed in position for reboring. The pilot bar is then lowered through the cylinder, centering in a hardened bushing in the base plate of the mill. Thus the pilot bar is held in rigid position by both bottom and top supports.

The cutter head contains three adjustable cutter blades, each blade being set independently and accurately by a micrometer gauge to the exact predetermined oversize desired. This adjustable cutter head is then mounted on the cutter tube or boring bar which is maintained in its proper relation to the cylinder by traveling over the pilot bar. The cutting bar is driven by hardened steel worm and bronze gears and double pitched spur gears. The proper speed of the cutter head is about forty revolutions per minute. The boring bar is fed automatically and is provided with an adjustable stop collar which should be previously set to stop the boring when the cutter head has reached the bottom of the given cylinder.

After cylinder block is once set in position and the boring started, no further attention is required until the operation is completed as it will automatically stop itself. In this way, the operator can be looking after other work, such as rebabbitting bearings, etc., while reboring the accumulation of cylinder blocks. It takes about five minutes to rebore a cylinder.

UNIVERSAL CHUCK.

The Karge-Baker Corporation, Phoenix, N. Y., have placed on the market a chuck for the holding of drills, dies, taps and similar tools. It is provided with a "cushioning" feature which is said to permit a moderate relative rotation between the shank and the socket ends of the chuck. A helical steel spring having a square section transmits the driving torque from one end of the chuck to the other, thus absorbing the shocks.

It is claimed that the use of the chuck largely eliminates the breakage of drills, taps and other tools, and because of the cushioning effect serves to eliminate chatter and to prolong the life of the cutting edges of the tool. It is said to act as a chip breaker when drills are used, and to provide a safety feature for such work as cutting threads to a shoulder with a die head.

The shanks and sockets can be secured in the size and style desired, and different styles are interchangeable on the chuck. The thrust is taken on double ball bearings, and an adjustment is provided to compensate for wear on the friction coil. The chuck is capable of operation in any position, and does not require lubrication. It is made in five sizes to carry drills from ¼ to 4 in. in diameter, taps from ¼ to 7 in., or die heads from ¾ to 9 in. in size.

POWER HACKSAW.

The Frontier Machine Tool Co., Inc., Buffalo, N.Y., have placed on the market a belt driven power hack saw which is provided with an automatic stop and positive clutch in the driving mechanism. The normal speed of the saw is 65 strokes per minute, while the cutting capacity is 5½ x 6 inches. Blades used vary from 8 to 14 inches in length.

NEW AUTOMATIC.

The New Britain Machine Co., New Britain, Conn., have developed a ⅝ in. by 3¾ in. six-spindle automatic screw machine which is similar in construction to the machines previously manufactured by this company. The machine carries six end-working and four side-working tools. The capacity of the chuck is ⅝ inch for round stock, 0.443 inch for square stock, and 0.542 inch for hexagon stock. The length of feed is 3¾ inches, and the length that can be milled is 3 inches.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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A. R.. KENNEDY, Managing Editor
J. H. MOORE, Technical Editor
T. H. FENNER, Associate Editor
J. H. RODGERS, Montreal Editor



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Noiseless Gun of New Design.

In another portion of the present issue appears a detailed description of a demonstrative test on a newly invented noiseless gun. According to the story, the benefits derived from this invention will not only revolutionize war methods of gunnery, but what is more important, will simplify the process of rivetting ships, buildings, in fact any style of steel construction.

In appearance the metal gun looks like a large syringe, and in one of the tests a sharp nosed bullet, three inches long and about one-half inch diameter was driven through a steel plate ¾' in. thick. To accomplish this feat, only one-third the amount of gunpowder necessary to discharge a small rifle was used. No smoke attended the experiment and the only audible sound was that caused by the impact of the slug as it entered the plate. According to the inventor the bullet travels at a velocity of a mile a second, with a charge of only twenty grains of powder behind it.

To prove its peace time possibilities, tests were made to show its uses in steel construction. Bolts were placed in a tempered steel plate, then nuts were fastened to these bolts efficiently. The inventor claims that in rivetting, the flattening of the heads can be achieved with a single motion. Blasting operations will lend itself to this new invention, and a diver at the bottom of the Hudson River at a depth of thirty-six feet has used the device for rivetting plates. In a later experiment it required a pressure of eight tons to force the rivets out once they had been driven.

The value of such a device to the engineering trade should be world-wide. It is to be hoped that the claims extended are not mere flashes in the pan, but as the demonstration was performed before a company of distinguished engineers we can reasonably expect that the various statements made are authentic.

In warfare, the uses of this gun have still to be proven. Apart from the distance which such a gun will carry a projectile, it is questionable if accuracy at great distances can be secured. There are so many factors which enter into the problem that the distance capacity is not the only consideration. Even during the bombardment of Paris, during the past war, the Germans could only hope to hit the city of Paris, not aim at any particular object. The industrial advantages of such a noiseless gun, however, offset any criticism which one might offer as far as war time use is concerned.

It Pays to be Sure

THE ease with which people continue to be roped into new ventures is amazing. For example; on May 24th, upon application made to Judge Lewis at Mineola. L. I., by William H. Doolittle of Woodmere, Louis Enricht, of Farmingdale, was arrested, but later released on $1,000.00 bail. This action followed a summons and complaint made out by Doolittle who said he had paid Enricht $1.000 for 100 shares of capital stock in the Enricht Peat Gasoline Corporation.

Doolittle avers that as far back as Nov. 18, 1920, Enricht represented to him that he had organized a Corporation known as the Enricht Peat Gasoline Corporation, of which Enricht was president. Enricht, according to Doolittle, claimed he was the inventor of a process and apparatus capable of producing gasoline for ordinary commercial usage from peat such as is found in and around the village of Farmingdale and various other parts of Long Island.

This isn't the first time Enricht has come into prominence, for several years ago he announced that he could produce gasoline for 2 cents a gallon by the introduction of a green ingredient. It is said that he had leading manufacturers of cars at his place, these including Henry Ford, but up to date nothing has developed in the green gas proposition.

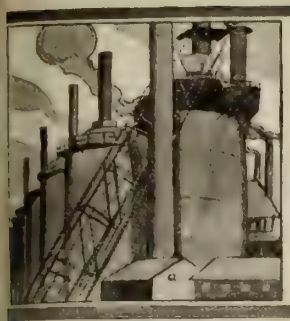
Why didn't these manufacturers take hold of the green gas idea? Simply because their knowledge told them the scheme wasn't feasible. Two cent gasoline would be a boon to the country in general, but like the peat scheme, the idea is still a theory.

When investing in any new venture it pays to make sure the idea is practical, not merely a dream of the inventor. Inventors generally see their idea in its very best form. To them obstacles do not exist. Listen to their claims by all means, then use your mechanical knowledge in arriving at your OWN decision. Should you still be undecided, consult some authority on the subject. Better lose a little money on good advice, than a large amount on a foolish venture.

A Move in the Right Direction.

The representatives of the building trades in Toronto made a wise move the other day when they passed a resolution in favor of accepting an all around wage reduction of 10 cents per hour. After a spirited controversy they decided to take this resolution to their respective unions, and it is to be hoped that the various bodies interested will follow up the good work, voting favorably on the resolution.

There is no question but that the cost of living has come down sufficiently for the building trades to accept such a small reduction. If building activities are to be stimulated such a move is imperative, but reductions should not be confined to wages alone. Materials in general should sag accordingly, and in some cases they have already dropped. Once let the building trades get down to a good solid foundation, and building will once more boom, giving employment to many who are at present in pretty poor circumstances. If the present motion goes through the reduction will become effective July 25th. For the good of Canada, let the leaders of the various unions see to it that no obstacle is placed in the way.



MARKET DEVELOPMENTS



Can't Get Any Worse—So Must Get Better!

That Seems To Be The Feeling In Some Of The Steel Centres—Lower Prices Not Likely To Bring More Business Into the Market under Present Conditions.

PITTSBURGH seems inclined to the belief that the turn in the steel situation must come very quickly, and that it must be for the better simply because things cannot get any worse. This may be a negative way of reasoning the matter out, but there is some slight evidence brought to bear on the point too. For instance some of the mills report a little better inquiry from sources that should take on quite a tonnage once they come into the market definitely.

The Canadian trade is inclined to argue that the prices of steel will make very little difference in the present market, as the business that is coming is almost certain to be placed regardless of price. One dealer quotes a $400,000 school contract placed a few days ago, showing that the steel in the place will run only $7,000. His conclusion is that prices of other lines must come down in order to loosen up building.

The machine tool market is doing little business, and the chances are that most of it is coming from the woodworking concerns, as they are doing more buying than the metal working industries.

Scrap metal markets continue inactive at nearly all points, and prices are not standard, being simply a matter of arrangement and bargaining between buyer and seller.

WILL OPERATIONS CONTINUE AT EXTREMELY LOW FIGURES

PITTSBURGH, July 21.—It is easy to guess wrong, but a perfectly rational guess is that the turn in the steel situation has come. There is no actual improvement to speak of, though some mills report a wider distribution of inquiry and a somewhat larger total volume of inquiry, while others report practically no inquiry. The chief point in the argument that the turn has come is that the steel situation could not grow any worse. If it could grow any worse it would have done so already, since it has been trying to do its worst for several weeks. There was not only the most complete absence of requirements that could be conceived, but also the strongest disposition on the part of those who did need material to postpone purchases because they did not have confidence in prices, which had the semblance of being maintained at arbitrary levels. Now that appearance has largely disappeared, for there is a strongly competitive market. The buyer may not be quoted as low a price as he would like to receive, but he can see that there is competition for his business. The common asking prices are those formally announced earlier in the month, but these prices are subject to concessions. Some mills will quote the full prices, but they will not do this, as usually they have done, on account of a feeling that they have a duty to maintain the market. They will adhere to the asking prices, if they do so, simply because they do not want to accept less, and that will make a decidedly different impression upon the buyer.

Mill Operations.

It is impossible to estimate with great closeness the rate of steel production, but there is no ground for estimating the rate at higher than 20 per cent. at the outside. One observer sets the rate at 15 per cent. The last report as to the Steel Corporation showed it at a 25 per cent. rate, at the end of June, and a rate a trifle below this was probably reached in the first few days of July. The independents are not operating at as much as 15 per cent., and possibly at not as much as 10 per cent. The balance of probability is that the rate for the whole steel industry is at about half way between 15 and 20 per cent. There is no evidence, however, that the rate has decreased any in the past week or ten days, and there is therefore basis for believing that the low point has already been reached. This means perforce that the next change in the operating rate will be an increase. It is the easiest thing for steel production to increase, and very difficult for it to decrease farther. For illustration, one of the largest of the independent steel plants has not made a ton of steel for three weeks.

Classes of Buying.

Buyers of steel may be divided into four general classes, jobbers, manufacturing consumers, railroads and builders. In the past few weeks there has been a little buying, a very little, by each of the four classes, the railroads making the lightest showing of all. There has been some speculation as to which line would first show improvement when any improvement at all should come. Some mills now pick out building as the line which shows the most marked improvement now. This would be contrary to a theory entertained in many quarters, that the demand for steel as a whole has been subnormal, below the actual consumption, so that the first increase in buying would come from those who should run out of steel. Jobbers and manufacturing consumers are always selling something and have been in process of liquidating stocks, while the railroads even if indisposed to buy must take something from time to time as they are still operating. Railroad traffic is only a few per cent. below the rate in the best year before the war. Builders, on the other hand, could wait an indefinite period. Nevertheless, there is the experience of some steel interests that the plainest improvement in demand now is in the line of construction work. This might be due to the widespread unemployment. It is said that wages in the building trades have not been liquidated or adjusted, but it is also re-

marked that the building trades unions have their scales but the scales are doing them no good. Work is being done by nonunion labor, or by workmen who have union cards tucked away at home and are working for what they can get and as hard as they can, hoping the "business agent" (who was called "walking delegate" until he took the automobile) won't see him.

Prices.

There is a regularly competitive market in steel products in general. In an occasional product there may be no regular competition, but the rule is competition. Some mills may not be competing in price, but enough ore to make a decidedly competitive market. The price may not entirely suit the buyer's preconceived ideas, but at any rate he can see that his business is being sought after on a price basis.

In general, though there may be exceptions, the actual market in a given commodity is some concession, more or less according to the attractiveness of the order, from the regular or nominal asking prices, which are: Billets, $33; slabs, $34; sheet bars, $35; rods, $42; bars, 1.90c; shapes 2c; plates, 2c; blue annealed sheets, 2.65c; black sheets, 3.50c; galvanized sheets, 4.50c; tin plate, $5.75; hoops, 2.60c; wire, 2.50c; nails, $2.75; painted barb wire, 2.90c; galvanized barb wire, 3.40c; cold rolled strips, 4.25c; cold finished steel bars, 2.80c.

Plates show the widest and most general divergence from the asking price unless that honor should be given to galvanized sheets. An ordinary order could probably be placed at 1.90c, Pittsburgh, for delivery nearby. In the east and west there is a wholesale ignoring of the Pittsburgh basing, prices f.o.b. Chicago or Eastern Pennsylvania mills being little if at all above prices f.o.b. Pittsburgh mills. On Pittsburgh basing, a price of 2c, Pittsburgh, would mean 2.35c, Philadelphia, and 2.38c, Chicago, but an order sufficiently attractive to bring out a price of 1.90c, Pittsburgh, for delivery in this district, would bring out prices much below 2.28c, Chicago, or 2.25c, Philadelphia.

Pig Iron.

The local pig iron market has worked off another 50 cents a ton. prices at valley furnaces now being: Bessemer, $21; basic, $19.50; foundry, $20.50, with $1.96 freight to Pittsburgh. In the case of basic there are offerings for Pittsburgh delivery by producers having much less than the valley freight at 50 cents or more below the valley equivalent, that is, $19.50 valley would be $21.46 delivered Pittsburgh if one bought valley iron, but one can get iron elsewhere at less than $21.46 delivered Pittsburgh, perhaps at about $20.50.

Connellsville furnace coke for spot shipment is weak at $3. Foundry is quotable at $4 to $4.50 according to brand and is selling very slowly, particularly brands held at above $4. The Wickwire-Spencer Steel Company, Buffalo, has inquired for 15,000 tons each August and September of Connellsville furnace coke, having in mind to start a blast furnace if the operating cost can be gotten down far enough.

POINTS IN WEEK'S MARKETING NOTES

According to reports the production of steel tube is lower than it has been for many years. There is little demand for heavy lap weld material. Building stagnation is holding back the buying of standard merchant material.

Coke shows slight signs of improvement, and raw coal output is beginning to gain. There is less difficulty in finding consumers for Connellsville coal than there is in locating buyers of coke.

The steel and scrap iron market in Chicago is very dull. The humdrum routine of trading continues, this being chiefly confined to dealers. There is very little consumer buying, this being confined to the purchasing of immediate needs.

The old metal market in New York presents no changes. The market is quiet with few enquiries. Scrap copper is the only metal stirring, and this movement is nothing to boast of. Zinc scraps are the weakest of all.

The pig iron market at Pittsburgh remains quiet. There seems to be a slight buying movement but nothing of real importance. A few enquiries for Bessemer are being received, and quotations remain around $21.50 to $22.00 valley. The volume of business, however, is no real test of the market.

Plate business in Philadelphia is better than usual, although other markets report no noticeable improvement. Railroad repair work is creating some business, otherwise nothing of importance can be recorded.

The recent price reduction on bars seems to have had a good effect as enquiries have been quite a bit better. Many of these enquiries have led to actual orders. It is expected that as time goes on this branch of the industry will improve considerably, but as dealers state: "One cannot expect any sensational improvement immediately."

In practically all markets, scrap is reported as very dull. One dealer says that industries as a unit are out of the market so far as purchasing is concerned, and that dealers are confining their operations to picking up bargains for storing or covering short contracts. Prices still seem to point downwards.

LOWER PRICE OF NO USE JUST NO

Dealers Hold That Business Cannot Brought Into the Market in This Way.

TORONTO.—The markets for ir steel and machine tools have be regular hot weather affairs during t week. There is very little business ing done, although one finds here a there dealers who claim that they h very hopeful-looking inquiries, but t have not booked anything very subst tial in the way of real business fr these prospects yet.

There is very little talk of lo prices in any of the lines, for the v good reason that the dealers seemed clined to the view that lower pri would not stir up any more business.

Machine tool builders for the m part are not busy, some of the pla being down in several departments. C adian representatives of United Sta firms also report that word they rece from their principals tells of quiet ti in the building of tools. The few m chines that are going through have bear the overhead, which in most ca is still high, and will likely stay up, for this reason it is hard for prices to brought down in the face of these pr pects.

Wood-working Better.

Firms handling both metal and wo working machines claim that the f mer is bringing the greater amount their business for the present, altho orders are coming through in s quarters for the metal working tools.

Two firms this week mentioned fact that with them collections w showing some improvement for the f time in several months. One of places in particular had a number of counts that had for some time cau difficulty.

The Steel Market.

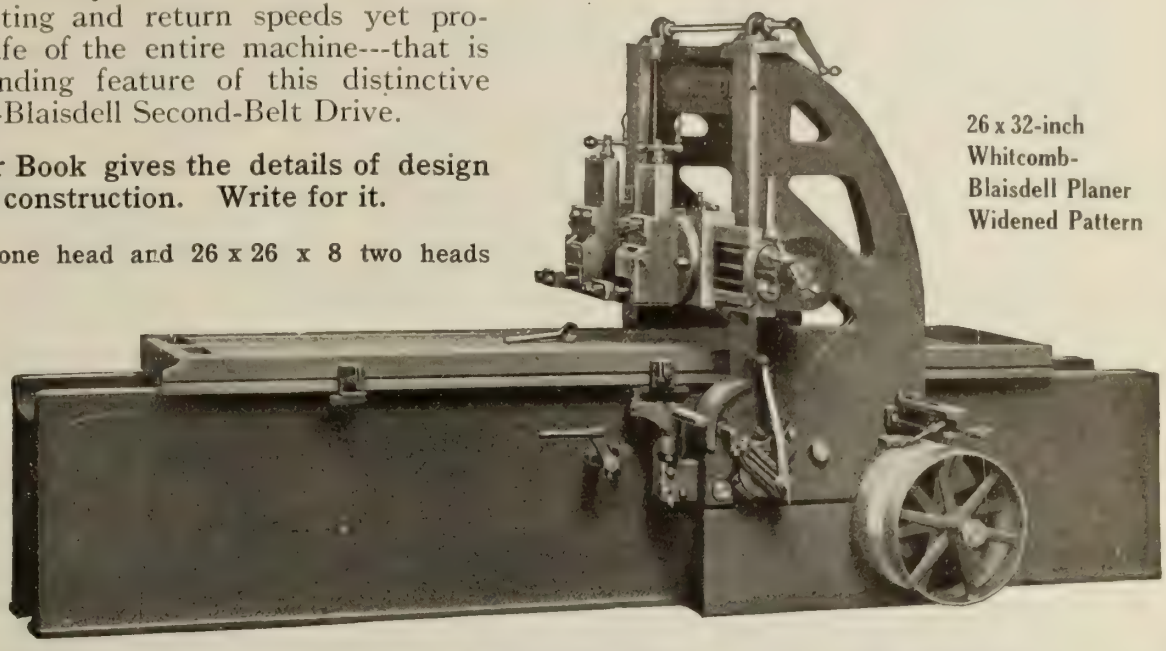
"There is too much being said ab the prices of steel being likely to dro claimed one steel dealer. "We hea all the time, and the statement is of made to us that building is not be proceeded with because the price steel is too high. I don't believe tha the price of steel were cut in two to it would sell another hundred tons. H are some of the figures that show t steel is not a very big item in m

The Planer with the Second-Belt Drive

A smooth, easy reverse --- which permits higher cutting and return speeds yet prolongs the life of the entire machine---that is the outstanding feature of this distinctive Whitcomb-Blaisdell Second-Belt Drive.

Our Planer Book gives the details of design and construction. Write for it.

24 x 24 x 6 one head and 26 x 26 x 8 two heads in stock.



26 x 32-inch Whitcomb-Blaisdell Planer Widened Pattern

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Heavy Duty Draw Cut Shapers, Special Heavy Duty Draw Cut R.R. Shapers, Special Locomotive Cylinder Planers, Traveling Head Planers, Special Roll Wobble Planers, Portable Planers, Stationary and Portable Keyway Cutters, Finished Machine Keys. See our full page advertisement in the first issue each month of "Canadian Machinery."

Pages 60-61 Are for You

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TRADE K–T MARK

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25 per cent.; a different method of molding them might double your production at no increase in molding cost. We can advise you and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us. Ask us.

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

buildings. In one school building that costs $400,000 the steel is worth $7,000, and in another job of $235,000, the steel is worth $10,000. There are a whole lot of other things that must take a drop too. As far as prices go, we cannot see where any good purpose would be served by cutting into them now. The business that is coming into the market is all for quick shipment, and there is very little being bought for future use. One might say very truly that the orders that are coming are placed regardless of cost because the steel has to be secured, and we might as well get three dollars more than three dollars less. When buyers show a tendency to take hold and buy more heavily there may be something done about prices, but not before."

Another office reports that they are getting from four to five hundred tons ordered per week, all for immediate shipment. The buying of this seems to be very general, and it can hardly be said that there seems to be a preference for any particular class.

Small Tools Are Slow.

Little business is being done in small tools. Prices are not holding any too firm in several places. Some of the dealers claim that buyers are getting supplies at figures which they cannot meet and make a living profit." I know of plants that used to carry a stock that would start a man in business, but today they have not enough in their place to keep the shop going. This is possible because operations are being carried on at a low ebb. Some day these shops are going to be busy again, and there is bound to be some good business handed out."

The Scrap Metal Market.

"Things are just the same in the scrap metal markets as they were two weeks ago or two months ago." That is the way the situation was described this week. This dealer added that there was only a small amount of business being done. Contracts are not being made as neither dealers or buyers feel any certainty of present values. The figures involved in sales represent in most cases less than the intrinsic value of the metal but that does not cause buying for the purpose of piling against future requirements.

Scrap Metal Markets

St. Louis reports that there is absolutely no change for the better. As they say, "Industries as a unit are out of the market so far as purchasing is concerned, and dealers are confining their operations to picking up bargains for storing or covering short contracts."

As far as can be noted the price tendency is still downward. From reports it would appear that less agricultural scrap has been collected this year than in more than a decade. Low quotations and high freight rates have practically squashed the scrap business.

In Pittsburgh the market is of the hand to mouth variety. In New York the prices have again dropped a little. On some materials, such as borings, turnings, etc., the dealers are actually offering less than the freight charges to point of consumption. Naturally, very little business is being done.

In Buffalo, it is said that the mills now in operation are so well supplied, that little buying is looked for. Cincinnati and Chicago both report a dull market; in fact the scrap market can be likened to the very hot man who weakly gasped, "I'm almost dead."

Pig Iron Markets

In Philadelphia the pig iron market is rather weak. Following the break of last week, the recovery has not been what was hoped for. Buyers are few and far between, and no immediate recovery is expected.

Chicago reports a slight increase in orders, but none of these are of large tonnage. New York and Cleveland speak once more of declining prices with a soft market and the same light buying which has existed for months. A better feeling seems to exist on the latter market and some producers who believe that the lowest possible point has been reached look for an early improvement.

Pittsburgh market is still light. On the surface there is an indication of a buying movement but not of any great proportions. A few enquiries for Bessemer are being received, but not enough to count.

In Boston and Cincinnati prices are again lower. Practically all orders coming into the market are accompanied by requests for shipment at once. This proves of course that purchasers are buying for immediate needs only.

TRADE GOSSIP

Stainless steel spoons and forks are now a commercial possibility. This is the result of over a year of experiment, and the finish in each case is said to be excellent, the varnishing being done by machinery.

It is claimed that there is no risk of stain or tarnish, and that both spoons and forks will retain their polish so long as no unnecessary cleaning materials are used. Like the stainless steel table knives, only ordinary washing and wiping are necessary.

In order to stimulate the machinery and machine tool manufacturing industry, the Japanese government is preparing plans to hold a machinery and tool exhibition at Osaka, Japan, some time in October.

Before the war the manufacture of tools and machinery in Japan was very light, but during the war the industry grew considerably. Since 1919 the industry has been on somewhat of a decline, and it is this condition that is spurring the Japanese government on to the decision to hold the exhibition.

They are said to realize that a powerful incentive is needed to prevent the collapse of the new found industry. The exhibition will be under the direction of the department of agriculture and commerce, with the cooperation of the army, navy and census bureau, and will include machine tools, small tools, motors, materials used in the manufacture of tools and grinding machines, etc. According to present plans, prizes will be offered for models and designs.

Mr. W. McL. Clarke, Canadian Trade Commissioner in Milan, writes that following on representations made, the recent concession to the United Kingdom by the Italian Government, under which it is no longer necessary to obtain a license for the importation of motor cars from that country into Italy, has been extended to Canada, and restrictions regarding the importation of Canadian motor cars have been withdrawn.

Extensive improvement plans are going to be made by the Jamaican Government to the harbour at Kingston. The cost will be in the neighborhood of $5,000,000, and it is hoped that these improvements will attract the ships passing through the Panama Canal. Vessels from New Zealand, Australia, Tasmania, and the ships of the Canadian Covernment Mercantile Marine coming to Jamaica have been exempted from tonnage and lighthouse dues from 1923 to 1923, inclusive.

The Town Council of Kingsville, Ont. intends making extensions and improvements to their water works. It is expected that the changes will cost in the neighborhood of $15,000.

Plans for several steel highway bridges for Edmonton, Alta., and locality, are made, and tenders on these will be received until July 30th, by J. I. Robertson, the Deputy Minister Dept. of Public Works, Provincial Govt.

The London and Port Stanley Railway Board are planning the construction of three railway sidings, which will cost around $20,000.

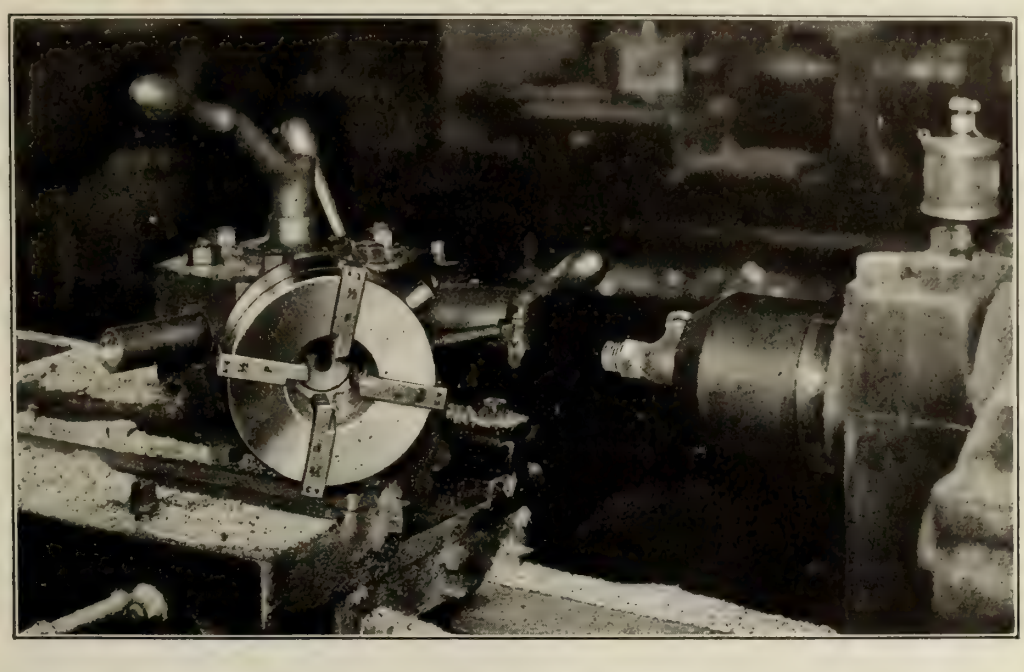
George Hibbert, 195 Jarvis St., Toronto, intends building a garage which will cost approximately $13,000.

An addition to a hotel for the Northern Hotels Co., Toronto, is being planned. It is expected that the work will cost about $700,000.

GEO MET RIC

Right on the Lead

A Busy Corner
Of A Notably Successful Shop



The Geometric Die Head illustrated has just cut the ½ in. pipe thread on the bibb shown. The equipment of this shop consists of many standard and special Geometric Tools.

These people express themselves as very strong for the Geometric line, and are always glad to recommend the use of these Tools. They have themselves used Geometrics for a great many years.

If you can find a user of Geometric Screw Cutting Tools who is not satisfied with them, you will do us a great favor by telling us who he is and where we can find him.

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Canadian Agents:

Williams & Wilson, Ltd., Montreal

The A. R. Williams Machinery Co., Ltd., Toronto, St John, N. B., Halifax, N. S.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



NOISELESS GUN FOR RIVETING STEEL

New Invention Which Has Both War and Peace Time Possibilities. Inventor Uses Charge of Gunpowder for Blow. Demonstrations Given Before Company of Engineers.

A new noiseless gun, with both war and industrial possibilities, has been invented and demonstrated by Dr. Miller Reese Hutchinson. In his laboratory in the Woolworth tower in New York, he demonstrated before a company of distinguished engineers the gun's possibilities.

Dr. Hutchinson, in the presence of many distinguished engineers, using a metal gun device no longer than his arm and looking like a big syringe, drove through a steel plate three-quarters of an inch thick a sharp nosed bullet three inches long and about one-half inch in diameter. In doing this, he said, the quantity of gunpowder used was only one-third the amount burned in discharging a small rifle. There was no smoke attending the experiment and the only audible sound was that caused by the impact of the slug as it penetrated the plate. The bullet, the inventor said, travels at the velocity of a mile a second with a charge of only twenty grains of powder behind it.

Penetration Regulated.

Dr. Hutchinson, using his right arm only held the gun of syringelike appearance directly against the steel plate, which was set across an ordinary wooden box filled with what appeared to be sawdust. The release of this almost incredible power and velocity seemingly was effected by a slight downward push such as might be used in emptying a large metallic syringe and it was attended apparently by no recoil such as would be felt from an ordinary gun. For wartime use enlarged guns of this type, Dr. Hutchinson said, could be made to throw five ton gas shells for miles.

The degree of penetration may be regulated by the size of the charge and the penetration of the slug may be stopped at the will of the operator. The inventor shot through the plate rows of bulletlike slugs the bottom half of which had been threaded like a screw. He caused the missiles to stop exactly where the threaded portion of the slug —or rivet—impinged upon the lower surface of the plate. Then, to demonstrate the utility of the device in steel construction, he speedily adjusted screw nuts to the dozen or more bolts he had shoved through the tempered steel in perfect alignment. He then tightened up the nuts.

Dr. Hutchinson said in steel construction, the flattening down of the rivet heads would be achieved with the single motion that drives the rivet through the steel plate—that is, by the simple discharge of what in its application to war will be a new weapon, soundless, smokeless, and of tremendous penetrative power. The device also, he said, will be of vast value in blasting operations.

"As a matter of fact," he claims, "this principle, which is a new one in ballistics, discovered by Robert Temple of England, was primarily developed under the stress of the war. Its application to the peace industries is what interests us principally now, and it is not difficult for you to see how this little device may eliminate the nerve racking din attending the hammering of the pneumatic rivetting machines now used on all steel construction, besides vastly simplifying the process of rivetting plates with great economy of time and effort.

"This device can be used under water I had a diver take it down to the bottom of the Hudson River and there, at a depth of thirty-six feet, it drove its rivets perfectly and they were so tightly inserted through the three-quarter inch plate that it required a pressure of eight tons to force them out once they had been driven. This suggests great utility in the speedy repair of shattered vessels."

IDEAS WANTED.

We are particularly desirous of obtaining for this section of our journal, short instructive ideas. These can cover any phase of machine shop practice and should be illustrated if possible by a sketch of the idea being described.

If you are unable to make a neat sketch, do not let that stop you. Draw the idea as best you can, send it in to us and we will finish it up for you. For all accepted material we pay a good rate, so that not only do you help some one else by passing along the idea, but you benefit yourself as well.

This section should be a regular exchange of ideas. Surely Canadian mechanics have many schemes that have saved them both time and money. Send them to the Editor of Canadian Machinery, 143 University Ave., Toronto, Canada. Don't be a once in a while contributor. Become a regular. You'll find it pays.

STEEL INDUSTRY NOT VERY ACTIVE

According to a report issued by the American Iron and Steel Institute, the production of steel ingots in June by 30 companies, which in 1920 produced 84.20% of the total output, was 1,003,406 tons made up of 808,286 tons of open-hearth, 193,644 tons of Bessemer 1,476 tons of all other steel. Upon this basis, all of the steel companies produced approximately 1,100,000 tons of ingots last month, against 1,360,000 tons in May and 1,297,805 tons in April. The U. S. Steel Corporation which operated at an average of 32% in June produced about 600,000 tons of the total and independent companies, whose operations averaged about 18% of capacity produced approximately 500,000 tons. The industry as a whole operated throughout the month at an average rate of 24.13% of capacity.

During the second quarter of the year, the 30 steel companies reporting to the American Iron & Steel Institute produced 3,479,808 tons of ingots against an output during the first quarter of 4,911,736 tons. The total output for the first six months therefore was 8,391,544 tons. All of the steel companies in the second quarter of the year produced 3,757,885 tons, against an output of 5,870,000 tons during the first quarter. The total output of all companies during the first six months

SKF BALL BEARINGS

How to save power by reducing friction
—in transmission
—in machines

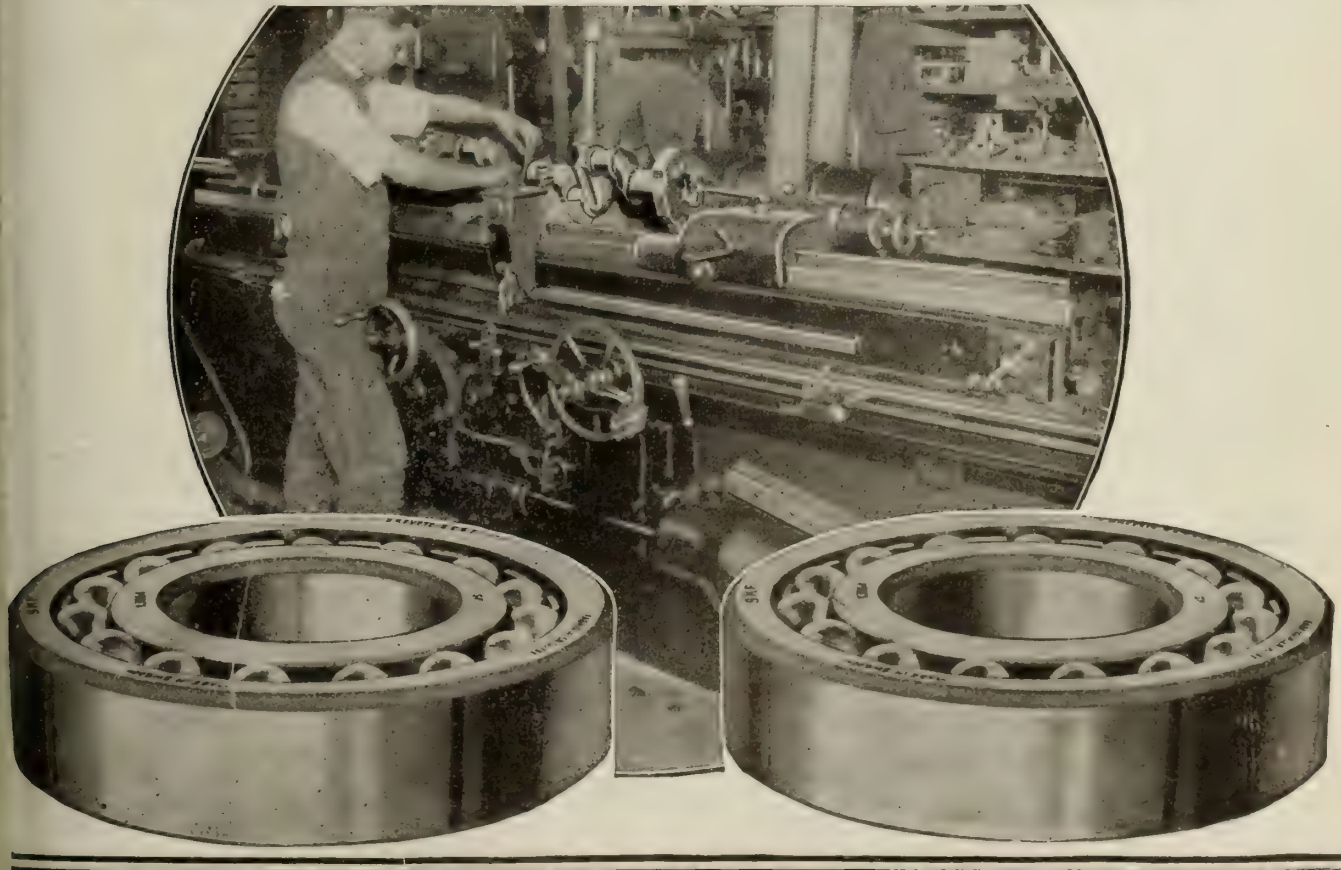
How to improve product by
—insuring accuracy and precision of machines
—increasing speed

How to reduce production costs by
—speeding up machines
—saving lubrication and overhauling of bearings
—reducing spoilage

SKF Engineers gather experience in these important questions from every civilized country of the world and place it at your disposal.

No charge nor obligation in consulting our engineers

CANADIAN SKF COMPANY, LIMITED
TORONTO - - - MONTREAL





The Set of
SIMONDS
Hack Saws

In giving "set" to Simonds Hack Saw Blades, the utmost care is taken to have it just the right degree, so that when cutting, the blade will run free and not bind. Because of this and other methods of construction Simonds All-Hard and Hard Edge Blades are found to be the best for machine shop use. They do not break, and shelling of teeth is reduced to a minimum.

Write us about your requirements.

Simonds
Canada Saw Co.
Limited
"The Saw Makers"

Montreal, Que.
St. John, N. B.
Vancouver, B. C.

of the year therefore was 9,627,885 tons.

To-day, of course, operations of the various steel plants are the lowest since January, 1908, and compared with capacity, the lowest of record. The industry as a whole has not more than 20% of capacity active but the Corporation is operating probably close to 25% of capacity.

NEW CATALOGUES

The Davis-Bournonville Co., Jersey City, have issued a revised circular covering their acetylene generators, welding and cutting torches, portable outfits, and welding supplies.

The Electric Hoist Manufacturers' Association, New York, have issued two circulars dealing with their different lines. One book is devoted to approved applications, the other to monorail runway construction. Both circulars are well illustrated and contain interesting data.

The Oliver Machinery Co., Grand Rapids, Mich., have sent us data on their pattern milling machine. This is in circular form, and should be of interest to anyone engaged in such work.

The Canadian Ingersoll Rand Co., Sherbrooke, Que., with general sales offices in Montreal, have forwarded us a very complete catalogue on pulp and paper machinery. It is in loose leaf form, consisting of sections under the following heads: The Ryther Slasher System; Pulpwood Barking Drums; Paulson Patent Bark Press; Ryther Reciprocating Chip Screens; Parallel Endless Chain Log Haul, and Bird Auxiliary Screens. The matter is well prepared and of decided interest.

We have received a book from the Swedish Chamber of Commerce of the U.S.A. Produce Exchange Annex, New York, entitled "Iron and Steel in Sweden." The book contains over 200 pages and is profusely illustrated. The work preparing this volume must have been enormous, for the data contained is accurate and reliable. The idea of the book is to give the necessary information to buyers of Swedish iron and steel. To anyone interested, we can recommend a perusal of this interesting story of steel.

The Sir W. G. Armstrong Whitworth & Co., Ltd., Westminster, England, have forwarded us various catalogues dealing with the following lines. Twist Drills, Pneumatic Tools; Screwing Apparatus; Standard Gauges; Tool Steels; Types of Warships and Mercantile Steamers; and Commercial Products. All these books are well illustrated and contain considerable data of value. In addition to the above this concern forwarded a book covering the war w of their firm, which in itself is a w derful story of achievement.

The Shurly-Dietrich Co., Ltd., G Ont., have issued a supplement to th main catalogue, this new book conta ing the new list prices. Their regu lines of saws are illustrated throughc

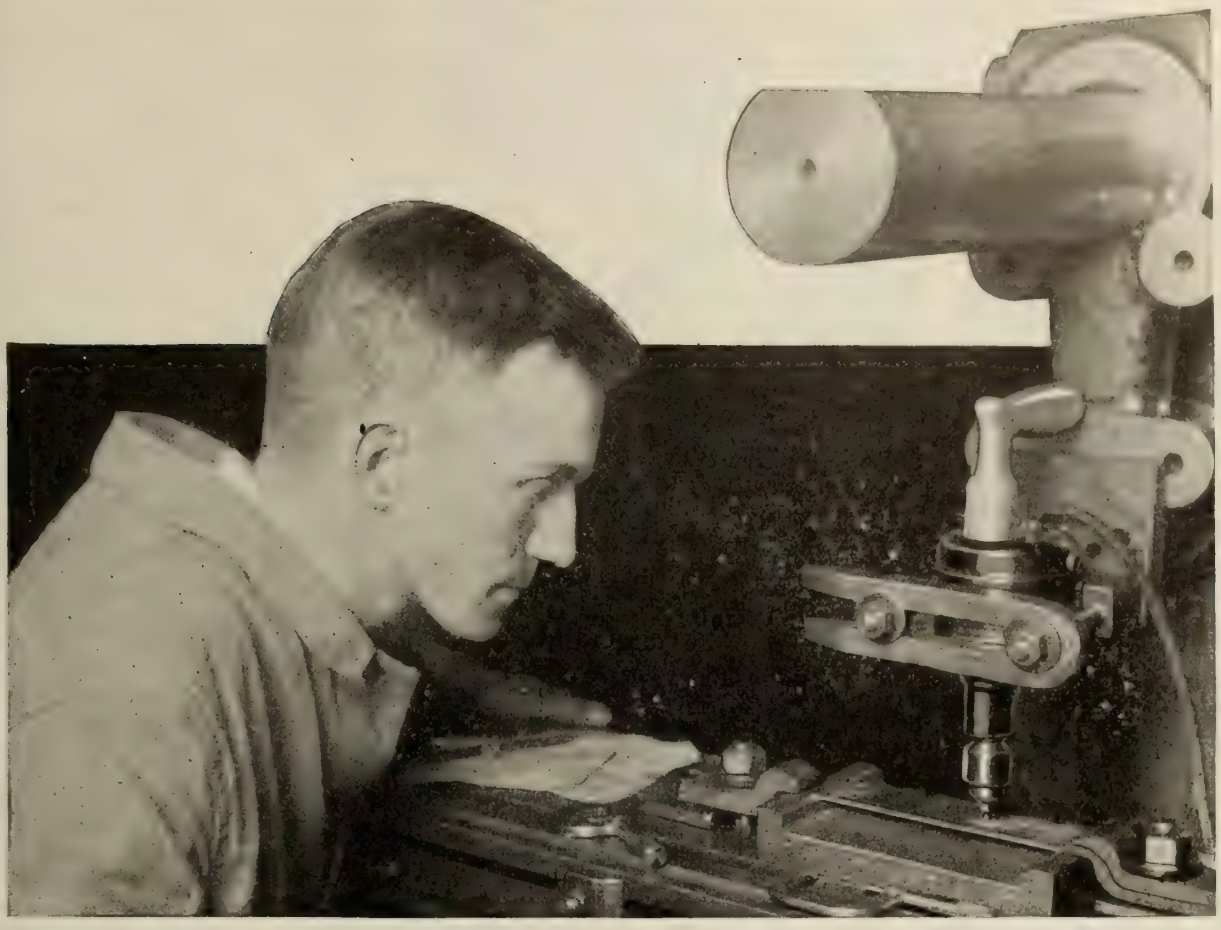
The A. R. Williams Co., Montr have issued a Machinery Bulletin, 2151, which shows clearly the vari lines which they handle. Many ill trations are used, and full data on various machines is given.

HOPE FOR DEVELOPMEN OF EXPORT TRADE

The Canadian section of the Bri Chamber of Commerce in Paris is tively engaged in a movement for development of trade between Can and France. The Hon. Secretary, W. H. Dorey, has for the past months been quietly working among manufacturers and exporters poin out the advantages there are for the port of Canadian products to Fra and the central countries of Eur Mr. Dorey advises manufacturers others desirous of opening up trade lations with the Central Euro countries such as Serbia, Roumania Czecho-Slovakia, to do so through Pa which is the most important finan centre and which controls wide in ests in those powers, which, as m people are aware, comprise the for State of Bohemia, and other le States of the disintegrated Austrian pire.

Support Given.

The movement has the support of Board of Trade, Canadian Manufac ers' Association, and a large and fluential number of mercantile financial concerns in the city. All C dian business men are invited to in est themselves in the movement through its agency a vast and profit market for Canadian products wil opened up. The main feature for manufacturers thinking of develo an export trade to consider is tha carefully studying the requirement the foreign markets and to see that products comply with same. Thi most essential for the building up remunerative export business. Inqu regarding the new markets and t openings are cordially invited by Chamber, which will furnish the fu and most reliable information pos free of cost. Communications shoul addressed to Mr. W. H. Dorey, Secretary, Canadian Section, Br Chamber of Commerce, 6 Rue Ha Paris, France.



Yankee Ingenuity Solves Drilling Problems with the Aid of this Dumore High Speed Drill

John Bath & Company, Inc. (Worcester, Mass.)—maker of fine tools—uses a half dozen each of Dumore Drills and Grinders in his up-to-date shop.

The Photograph shows a Dumore Drill mounted on the overarm of a milling machine drilling holes in a tool steel jig plate ⅛″ thick. There are 76 holes spaced .080″ apart in several rows and a drill .051″ in diameter is used.

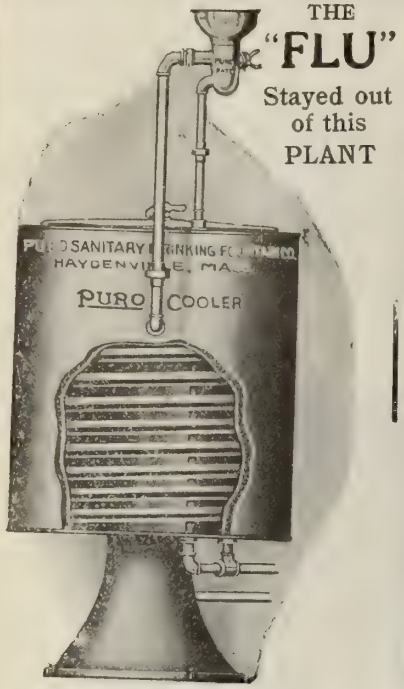
Dumore Drills—like the well known Dumore Grinders—are accurately built, with an almost unlimited range of application. Used to supplement the work of big machines, Dumore High Speed Drills add to the capacity of the shop and cut production costs on many classes of work.

Send for the details of Dumore High Speed Drills and Grinders. Let us show you how you can use them to advantage.

WISCONSIN ELECTRIC COMPANY, 2937 Sixteenth Street - Racine, Wisconsin

DUMORE PORTABLE DRILLS

THE "FLU" Stayed out of this PLANT



PURO SANITARY DRINKING FOUNTAIN
(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.
888 F. St. Andrew St., Montreal, P.Q
CANADA



UNFILLED ORDERS REMAIN ON BOOKS

5,117,868 Tons Remain on Books of Subsidiary Companies—Operations in June Averaged 32% of Capacity.

According to the monthly statement of the U. S. Steel Corporation, there remained unfilled, orders on the books of the subsidiary companies, to the extent of 5,117,868 tons. This shows a decrease of 364,619 tons during the month. Since the first of the year the unfilled tonnage has decreased over 3,000,000 tons. The corporation operated its plant in June at an average rate of 32% of capacity, indicating an output of 607,000 tons of ingots and 456,000 tons of rolled products. Shipments of finished steel are estimated at 450,000 tons. Orders booked during the month averaged a little less than 7,000 tons a day, making a total of 175,381 tons, the smallest bookings in any month since before the war. The indication is that there were cancellations of about 90,000 tons and with that exception shipments exceeded business by 274,619 tons.

To-day they are operating at not much over 25% of capacity and unless the new schedule of prices has just been put into effect develops new business of importance, the outlook is not very encouraging for the near future. In the second quarter of the year, that is, in April, May and June, the Corporation produced approximately 2,133,792 tons of ingots and 1,601,092 tons of rolled products. Shipments are indicated to have been 1,550,000 tons and the total orders taken, 618,459 tons. It is quite evident that the second quarter earnings were very unsatisfactory, but fortunately they have a large surplus upon which it may draw to meet dividend requirements.

The new schedule of prices, of course, did not go into effect until the second quarter was ended, but many of the lower prices recognized officially last week were already current during the latter part of June. The lower wage scale of the Corporation which results from its abrogation of the basic or overtime day did not go into effect until July 16th. This abrogation is equivalent to reducing wages 8½% to 14%.

ADJUSTING THE SPEED

Continued from page 44

to counterbalance the magnetic pull of the fields and armature. This magnetic pull tends to return the armature to its normal position beneath the poles and is greatest just as the armature is leaving the pole pieces, gradually decreasing in value from that point as the air-gap is lengthened. The spring is compressed between a seat on the inner face of the front bearing bracket and a shoulder on the speed adjustment nut. The lever rod passes through the helical spring. It is evident that the spring is brought into the greatest compression, exerting its greatest counterbalancing, as the armature approaches its normal position under the main poles. By a careful proportioning of the different parts, satisfactory adjustment of the two opposing forces is obtained for all positions of the armature, making easy and simple the shifting of the armature for speed control.

These motors are made both in the open, and fully enclosed dust proof type.

CASTING TROUBLES

Continued .rom page 42

dred 1,200 lb. castings per year. Their grey iron department could take on more work and they quoted a 5 cent price against the 6½ cents we were paying elsewhere and agreed to make their own pattern. They were a big concern and evidently knew all about the business, so we contracted at once. We stipulated that the castings were to be delivered one side up and that a sample casting should be sent for us to try out in all particulars. Three months later, the freight office notified us that a car had arrived loaded with castings from this company.

We got two of them trucked in at once and put one on each planer. That was enough to run us two days and the truck was to unload the rest on the morrow. They were the nicest, cleanest, straightest looking castings we had ever seen and we congratulated ourselves on having struck a real foundry at last. Just then Jimmy came up to say he couldn't drill the holes for the finger clamps. He was given a new drill and finished presently. An hour later, Steve, the planer hand complained of the castings—said he had used six good H. S. bits already and hadn't cut two inches across.

Those castings arrived about two years too late to be used in the war as bullet proof armor plate. We didn't unload any more but phoned the N. Y. office and a representative came right up. He spent two days trying to chip test the castings and then gave it up. Our dream had faded over night. Instead of following instructions and sending one casting to be tried out, they went ahead and made a big lot of them —while we waited. That deal cost them over $3,000 and lost them a steady business. The N. Y. man was pretty cute. He had the castings taken out of the car and trucked down to the other freight station, returning them by the Central Ry. There were a dozen cracked castings in the lot and he made claim for these on the score of mis-handling (thus the railway paid for a part of the loss, which was no more fault of theirs than if the parts had been so much glass shipped unpacked).

It has been said that the automobile business has taken the best iron and the best foundry workers. Maybe that is so. In our case, poor castings lost us $6,000 last year and yet the foundries act insulted at the return of a single piece. There exists a widespread belief that only in those plants where they machine their own castings is there any care taken of the work in the foundry. I used to make an occasional suggestion to one foundry superintendent and it never got any further than his stock question, "You're not a moulder, are you?" Moulding is a trade that is just as susceptible to human skill and study and care as is any other—there's something radically wrong with either the men or the equipment to let them turn out such a low grade product—a machine shop could not turn out a single piece to the same standard.

RATES FOR CLASSIFIED ADVERTISING

Rates (payable in advance): Two cents per word. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

'OUTHS SHOULD BE TRAINED TO EFFICIENCY

Speaking on "Canada's Interests rom a Business and Citizen Point of ew," Dr. Cody, aired a few truths that e well worth repeating. He said in rt: —

"What has enabled Germany to recov- so rapidly from defeat and once again ve signs of becoming one of the most rmidable competitors in the world's arkets?" he continued. "The German orkman to-day is willing to work - id work efficiently- at a lower wage an the workmen of Great Britain and her countries. Technical education ays a big part in the development of e commercial interests of Germany. though still suffering from the knock- t blow delivered by the troops of the lied armies, Germany has established ousands of technical schools through- t her empire for the better equipment her workers, so that they may become illed and competent to do the best rk.

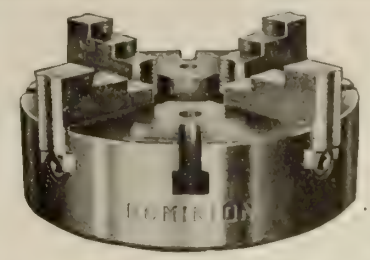
"This can be accomplished in Canada ly by training our youths in a Do- nion-wide system of secondary tech- al schools. The idea that should oc- py first place in the minds of our edu- tionalists is that the Canadian youth all be as well trained technically and iciently as in any other country in the rld. The Dominion Government by a thod of subsidizing has succeeded in ablishing technical schools in the dif- ent provinces."

A SOLID ROCK HARBOUR.

There is a natural impression that all nstructional engineering work of the linary kind in Great Britain was sus- ided during the war, but in point of t it was found possible to keep quite number of schemes going in spite of concentration of effort upon definite r work. A case in point is supplied an extensive harbour improvement ich was begun in Great Britain a nth or two before the war. The heme included a new basin with an a of 2¼ acres and 1,500 feet of new ays. All through the war the work ceeded steadily, if slowly. Its most narkable feature was that the basin s cut out of solid rock to give an rage depth of 13 feet. The material avated was ingeniously used to re- im from the sea a considerable tract se to the harbour.

GRINDING ATTACHMENT.

The Hjorth Lathe & Tool Co., Boston, ss., have placed on the market an ernal grinding attachment that can used on practically any of the plain universal grinding machines now on market. The attachment is driven m a ceiling countershaft, and the ndles are of two types—one for deep d large holes, and one with tapered ors for small holes; the latter ac- mmodates small emery wheels and mond grinding plugs.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

DOMINION STEEL PRODUCTS CO. LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
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LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
195 KING WILLIAM ST. HAMILTON

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BERTRAMS LIMITED
SCIENNES EDINBURGH

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BLACK DIAMOND OVENS
OVENS
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators. Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd
Brantford, Canada

DROP FORGE DIES
Send us your blueprints and specifications. Entrust your requirements to experienced workmen and up-to-date equipment. Have your dies made in Canada. First-class workmanship guaranteed.
THE KIMBER & HILLIER MFG. CO.,
Thorold Road, - St. Catharines, Ont.

FITTING TO THE BONE.

Do you want a good shoe fit? Then use the X-ray as they are doing in Great Britain in some stores. A simple self-contained X-ray apparatus has been produced by which the customer and the shop assistant can see, on a fluorescent screen, the bones of the foot. The picture thus given shows exactly the real structure of the foot, from which an intelligent shop man can gauge the type of shoe which will give the customer the support and comfort he, or she, desires. The elecric power required is so small and the exposure of such brief duration that there is absolutely no fear of any burning or ill effects from the use of this appliance.

Classified Opportunities

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

MOTORS

MOTORS WANTED:

1—25 H.P.—3 phase, 25 cycle, 220 volts.
1— 5 H.P.—3 phase, 25 cycle, 220 volts.

THE BELL THREAD COMPANY, LIMITED, HAMILTON, ONT.

MOTORS FOR SALE:	R.P.M.	Starter	Price
1— 3 H.P. Westinghouse	1700	Switch Starter	$ 90
1— 5 H.P. Can. Gen. Electric	1800	Switch Starter	100
1—20 H.P. Fairbanks-Morse	1200	Auto Starter (no low voltage release)	250
1—25 H.P. Can. Gen. Electric	1000	Auto Starter (no low voltage release)	350
1—30 H.P. Westinghouse	945	Auto Starter (no low voltage release)	400

All 2 phase, 60 cycle and in good running order.

THE BELL THREAD COMPANY, LIMITED, HAMILTON, ONT.

POSITION WANTED

SUPERINTENDENT OR MASTER MECHANIC. Experienced on locomoive, stationary and marine work. Thoroughly familiart with modern methods of production, plant upkeep and repairs. Box 785 CANADIAN MACHINERY. (c4m)

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT

Builders of Reliable Machinery.

Phone Park. 3550

A. AUSTIN

GENERAL MACHINE WORK

Turret Lathe and Automatic Screw Machine a Specialty. Let us quote on your work.

With: Garlock, Walker Machinery Co. 163 Dufferin Street.

SUNCLO BRAND

WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Fattern Works, 49 George St., Brantford, Ont. (ctfm)

SALESMAN WANTED

WANTED — BY WELL-KNOWN AMERICAN manufacturers of pneumatic tools enterprising salesman for Canadian field. Reply giving full experience, present connection, etc. All replies will be treated in confidence. Box 782N, Canadian Machinery.

Used Machinery For Sale

1—18" x 8' Mueller Lathe.
1..24" x 24" x 6' Putnam Planer.
1—32" Bandsaw.
1—30" Foot Squaring Shear, Brown Boggs.
1—96" Power Squaring Shear, Brown Boggs.
1—No. 3 Greenard Arbor Press.
1—10,000 lb. Olsen Testing Machine.

CHAS. P. ARCHIBALD & CO.
285 Beaver Hall Hill, Montreal

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

Used Belting, Pulleys, Etc.

We carry right in stock a large quantity of used Belting, Pulleys, Hangers, Shafting, etc., in good condition, which we sell at half the price of new. Inquiries solicited. In writing mention sizes wanted. L. S. Tarshis & Sons, 92 Wellington St., Montreal.

Machine Shop and Foundry for sale, St. Catharines, Ont. In the centre of the Welland Ship Canal and Hydro activities. Going concern capable of handling all classes of work. Turnover $60,000 a year. Good reasons for selling. Box 777, Canadian Machinery. (c5m)

RATE FOR CLASSIFIED ADVERTISING

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BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCER Twelve to fifteen thousand dollars for a peri of from one to three years, to take care of bu ness expansion. This concern will stand the fu est investigation. 8% is offered with am security to principals only, with an opportun of becoming permanent associates with the pa ners, if mutually satisfied. Box 767, Canadi Machinery. (etf

FOR SALE

ELECTRIC STORAGE BATTERY LOCOM tives for sale. Two. 36-inch gauge. Co plete and in good condition. R. T. Gilman Company, Dept. "E," 211 McGill Street, Montre (etf

ALMOST NEW 150 K. W. GENERAL ELECTR Generator, 25 cycle, type A. T. B., 550 or 2 Volts, 500 R. P. M., form B, class 5-150-500. W Gray-Dort Motors, Chatham. (c4m

1—Single Acting Smart Turner Triplex Pump, 2 x 4

THE BELL THREAD COMPANY, LIMITED, HAMILTON, ONT.

POSITION WANTED

TOOL STEEL AND MACHINERY SALES R presentative open for connection. Sixteen ye sales experience in Canada and United States. Ha had practical machine shop experience and thorough understand the metal lines. P. O. Box 539, Geor town, Ont. (c5m

Used Machinery For Sale

Slightly used Davis Bournonville Welding and Cutting Outfit, perfect condition, will sacrifice. Box number 784, CANADIAN MACHINERY.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.

THE KATIE FOUNDRY, GALT, ONT.

CANADIAN MACHINE SHOP

Will handle medium Specialty Line — Manufacturing and Selling

Apply Quickly

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CANADIAN MACHINERY

Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force cannot replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every week will keep you posted on the latest developments of machinery equipment.

C N C

It's a quiet, cool, smooth-running commutator where

Columbia Pyramid Brushes are used

Let's Co-operate

There's one best type of Columbia Pyramid Brush for your generator or motor, whatever its make—tell us about your machine, and we'll put on exactly the brush it needs.

CANADIAN NATIONAL CARBON CO. LIMITED
TORONTO AND WINNIPEG

GARLOCK-WALKER LIST

Over 20,000 square feet in our warehouse is filled with every variety of Equipment for Machine Shops and Woodworking Factories.

You will find Garlock-Walker service thoroughly dependable. Let us know what Machinery you require.

If you want Machinery Equipment, send us your enquiries.

A few Machines from our Toronto stock at exceptionally attractive prices are:—

LATHES

1—144" x 12' Berg Pit Lathe (used).
1—36" x 18' Putnam (used).
1—30" x 12' Blaisdell (used).
1—30" x 14' Niles-Bement-Pond (used).
1—26" x 14' Niles-Bement-Pond (used).
1—24" x 10' Milwaukee (new).
1—20" x 6' Le Blond Heavy Production (used).
1—18" x 8' Bertram (rebuilt).
1—18" x 8' Rae (new).
1—16" x 6' Reed (used).
1—12" x 8' LeBlond (used).
1—8" Rivett, Bench, Cabinet and Attachments (used).
1—7" Cataract Precision, Standard Equipment.

GAP LATHES

1—22" x 40" x 16' McDougall (used).
1—20" x 38" x 12' C. M. C. (used).
1—18" x 24" x 10' Rahn Meyer (used).

TURRET LATHES & SCREW MACHINES

Several No. 4 Millhollands. Davis, Oliver, Garvin, Warner & Swasey, and National Acme.

SHAPERS

1—16" Rae B. G. Crank Shaper (new).
1—24" McGregor-Gourlay Crank Shaper (used).

PLANERS

1—42" x 42" x 20' Putnam, 1 Head (used).
1—48" x 48" x 14' Patch, 4 Heads.
1—36" x 36" x 24' Sellers, Open Side (3 Heads).
1—30" x 30" x 10' Pond, 1 Head.

MILLING MACHINES

1—Briggs High Duty Type "A", 22" Traverse (new).
1—Briggs High Duty Type "B" 42" Traverse (new).
1—Ryerson-Owen No. 3, Universal (new).
1—Ford-Smith, No. 3 Universal (used).
Several Plain and Small Hand Millers.

DRILLS

1—10" Burke Sensitive Bench (new).
1—15" Rockford (used).
1—16" No. 2B Edlund H. S. Sensitive (new).
20" "Sibley," "Champions," "Rockwell" and "Silver" (new and used).

BORING MILLS

1—Universal No. 2½ Horizontal, Table 42" x 22" (used).
1—Bullard "New Era" Type Vertical Turret, 36", Complete Equipment (new).

POWER HACK SAWS

1—No. 10 Racine 8" x 8" Cap. (new).
1—No. 7 Watkins, 9" Cap. (used).
1—No. 1 Racine, 6" x 6" Cap. (used).

GRINDING MACHINES

1—Landis No. 4 Universal (used).
1—Landis Plain, self-contained, 36" x 12" (used).
1—Fitchburg Cylindrical, 8" x 36" (new).
Tool and Cutter Grinders. New and used. "Globe," Stevens, LeBlond and Cincinnati.

AIR COMPRESSORS

1—8" x 8" Sullivan, Class W.G.-3, belt driven (used).
1—8" x 10" x 8" Bury, steam driven (used).
1—12" x 18" Ingersoll-Sargent, belt drive (used).
1—12" x 12" Can. Ingersoll-Rand, N.-E.-1 (used).

PRESSES

1—No. 0 Consolidated Inclinable Power Press (used).

MISCELLANEOUS

2—No. 4 Jno. Hall Pipe Machines (1 used), (1 new).
1—No. 4 Jno. Hall Nipple Machine (used).
1—Lennox Rotary Bevel Shear, 1" cap. (new).
1—6" Curtis Pipe Machine (used).
1—Beaudry Champion Power Hammer, No. 9 (used).
1—Grant Rivet Spinning Machine, No. 80A (new).
1—Grant Rivet Spinning Machine, No. 80B (used).
1—Greenerd Arbor Press No. 4 (used).
Transmission Equipment, Pulleys, Belting, Shafting and Hangers.

GARLOCK-WALKER MACHINERY CO., LIMITED

MONTREAL, 337 St. James St. **TORONTO, 32 Front St. W.** **WINNIPEG, 567 Banning Ave.**

Warehouse: 163 Dufferin Street, Toronto



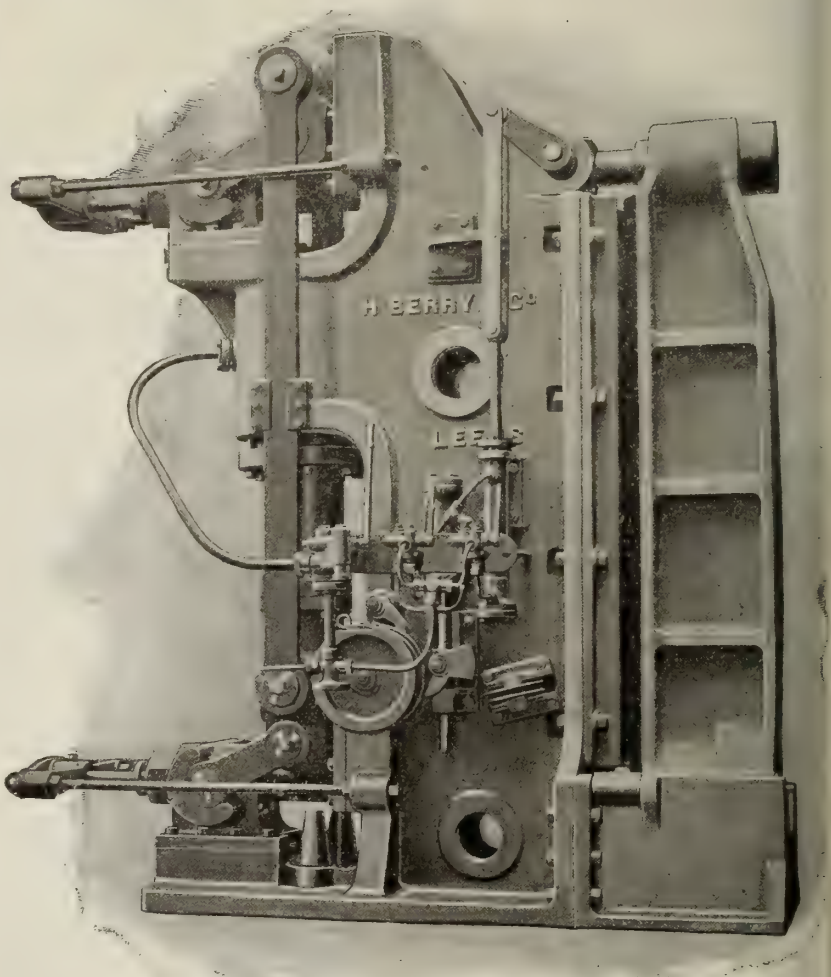
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& Company Limited.

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have for the past forty years assisted in forging the industrial link between Great Britain and the overseas dominions. Specialists in the design and production of

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of every type we are able to instance practical examples of our work in some of the world's greatest shipyards, boiler factories and steel works. We are prepared to submit designs and estimates for every requirement—nothing that concerns hydraulic plant is outside our scope.



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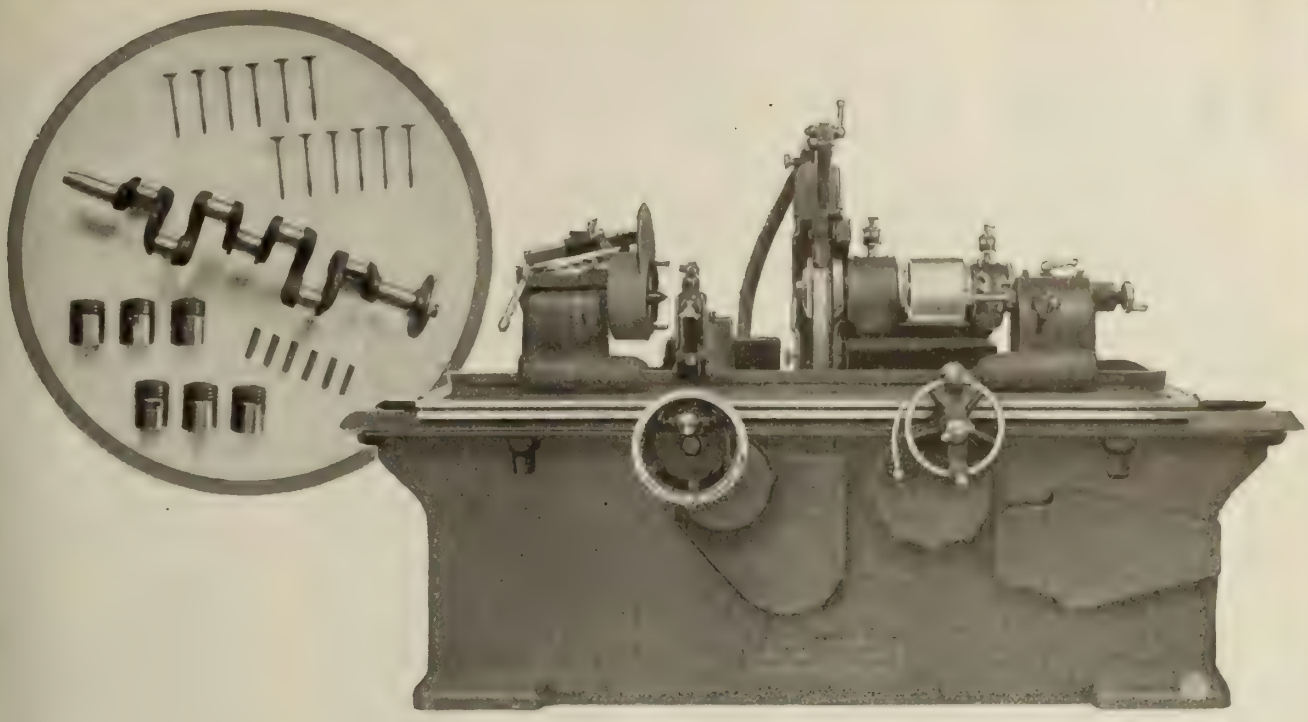
Contractors to both British and Colonial Governments, to the Indian Empire and to the Governments of Japan, Russia and Turkey.

VERTICAL HYDRAULIC PLATE BENDING MACHINE

as used by many of the leading Marine and Stationary Boiler Makers. Bends plates completely up to the end and to any given radius by once passing through the machine and can be also used for bending Butt Strips, &c. Effects economy of 50% and can be operated by unskilled labor.

CANADIAN AGENTS: Messrs. Fairbanks, Morse Co., Limited. Head Office: MONTREA





Crankshaft Grinding Made Easy for the Repair Man

Here is the new Norton Autopart Regrinding Machine—designed exclusively for the automobile repair or regrinding shop.

It will perform every cylindrical grinding operation necessary to put an automobile engine in first class condition. It will grind pistons, piston pins, valves and *ALL TYPES OF CRANKSHAFTS.*

An engine is not properly repaired unless the crankshaft is reground. Car owners are fast waking up to this fact.

This machine has both the capacity and rigidity for grinding crankshafts combined with speed range and ease of set-up for handling every small cylindrical job of the repair shop.

It has made the problem of the automobile repair shop man a simple one—it will do *ALL* his cylindrical grinding.

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Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Independent Pneumatic Tool, Chicago, Ill.

Analyses, Chemical
Toronto Testing Laboratory, Toronto, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Columbia Hdwe. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Burners, Oil and Gas
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

For list of Dealers see the last page of This Buyers' Directory

BUYERS' DIRECTORY

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont.

Castings, Semi-Steel
Davidson Mfg. Co., Thos., Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Swedish Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hender Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth, of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montre.
Garlock-Walker Mchy. Co., Toronto, Ont
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Sco
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Q
Dom. Foundries & Steel, Hamilton, O
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N
Steel Co. of Canada, Ltd., Hamilton, O

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbroo Que.
Can. Ingersoll-Rand Co., Ltd., Sherbroo Que.
Ford-Smith Machine Co., Hamilton, O
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Phi delphia, Pa.
General Combustion Co. of Can., Ltd Montreal, Que.
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd Montreal, Que.
Mechanical Engineering Co., Three Riv Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and G
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbroo Que.
Can. Fairbanks-Morse Co., Ltd., Montre
General Combustion Co. of Can., Ltd Montreal, Que.
Mechanical Engineering Co., Three Riv Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Phi delphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Anneal
Brown & Sharpe Mfg. Co., Providence.
Electric Furnace Construction Co., Phi delphia, Pa.
Mechanical Engineering Co., Three Riv Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, O

Gages, Comparator
Jones & Lamson Machine Co., Springfield, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
Johansson Inc., C. E., Windsor, Ont.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work
Chesterman & Co., Ltd., J., Sheffield, I
Crescent Machine Co., Ltd., Montreal,
Greenfield Tap & Die Corp., Galt, On
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.

BUYERS' DIRECTORY

Ackworthic, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Johansson Inc., C. E., Windsor, Ont.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glasco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec

Gears, Worm
Dom Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lord-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can. Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Stewart & Co., Duncan Glasgow Sco.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que
Crescent Machine Co., Ltd., Montreal, C

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd. Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd. Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montrea
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt. Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto Ont.
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montrea
Graton & Knight Mfg. Co., Worcester Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd. Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont
Waggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

osphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
anada Metal Co., Ltd., Toronto, Ont.

otographic Duplicating Machines
ommercial Camera Co., Providence, R.I.

g Iron
teel Co. of Canada, Ltd., Hamilton, Ont.

pe Bending Machines
merican Pipe Bending Machine Co., Boston, Mass
an. Fairbanks-Morse Co., Ltd., Montreal.
nderwood Corp., H. B., Philadelphia, Pa.
Villiams Machinery Co., A. R., Toronto, Ont.

pe Couplings
teel Co. of Canada, Ltd., Hamilton, Ont.

pe Cutting and Threading Machines
an. Fairbanks-Morse Co., Ltd., Montreal.
rane Ltd., Montreal, Que.
reenfield Tap & Die Corp., Galt, Ont.
ardine & Co., A. B., Hespeler, Ont.
andis Machine Co., Inc., Waynesboro, Pa.
urchey Machine & Tool Co., Detroit, Mich.
cDougall Co., Ltd., R., Galt, Ont.
etrie, Ltd., H. W., Toronto, Ont.
Villiams Tool Corp. of Can., Ltd., Brantford, Ont.

pe and Nipple Threading Machines
andis Machine Co., Inc., Waynesboro, Pa.

pe Fitters' Tools
tkenhead Hardware Ltd., Toronto, Ont.
rane Ltd., Montreal, Que.
ice Lewis & Son, Ltd., Toronto, Ont.

pe Threading Die Heads
andis Machine Co., Inc., Waynesboro, Pa.

ston-Ring Machines
ational Acme Co., Cleveland, Ohio.
teinle Turret Machine Co., Madison, Wis.

ners, Parallels
. & P. Mfg. Co., Niagara Falls, Ont.

ning Machines
ertram & Son Co., Ltd., The John, Dundas, Ont.
anada Machinery Corp., Galt, Ont.
an. Fairbanks-Morse Co., Ltd., Montreal.
oss Machinery & Supply Co., Geo. F., Montreal, Que.
arlock-Walker Mchy. Co., Toronto, Ont.
epburn Ltd., John T., Toronto, Ont.
erbert Ltd., Alfred, Toronto, Ont.
& P. Mfg. Co., Niagara Falls, Ont.
orton Mfg. Co., Muskegon, Mich.
liver Machinery Co., Grand Rapids, Mich.
Villiams Machinery Co., A. R., Toronto, Ont.

ning Machines, Rotary
ertram & Son Co., Ltd., The John, Dundas, Ont.
anada Machinery Corp., Galt, Ont.

te Rolls
ertram & Son Co., Ltd., The John, Dundas, Ont.

mbers' Brass Goods
ero Sanitary Drinking Fountain Co., Haydenville, Mass.

eumatic Tools
an. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
eveland Pneumatic Tool Co., Toronto, Ont.
arlock-Walker Mchy. Co., Toronto, Ont.
dependent Pneumatic Tool, Chicago, Ill.
eller Pneumatic Tool Co., Grand Haven, Mich.

lishing and Buffing Machines
ckworthie, Ltd., John, Birmingham, Eng.
rchibald & Co., Chas. P., Montreal, Q.
lount Co., J. G., Everett, Mass.
rown & Sharpe Mfg. Co., Providence, R.I.
an, Hanson & Van Winkle Co., Ltd., Toronto, Ont.
ort-Smith Machine Co., Hamilton, Ont.
arlock-Walker Mchy. Co., Toronto, Ont.
rry & Co., John C., Birmingham, Eng.

ls, Steel
redish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

ased Steel Parts
ckworthie, Ltd., John, Birmingham, Eng.
merican Pulley Co., Philadelphia, Pa.
ber Motor Co., Ltd., Orillia, Ont.

ases, Arbor
las Press Co., Kalamazoo, Mich.
an. Fairbanks-Morse Co., Ltd., Montreal.
& P. Manufacturing Company, Ltd., Niagara Falls, Ont.
ational Engineering Co., Sarnia, Ont.
etrie, Ltd., H. W., Toronto, Ont.
tralinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

ases, Drop and Forging
rown, Boggs & Co., Ltd., Hamilton, Ont.
anada Foundries & Forgings Co., Welland, Ont.
an. Fairbanks-Morse Co., Ltd., Montreal.
oledo Machine & Tool Co., Toledo, Ohio.

ases, Foot and Hand
rown, Boggs & Co., Ltd., Hamilton, Ont.
rry & Co., John C., Birmingham, Eng.

ases, Forcing
las Press Co., Kalamazoo, Mich.
tewart & Co., Duncan, Glasgow, Scot.

ases, Hydraulic
aird Machine Co., Bridgeport, Conn.
ertram & Son Co., Ltd., The John, Dundas, Ont.
an. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
aurie Mfg. Co., Springfield, Ill.
rrin Ltd., W. R., Toronto, Ont.
tewart & Co., Duncan, Glasgow, Scot.
Villiams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sanding Machinery
Oliver Machine Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal. Q

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio
Tallman Brass & Metal Co., Hamilton Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
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Gisholt Machine Co., Madison, Wis.
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National Acme Co., Cleveland, Ohio.

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Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
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Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

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Can. Wire & Iron Goods Co., Hamilton, Ont.

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Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

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Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Can. Driver-Harris Co., Walkerville, Ont.
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Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
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United Alloy Steel Corp., Canton, Ohio.

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Atkins & Co., Ltd., Wm., Sheffield, Eng.
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'ube Co. of Canada, Toronto, Ont.

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'ational Acme Co., Cleveland, Ohio.
'ratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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'arner & Swasey Co., Cleveland, Ohio.

'rrets, Tool Post
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Armstrong Bros. Tool Co., Chicago, Ill.
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Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

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Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont

Wrought Iron Pipe
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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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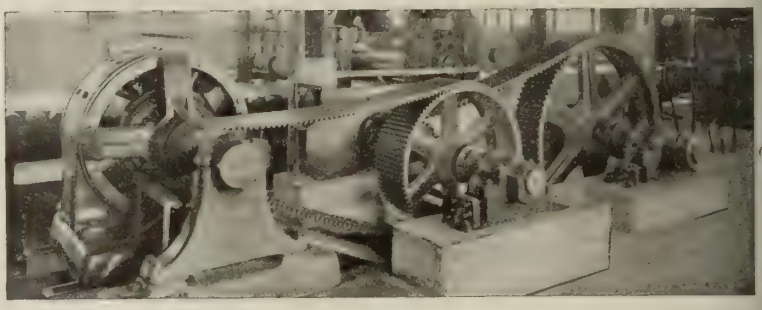
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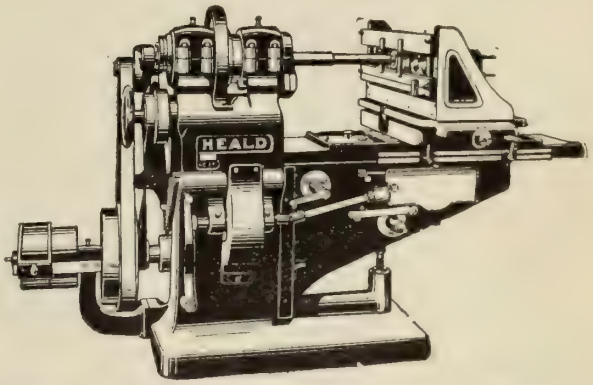
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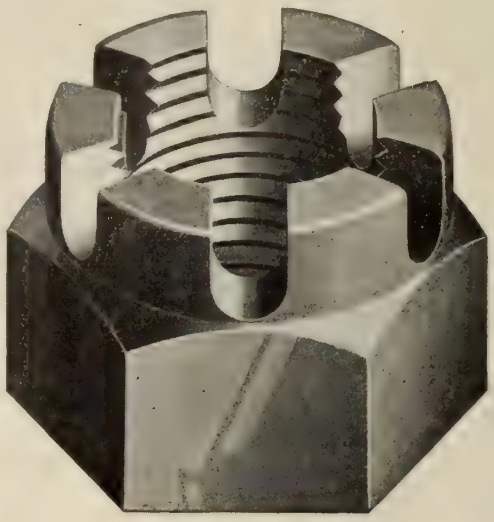
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MACHINE TOOLS

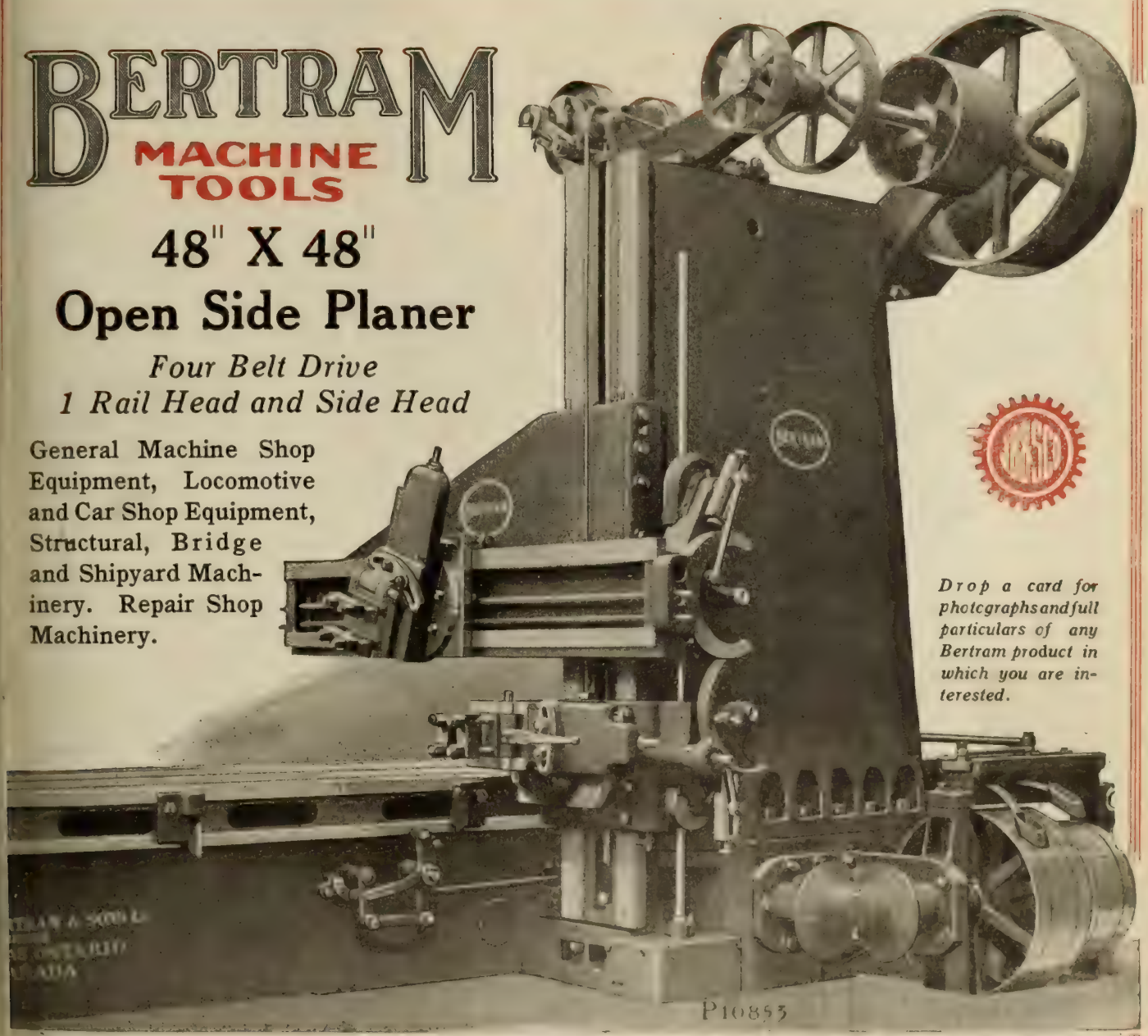
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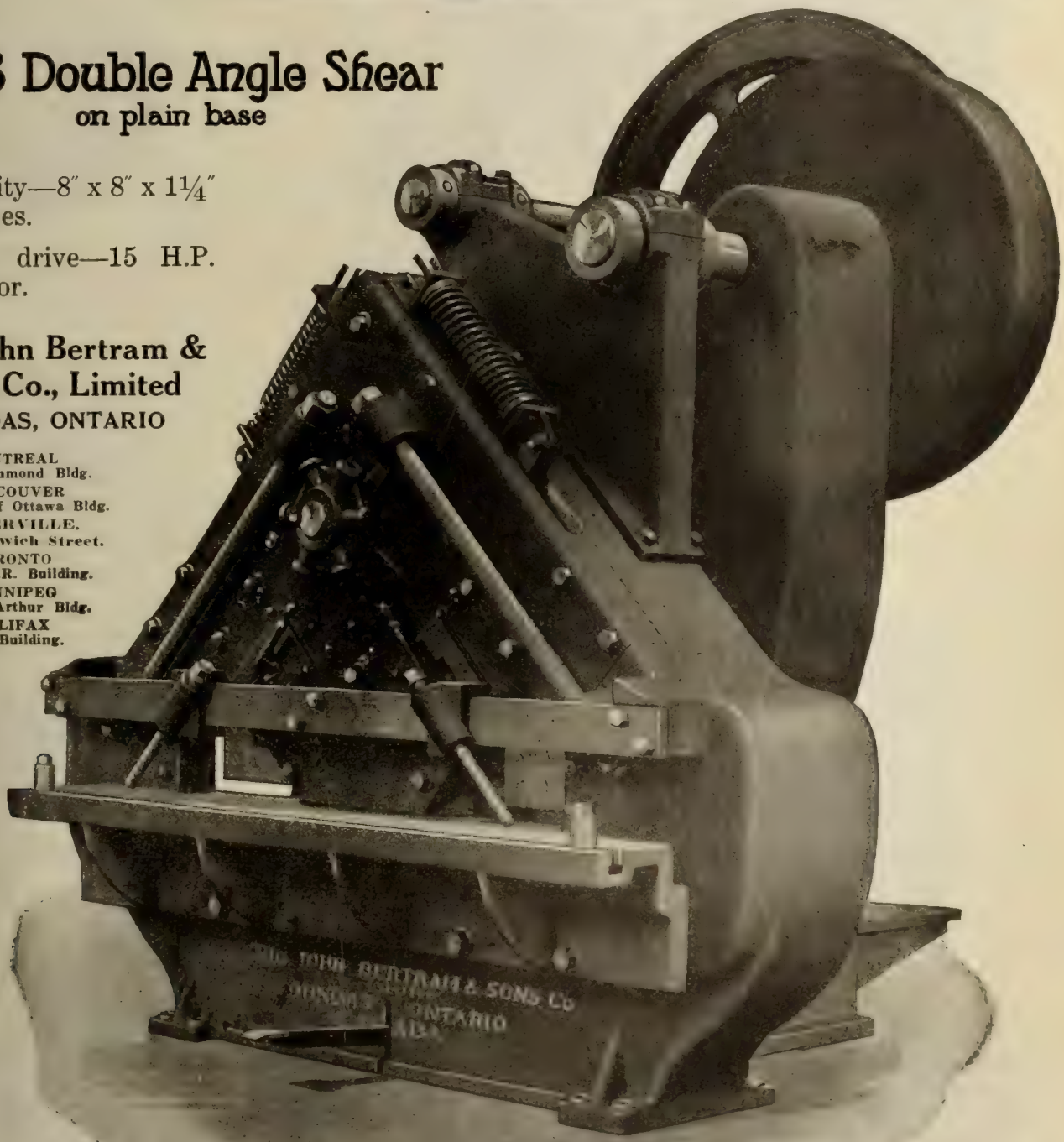
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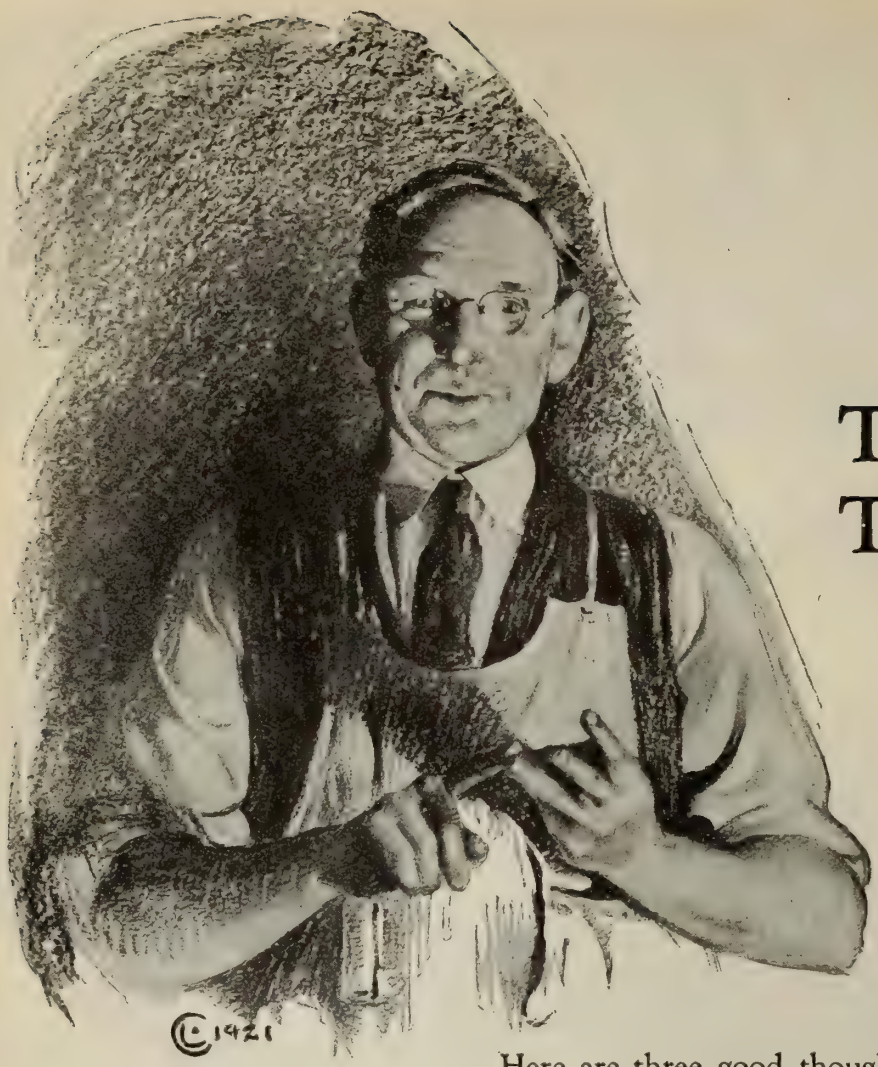


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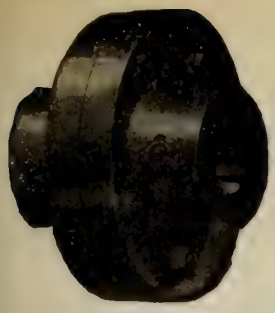
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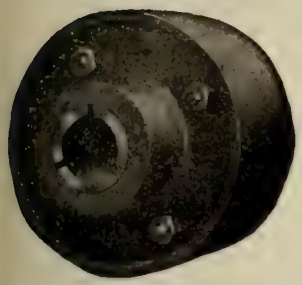


Starrett Tools

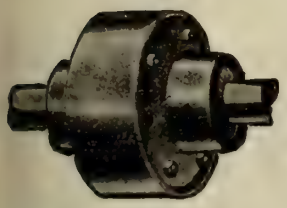
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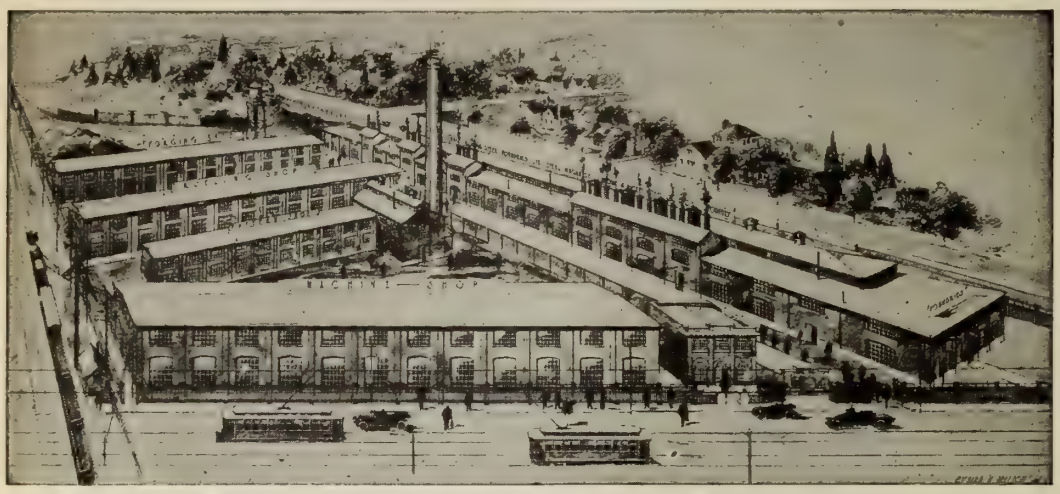
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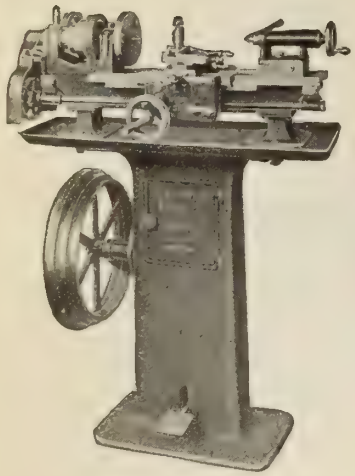


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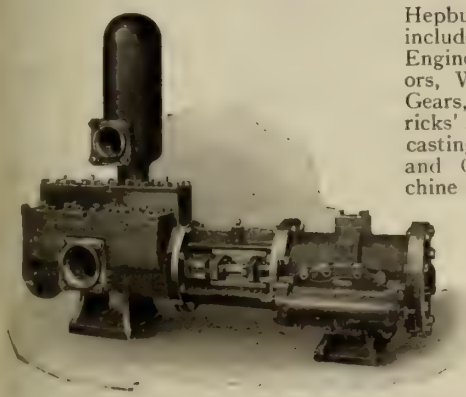
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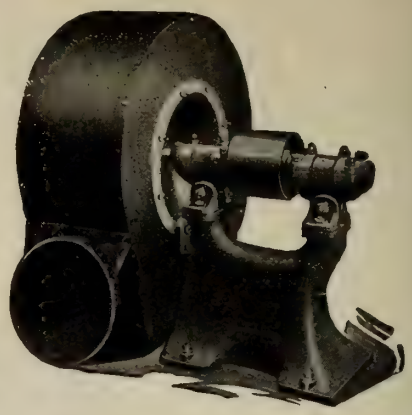
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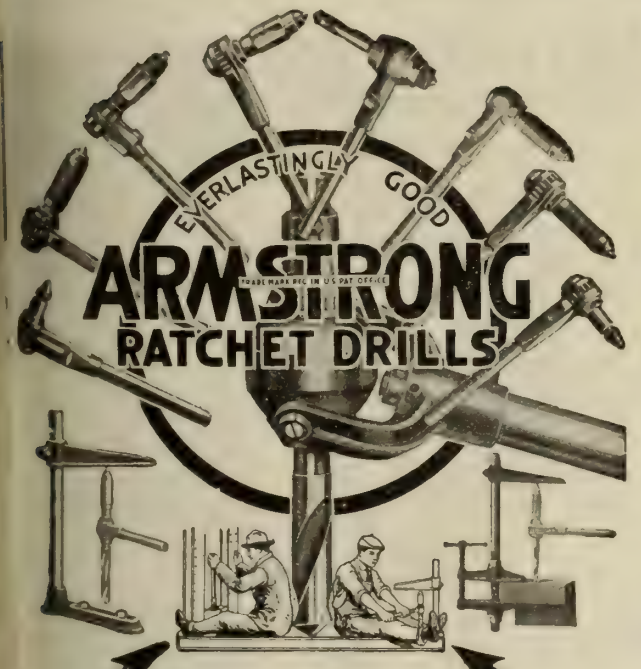
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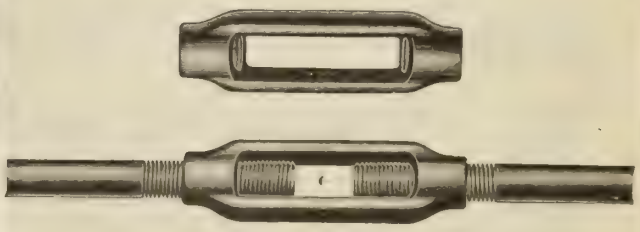
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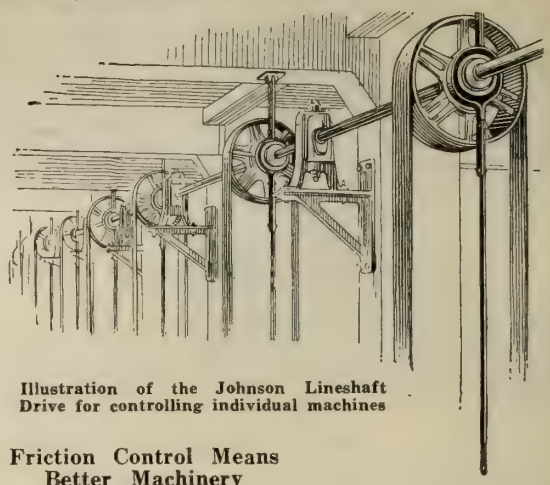
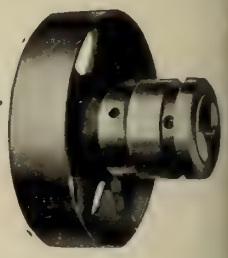


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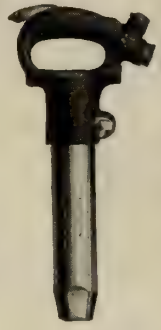
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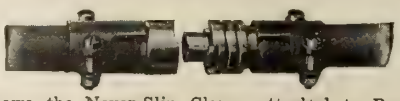


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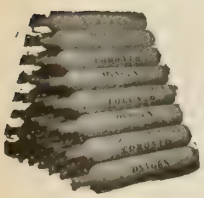
Murchey Tools are built for long, hard service. The fine materials and workmanship, their extremely simple design and rugged construction, enable clean, accurate threading under all conditions.

If you would experience a new kind of tap and die satisfaction send for a trial order of Murchey Taps and Dies.

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WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER

We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

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Our entire organization—technical and sales—is always at your service.

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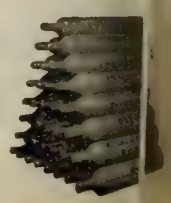
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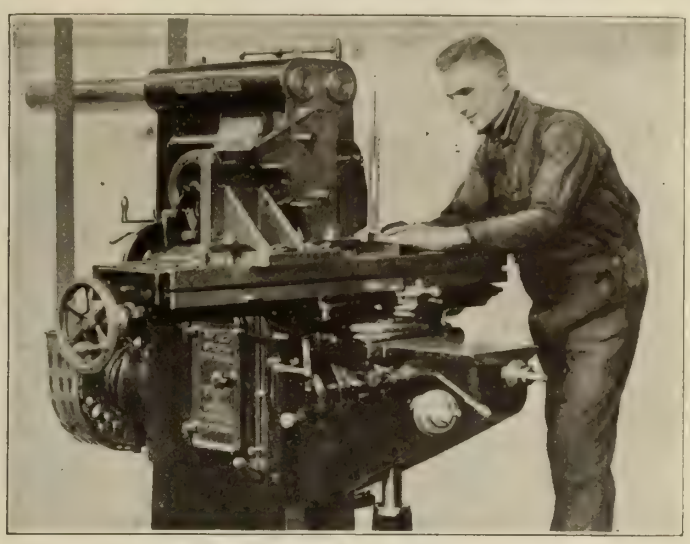
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Lasalle 508

TORONTO FACTORY
295 Dufferin Street
Park 7656





MILWAUKEE MILLING MACHINES



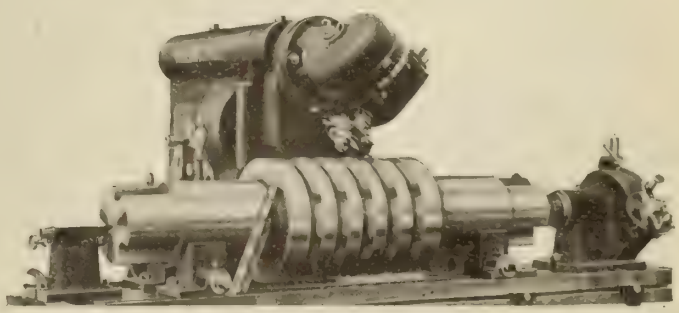
Efficient on Light and Heavy Milling

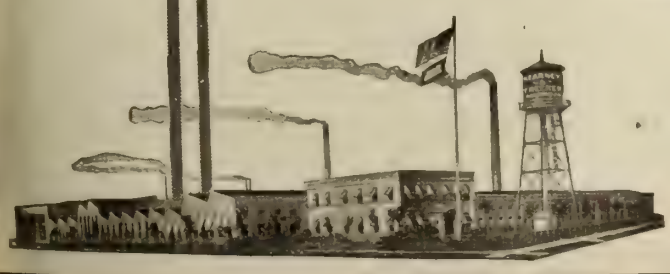
Heavy milling jobs are not unknown to Milwaukee Universal Milling Machines, while delicate and intricate ones are efficiently performed with little effort.

Both light and heavy milling operations are handled with such smoothness and accuracy that the finest results are obtained. Because Milwaukee Universal Milling Machines perform such a wide variety of work, they are particularly well adapted for the tool-room.

The jobs shown in the two illustrations are representative of "Milwaukee" adaptability. The upper illustration shows a jig being bored with a fly cutter. The lower illustrates the milling of a chilled roll with the use of a Universal Milling Attachment.

Write for Catalogue—NOW.





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CORPORATION
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Reed's "Shur-Pull" Exhaust Systems

have stood the test of time

Each system is specially designed to meet the requirements of the work. No hit-or-miss methods are employed.

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"Shur-Pull" Exhaust Systems are Canadian through and through.

Tell us your exhaust problems and we will solve them

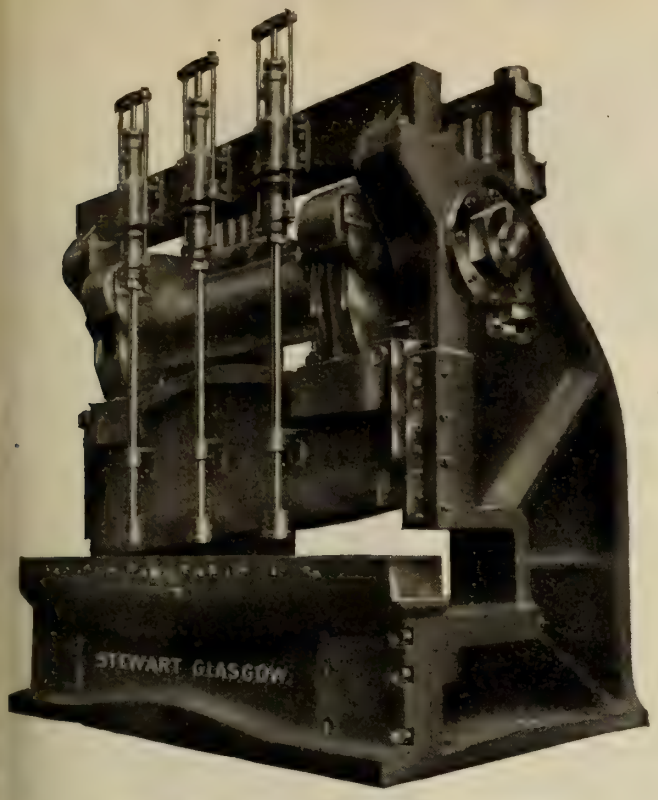
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Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

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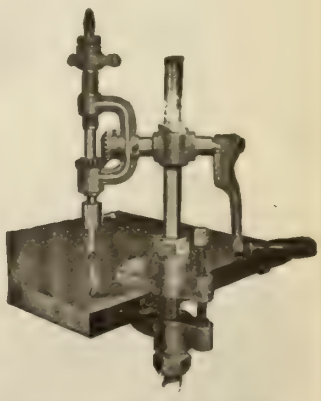
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Time is expensive when a machine is standing idle, waiting for repairs.





On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

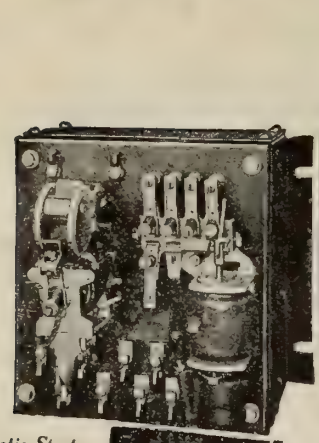
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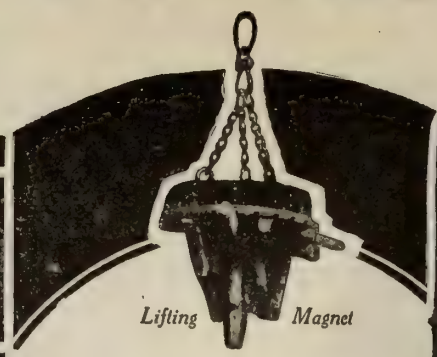
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CUTLER-HAMMER



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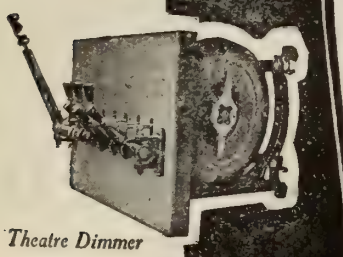
Compensator

Magnet and Control Devices

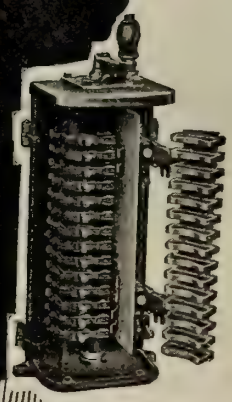
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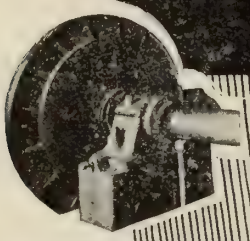
¶ Details and recommendations of suitable Cutler-Hammer apparatus for your control problems are available at our branches.



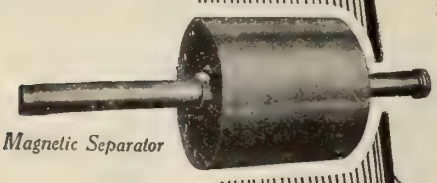
Theatre Dimmer



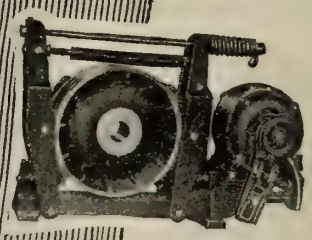
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Magnetic Separator



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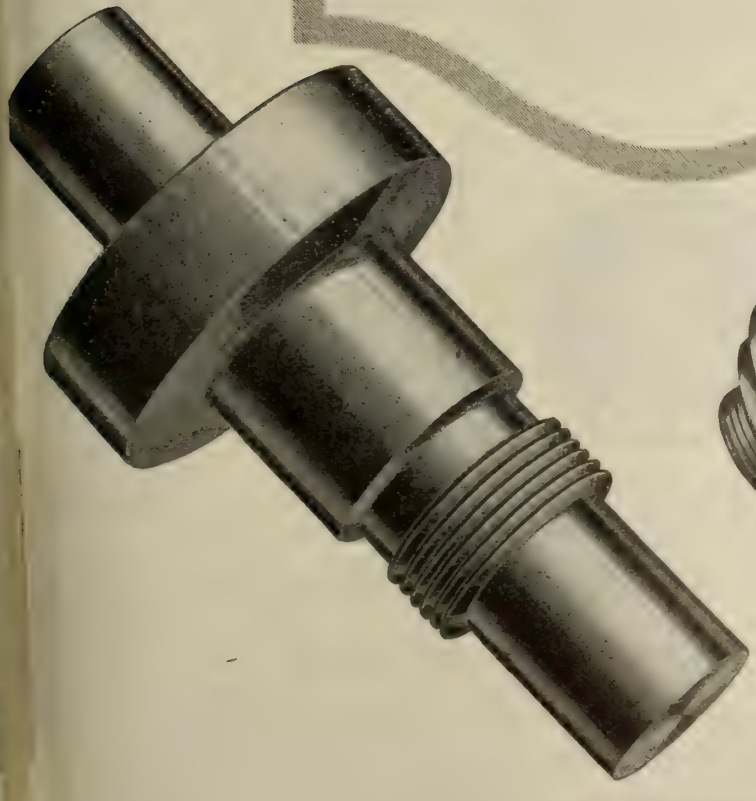
Screw machine product up to 2¼" diam. to specifications. Hardened and ground product to Specifications.

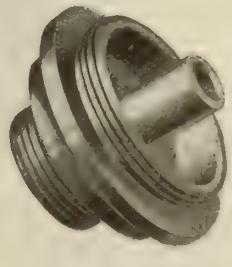
STANDARD

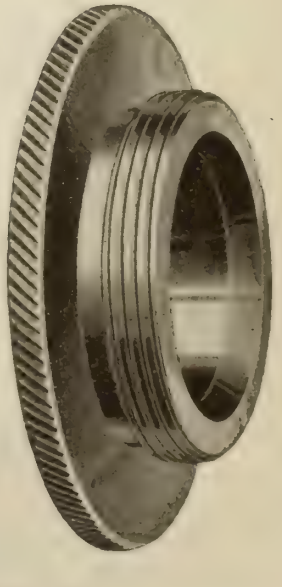
V., U.S.S. & S.A.E. Cap Screws
V., & U.S S. Set Screws
S.A.E. Plain & Castellated Nuts
V., & U.S.S. Semi-finished Nuts
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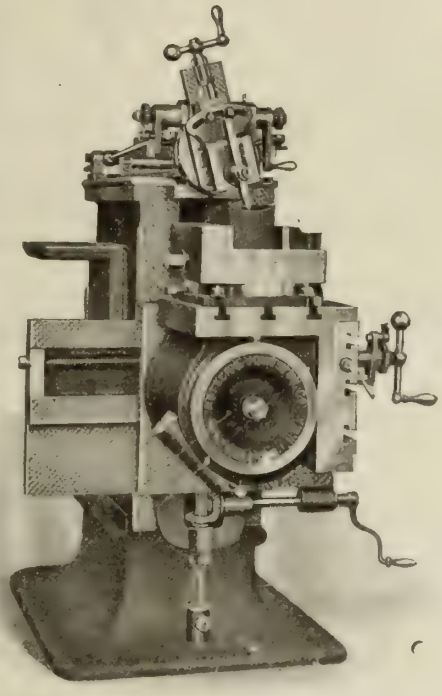


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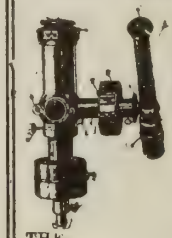
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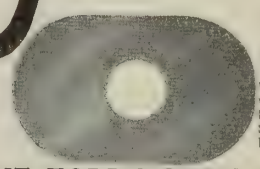
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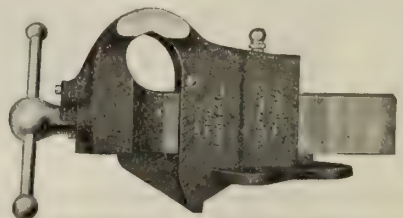
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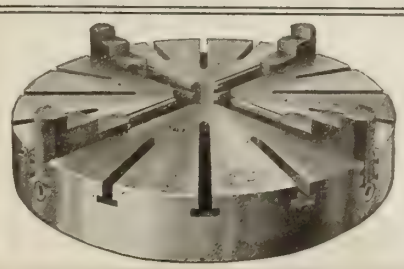
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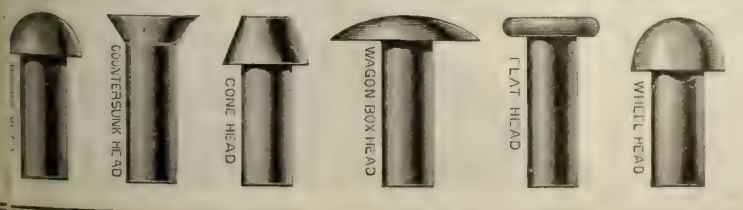
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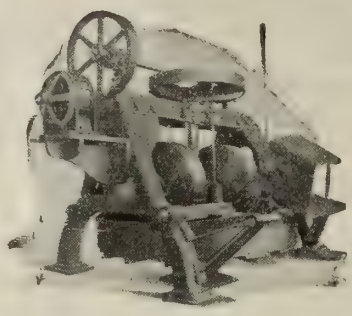
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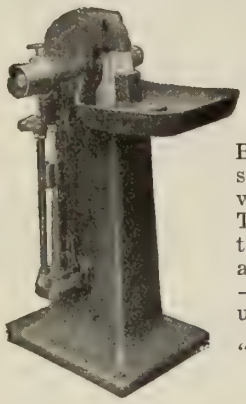
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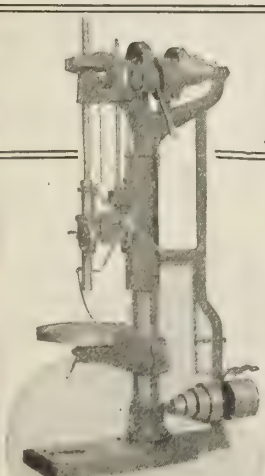
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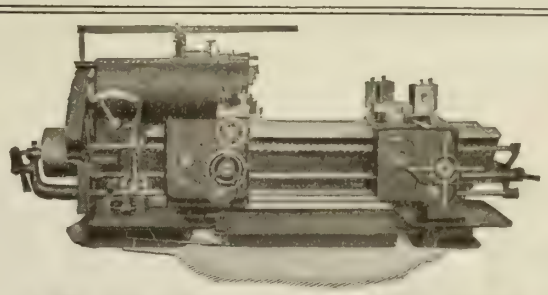
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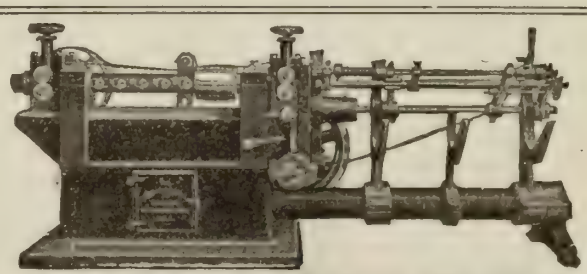
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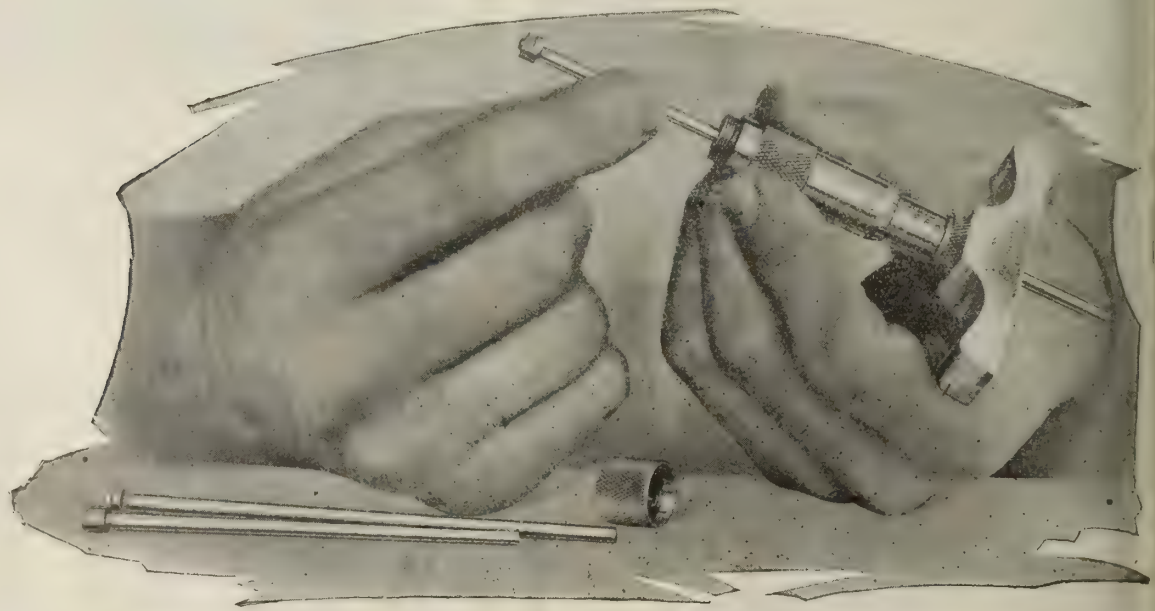
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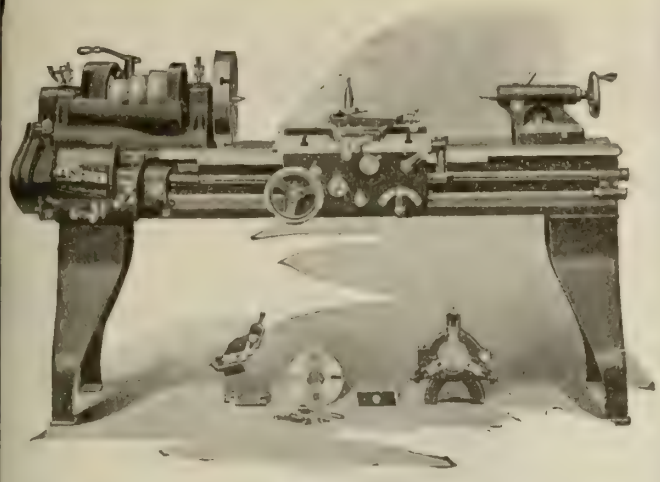
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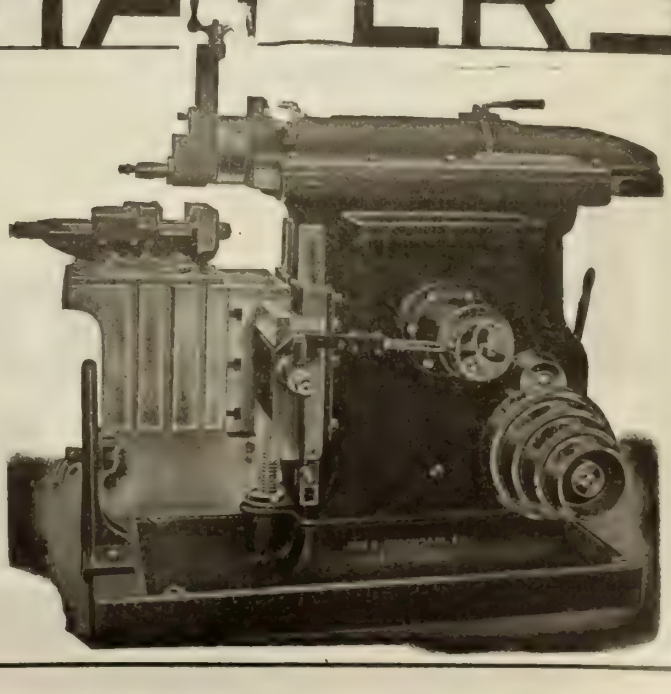
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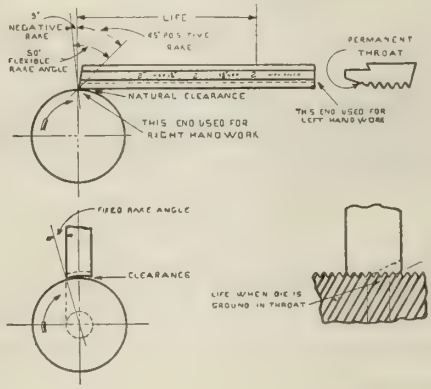
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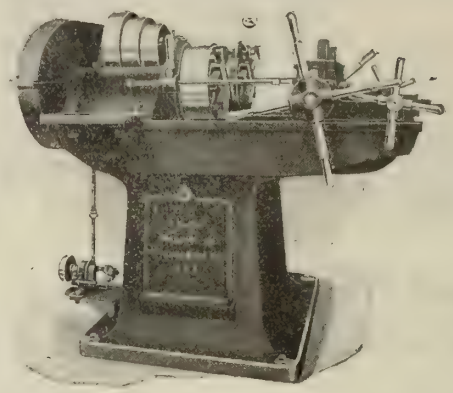
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI. No. 4. July 28, 1921

The Machining Of Spindle For High Duty Lathe

Efficient Lathe Practice—Examples Given Do Not Call For Elaborate Fixtures—Making a Cone Pulley Bush—Machining Head Gear—Work On The Lathe Spindle—Producing a Pulley Hub.

by J. H. MOORE

THE subject of efficient lathe practice will always be one of decided interest. The examples of work scribed in the following article do not all for elaborate tool holding fixtures, are typical of the average machine throughout the country.

ake for example Fig. 1. Here we the top slide for an 18-inch high lathe. A special holding fixture sed as shown in the photograph, 7, and in this operation the slide ced, bored, and tapped in the en- lathe.

llowing are the steps taken. The le is placed in the fixture, which hly takes 2 minutes; it is drilled a one-inch drill at 205 r.p.m. in ap- mately one minute, after which it ced with a high speed cutter also ing at 205 r.p.m. The slide is now bored to 1.045 in., then the hole ghtly chambered with a tool in the s shown at position 4 in Fig. 2.

xt comes reaming, see position 5 g. 2. The hole is reamed to 1.055 with a solid reamer at a speed of r.p.m., this taking approximately conds. At position 6, see Fig. 2. ole is tapped, and at position 7, ole is finish tapped. The remain- ime is occupied in removing the work from the fixture, the floor to floor time on the slide being 9 minutes, 30 seconds.

Cone Pulley Bush.

The bush shown at Fig. 3 is used on the cone pulley of a 15-in. plain crank shaper and it is made from bronze. The operations are boring and reaming and an air chuck is used in holding the work. The chucking takes roughly 10 seconds, while the boring, which is done with a double end tool at a speed of 135 r.p.m., occupies 2 min., 10 sec. Reaming is accomplished with a 2 7/8-in. adjustable reamer, and 45 seconds is used up in this step. The removing of the part takes another 5 seconds, so that the complete bush is produced in a floor to floor time of 3 min., 10 sec.

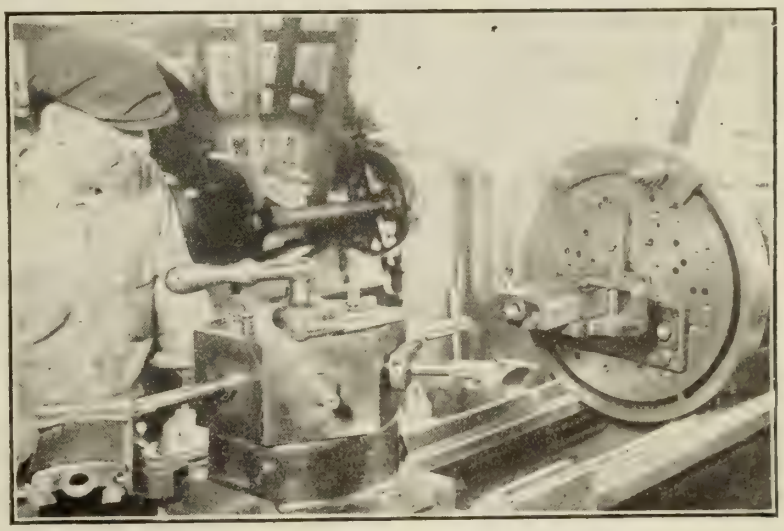
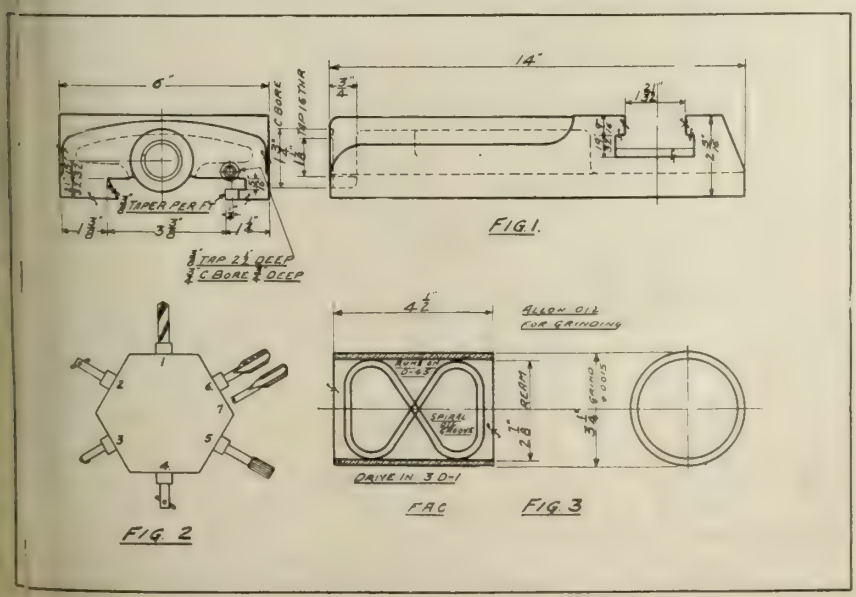


FIG. 7—SPECIAL HOLDING FIXTURE USED FOR FACING AND BORING SLIDE.

Illustrations by courtesy American Tool Works Co. Cincinnati, Ohio.



FIGS. 1 TO 3.—TEXT MATTER EXPLAINS THE VARIOUS PIECES.

Head Gear.

The next example, Fig. 4, shows a head gear made from an alloy forging which is completed in a floor to floor time of 57.7 minutes. Two settings are necessary, and in the first setting here is the procedure. The piece is chucked in a four jam chuck, and the top is rough turned. Next the large diameter is faced, after which the first cut on the hub is taken. The gear is now turned to 4 5/8 in. diameter, then the hub receives its second cut. The end of the hub is next faced; the oil groove is cut, after which the work is removed. This completes the first operation in a floor to floor time of 27.5 minutes.

The second setting calls for the work to be chucked as usual; then the top is turned; next faced; then bored about 3 1/4 in. diameter for 1 5/16 in. deep.



SHOWING OPERATION ON THE HEAD GEAR.



FIG. 9—SHOWING OPERATOR WORK ON SPINDLE FOR 30 INCH HIGH DUTY LATHE.

The bevel comes next in order, this completing the second setting in 30.2 minutes, or a total time on both set ups of 57.7 minutes. Fig. 8 shows the lathe in actual operation on this part.

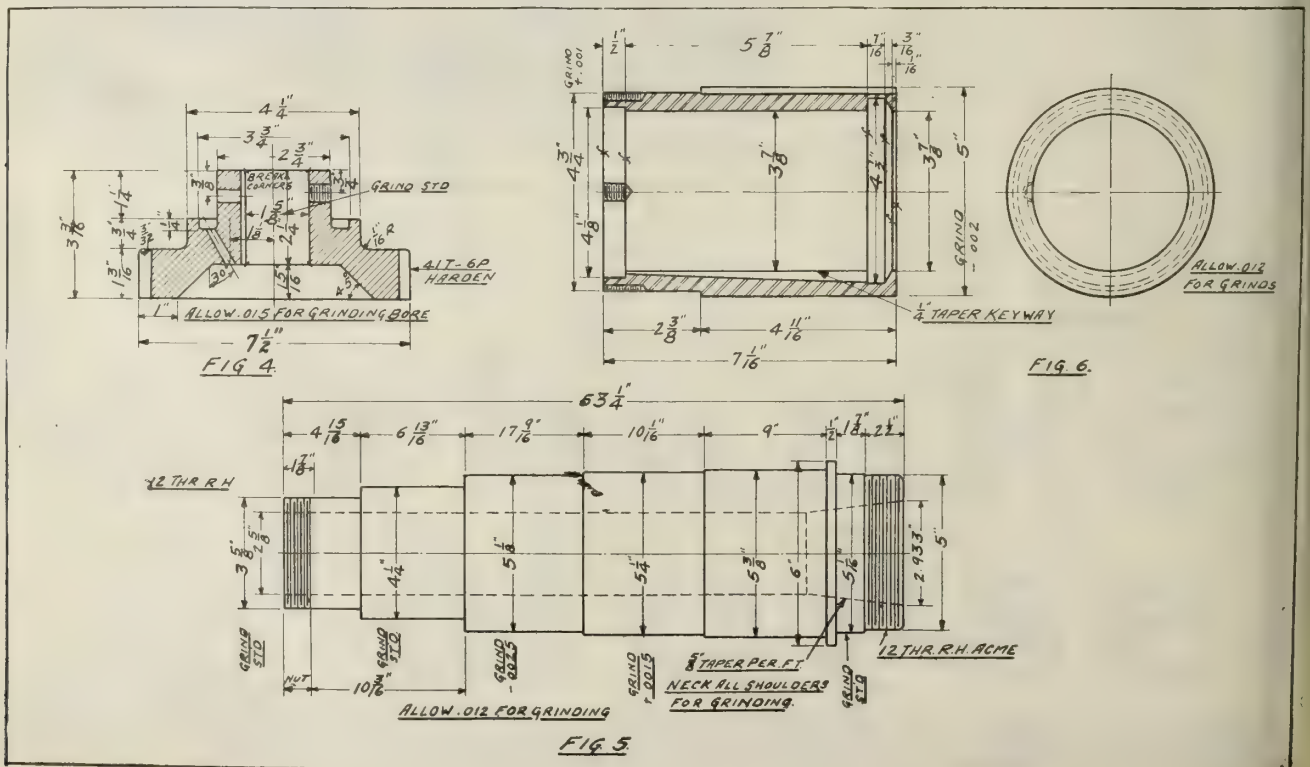
Work on Spindle.

The spindle shown at Fig. 5 is used on a 30-inch high duty lathe, and Fig. 9 depicts the operator at work on one of these spindles. Following are the steps taken in its completion. The spindle is placed in a special fixture, then the 6-in. diameter is faced in two cuts. The end of the spindle is next faced, then the 5-inch diameter portion is rough turned. The 5 1/16 in. diameter is next to be rough turned, after which the 6-in. portion is finish faced. The end is now finish faced, and the 5 in. part finish turned. The corners are next broken, these steps complete taking 53 minutes.

The shaft is now drilled for chasing, after which an Acme R. H. thread of 2 per inch is completed on the 5 in. diameter portion of the spindle. This operation takes 10 separate steps. After these steps have been completed the taper hole in the spindle is bored, also the center hole. From the start to the finish a total time of 479 minutes is necessary to complete the piece. It might be well to add that a limit o hours is allowed on the spindle though the time steps as mapped shows the floor to floor time to be minutes.

Pulley Hub.

The last example, Fig. 6, shows a ley hub made from machine steel w is finished in a floor to floor time c minutes. A three jawed univ chuck is used for holding the hub, the first step is to bore half way thr the piece with an inserted high s cutter. The part is now rechucked the remainder of the hole bored. next step is finish boring,a single high speed cutter being used.



FIGS. 4 TO 6—SHOWING THE HEAD GEAR, PULLEY HUB AND SPINDLE.

Outside Jobs And How They Were Accomplished

The Repair Business Is An Exceedingly Interesting One—How Channels Were Straightened—Turning Heavy Shaft On Its Own Bearings—Making a Rejected Job Pay, and Other Valuable Hints.

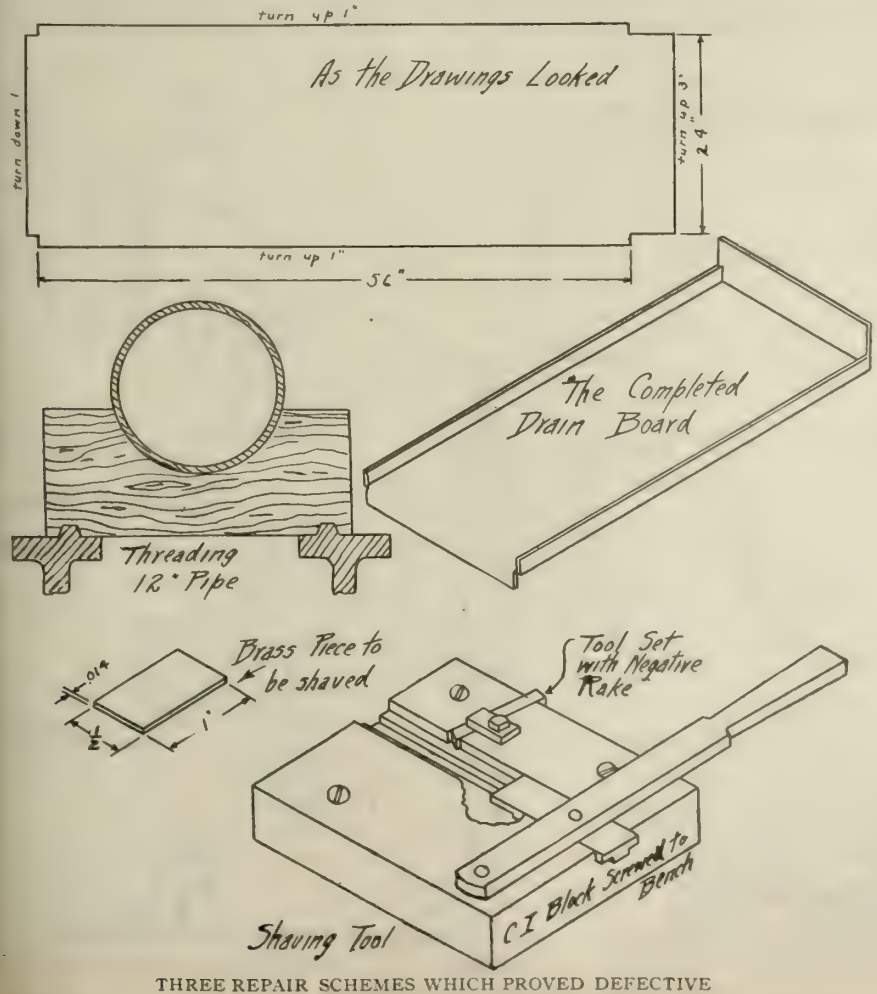
By DONALD A. HAMPSON.

THERE is always variety in the jobbing and repair business, even if there is not much profit. Some owners object to having their plants known as "job shops" or "repair shops," thinking that it casts a reflection on the place—one man went so far as to make his sign and his stationery read, "Research, Development, and Specialized Repairs," in the hope that it would lend dignity to his business. But after all, the biggest locomotive and shipbuilding plants take in repair work as a regular part of their business and a visit to a good many of the most highly specialized machine tool plants during slack times shows outside repair work and special jobs being done.

The repair business can be made to pay if each job is charged with all the incidentals belonging rightly to that job but when you "throw in" half an hour of a busy executive's time or don't charge for an hour's drafting or do a hurry job without adding enough to straighten up things the next morning, or fail to add for dressing a set of chisels that were ruined on some hard steel castings then you are going to lose money. Frequently a shop makes an estimate on a piece of work and fails to add the cost of estimating to the price or, in the struggle to get business, will not charge for some items such as when a boy tends the hack saws or runs a bolt cutter and he stays on that job whether the machines are running full time or not.

More extensive jobs ought to have a liberal charge added to the price to cover the work of "running down" various items of material and parts that have to be secured from a distance—no one would believe the amount of effort involved in such work until they have tried it once.

But though the business side may have its charms, it is the engineering features that appeal to the mechanical mind. The ingenuity that does the seemingly impossible or that disregards conventional methods and gets out the work with the equipment (or lack of it) at hand. This is the side of the jobbing business that appeals to the mechanic, it is part of a liberal education to work in a shop doing such work.



THREE REPAIR SCHEMES WHICH PROVED DEFECTIVE

How We Straightened Channels.

They were putting up the elevators in a new hotel down town and when they came to place the channels they found them badly bent, due to mishandling on the railroad. They were 12" channels and we had no special facilities for structural work, but we agreed to try to straighten them. We had a planer with 15 ft. table and the channels were only a little longer than this.

Actually, it was much easier than we had anticipated. The high part of each bend was chalked, then this was placed down and resting upon a one-inch parallel, and heavy straps bolted across the channel on either side at distances of about 15 inches. By drawing the straps down with the bolts, the channels were quickly straightened. The bends where the web was up were hardest to straighten and, to better stretch the metal, peening on top was resorted to along with pressure.

Turning a Heavy Shaft in Its Own Bearings.

The local brewery was extremely busy turning out "cereal beverages" and as we had done most of their work, we got the call when they wanted a section of the ice machine crankshaft turned. It seems that the flywheel had been loose for a good while, eating into the shaft and getting worn in the bore so that there was a continual pound. A new wheel had been ordered from Milwaukee and would be delivered the following Monday, but, in the meantime, the shaft must be dressed off straight and 1/16" smaller, which was the size the new wheel was to be.

We looked the job over and decided that the best way was to use the cross rail from the 20" planer. Accordingly, a pair of brackets were cast and machined—these fitting the back of the cross rail, and the face of the ice machine pedestals. The clapper block of the tool head was bolted down. Three Armstrong tool holders—straight, R.H., and L.H.—were provided and one of the boys set out for the brewery. He was back before noon the next day, having set up his fixture and turned off a 15" section of 10" shaft. The engine throttle valve was the "gear box" that produced just the right cutting speed for the work.

Big Press Work Done With Hand Tools.

A certain rich man wanted to get brass tracks made for the sliding doors in his house to replace those of blue steel which were originally installed. The drawing shows the shape. If we had received an order for ten thousand feet, we would have rigged up some arrangement to roll the section, but only eight 60" lengths were wanted—and these regardless of cost.

Our tools consisted of a piece of cast iron and one of steel—and a planer. We made a rough pattern and got a casting five feet long that was bolted to the planer and cut with the proper shaped channel. The piece of steel was whittled to form the punch, or male member, and this was to be used with a hammer. Straps were put on each side of the casting to hold the brass light enough to permit drawing but firm enough to keep the flanges out flat and straight. By using a soft brass, the forming was easily done—the work was gradually formed, starting at one end and working over the whole length with the "first draw," then going over it a second and a third time, until when finished it looked very nearly as good as if formed in a big press or rolled.

A Small Tool Job.

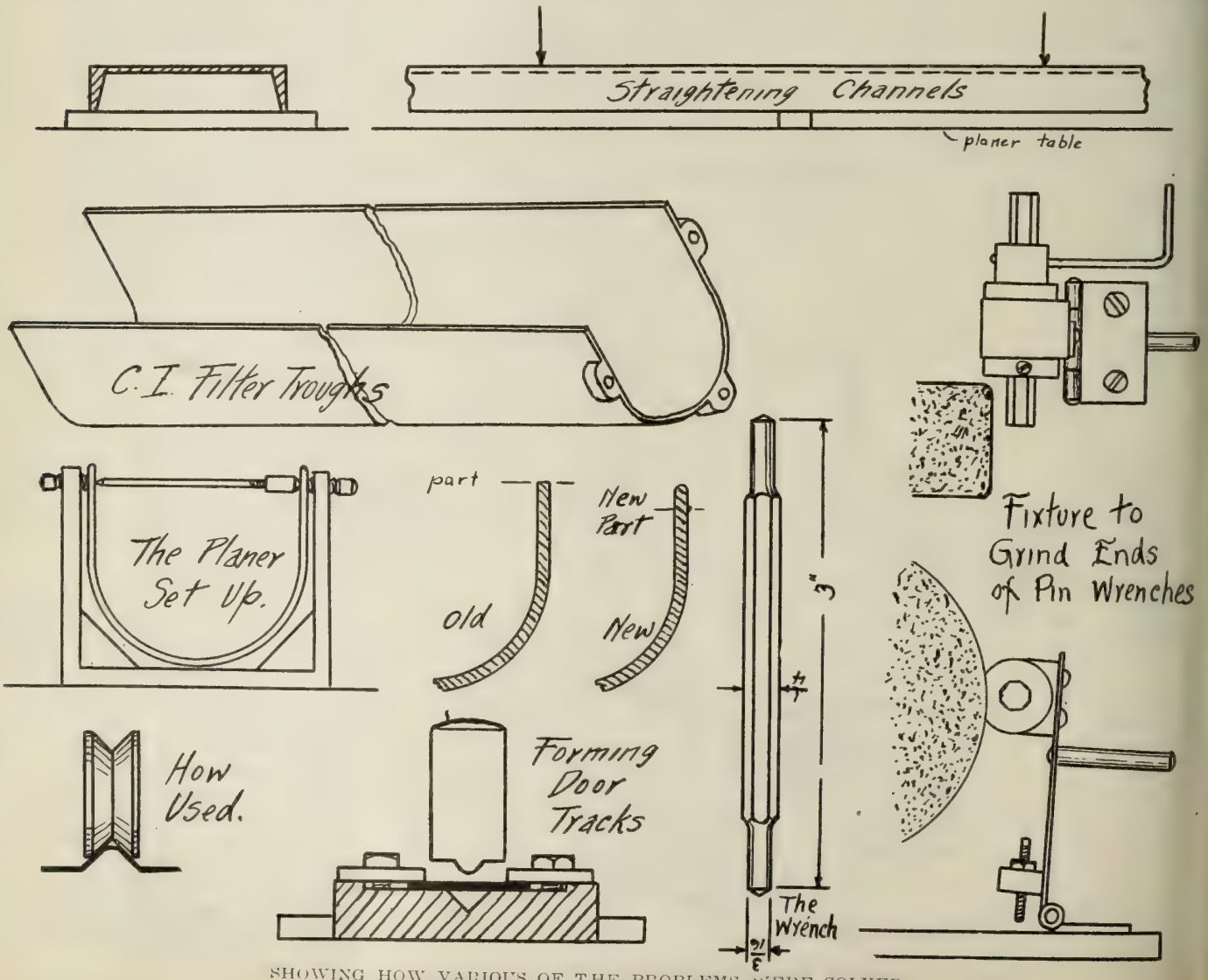
Our shop did the screw machine work for a suburban plant without such facilities. One of their products was operated by a little pin wrench such as represented in the drawing. Originally, these were made of 3/16" C.D.S., pointed and cut off, but a better article was desired and they settled on octagon tool steel with each end turned to fit their holes.

This steel was secured from a house that supplies steel for dentists' tools—in fact, enough steel was robbed from a dental order to make 10,000 of the pin wrenches under consideration. Long ago we formed a high regard for the quality of the steel in these tools with which the dentist prys and probes and punches and so we doubted the practicability of running off the bars on the automatic, but the steel salesman assured us that the toughness of the tools we so respected came from the temper and that the steel he would send could be worked at automatic speeds.

Well, it could not—nor at any other speed. We tried all speeds and feeds and various cutting compounds and ultimately ruined a perfectly good set of tools. The experience proved that the steel, just as it was, would make ideal pin wrenches for our customer—tools that would neither bend nor break, so we designed a "fixture" to grind the octagon down to a round.

An eight inch T hinge formed the basis of the fixture. In use, the butt end of this was fastened to the table of an emery grinder with the strap end pointing upward and carrying the work holder. The latter consisted of a socket rivetted to the hinge and a piece turning in the socket whose axis was parallel to the grinder spindle. The piece that turned was collared to keep it in the same relation to the socket, one end carried a short crank, and the other end was drilled to receive the octagon stock.

The latter was sheared off to length. Then the pieces were placed in the hole and held by a set screw and the operator brought the work in contact with the emery wheel with his left hand while turning the crank with his right. In this way, the desired round was quickly produced. A stop was used to maintain the size within given limits. This method was not as quick as a screw machine process, had the latter been possible, but it did a good job at a reasonable



SHOWING HOW VARIOUS OF THE PROBLEMS WERE SOLVED.

price and with little tool expense; it used up material that otherwise would have to have gone through more or less negotiation and it saved the cost of heat treatment.

Turning a Rejected Job Into a Paying Contract.

A nearby foundry does the casting for a large filter manufacturing concern. Most of this work is installed without machine work other than some drilling but occasionally there are parts that require machining and the foundry gets bids from the various shops about town. One of these jobs was the work on 100 troughs about seven feet long and weighing 250 lbs. each (see sketch). The long edges were to be planed, holes drilled in each end, casting painted, and delivered on motor truck. Our bid was $4 each; a neighbor bid $2.50 each and got the job. Also, he lost money and when the job came up again he refused to do them at any price, so we got a chance at the $4 price—and made good.

To hold the work on the planer, conventional brackets were cast and set-screwed. These held the work steady, with a screw post inside at the three bracket positions to prevent collapsing. A clamp at the bottom of the U at each end was all the fastening required. A well planned handling arrangement simplified the on-and-off work.

The other people had lost out on the planing and the drilling. The narrow edges of the castings often showed hard spots, little chilled overflows, and sand. They could not use a flat tool and feed downward and the work sprung and jumped under cross cuts. These were the planer troubles we had anticipated and when we got the job we avoided them by changing the shape of the pattern. Instead of a flat edge coinciding with the parting line, we changed the edge to half round and arranged with the foundry to part the moulds about an inch back—the width of the planed edge made no difference to the filter people, who merely required a straight water level line.

The clean round edge made it possible for us to use a flat nosed tool and plane directly down. The tool was always cutting clean, soft metal, with the thrust in the direction of the casting's greatest stiffness. When set, the tool was good for 50 or more castings. We averaged three castings per hour.

After planing, the troughs were delivered on the floor ready for drilling. The end holes were the biggest job of drilling. We had a Stow electric drill, geared to 500 R.P.M., which was rigged up for this work. A plate was cast to clamp to the lugs on the ends and this plate had cast lugs, or cradles, to place the drill in for each of the three positions. Incidentally, the plate carried the drill bushings. A lever was provided and all the workmen had to do was to clamp on the plate, place the drill in a cradle (not even clamp it), slip in the lever, and push. We did well at the $4 rate, in fact, we would not have lost if we had received only $2.50. But the thing that saved us money was not machine shop practice at all—it was the slight change in the foundry work.

Another Use for Wood.

Some short lengths of 12" pipe had to be threaded for a steam plant. Nobody within a hundred miles had a pipe machine and we had no pipe centers for this size. And as we didn't want to go to the expense of making them up for one job we cut a piece of 2" maple as shown by the drawing. A light band over this was added for security, though the weight would almost had held the pipe down. One end chucked and the other in the wood steady rest made a good set-up—one that may be used for other extraordinary jobs.

Shrinking on Bands Without a Heater.

New wheel centers were being put under a fire truck. We got the job of putting the old felloe bands on the new wheels. These bands were 30" diameter and about 7" wide and had to be shrunk on. Lacking better facilities, we set each band in turn on four fire bricks out in the yard. The wheel centers were also taken out in the yard and placed nearby, ready to be fitted, and with three steel pieces clamped on to serve as stops to correctly position the felloe. A wood fire under the band quickly brought it to a red heat, two men with tongs picked it up and dropped it over the center to the stops—and went back to the next band.

Even Housework Has Its Roots in the Machine Shop.

A State institution near us was gradually installing metal drain boards in the numerous kitchens. That doesn't sound like machine shop work! These were made of ⅛" iron sheets with edges turned up and down, fitting into existing wall spaces. It had been the practice to buy the sheets locally, of a size near the requirements, and send them to a distant sheet metal shop. One of the managers wanted us to try the job—we told them we had no sheet metal machinery but we knew we could bend them if they didn't object to a few dents. And now we have four or six a year to get out.

Again the planer comes in handy for other work. We first cut a square notch out of each corner. The first bend was always an "up" bend the long way though. We made it by clamping to the planer table and hammering the sheet downwards against a vertical face; this was done on a wide planer with just the bend width overhanging the edge and with the opposite edge blocked so our hammering did not disturb the parallel setting. Then the piece was moved to a narrower planer where the bent edge could lap over and act as a stop while the second long side was bent.

After that the trouble began, though by always backing up the piece against the thrust of the blow we got along pretty well. We would select from the stock rack the longest piece of square or rectangular that would go between the turned up edges, place this near the edge of the planer with stops (posts) behind, and clamp the bent sheet down on top with 1" or 3" overhanging as the case might be; to clamp the job securely, we would use a bar of 2 x 3 laid clear across the top. The final bend on the end was always the opposite way and, as such, it came easily. With a little care, it was possible to turn up the edges, hammering them so that the joint was water tight.

Shaving Brass Slips.

In connection with a manufacturing job, we had several thousand pieces of brass as shown by the drawing that had to be re-sized from an average width of 0.500" to a close 0.499". We tried several methods of doing this, only to learn that there was no royal road to the end. We finally made the simple fixture shown and pushed the brasses through one by one. This sounds slow, but considering the accuracy we got and the fact that one of the girl helpers soon acquired speed, we got out of it quite nicely. Our cutter was a 5/16" square high speed bit and our fixture made of an odd piece of cast iron.

INTERESTING MAPS.

We have received two interesting maps from the Musson Book Co., Ltd., Toronto, dealing with Eastern and Western Ontario respectively. These maps are very well prepared and show not only the main roads, but every secondary, side, and concession road. Every railroad, city, town and village is also listed. These maps should appeal to business men generally, both for pleasure driving, or for use when planning motor truck hauls.

CARBON CONTENT.

The carbon content of gray cast iron affects the melting point, the higher the carbon the lower the melting point. The melting point of the oxide of cast iron is higher than that of the metal, which fact makes it necessary to use a flux to dissolve the oxide or cleanse the molten metal. Gray cast iron containing 6.0 carbon melts at about 1,920 degrees F.; 4.0 carbon at 2,100 degrees; and 2.5 at 2,192 degrees. The oxide fuses at about 2,450 degrees.

Is It Possible To Minimize Drawing Office Errors?

There Are Certain Common Errors That Crop Up In Most Drawing Offices—A Proper System Of Checking Should Be Used Whenever Possible The Design and Detailer Should Hold Consultations.

"I WAS once told in all seriousness that draftsmen employed in a certain establishment did NOT make mistakes. If a mistake was made, the delinquent was not given a chance to repeat the offence, being dismissed forthwith, and his place filled by a less fallible individual." So comments W. E. B. B. in "Mechanical World." He continues:—

On reflection, one is obliged to conclude that the survivors at that particular establishment must have been veritable supermen, and doubtless by now have all obtained responsible and lucrative Government appointments. While it is easy to see the absurdity of such bombastic exaggeration, it is certainly possible by adopting proper methods to avoid many of the vexations and delays caused by mistakes in drawings.

Mistakes most frequently met with are:

(a) Arithmetical blunders, causing fouls, etc.

(b) Errors of judgment, resulting in failure of the structure or machine to do the work for which it was designed.

(c) Faulty design of castings, forgings, etc., due to imperfect knowledge of the processes of manufacture or of the limitation imposed by shop equipment.

(d) Mistakes resulting in great difficulty or impossibility of assembly of machine components.

The arithmetical blunder can and should be almost eliminated. The surest way to effect this is to have every drawing checked by an independent authority before it is issued to the works. In the small office this may best be effected by an exchange of work between the draughtsmen themselves.

A Checker Essential.

In larger concerns it will pay to employ a checker exclusively for this work. This plan has a good deal to recommend it. Checking calls for rather special qualities of mind, and it is possible for a man to be a fully competent draughtsman yet a very indifferent checker. It may, of course, be argued that all this takes valuable time and adds to the drawing-office charges. It must be remembered, however, that time spent in this department may be saved many times over in the shops, besides the probable saving of many costly components from the scrap-heap.

Errors due to (b) are best eliminated by thorough and conscientious work in the designing and estimating office. If due care and forethought are exercised here, the work of detailing is rendered vastly easier and some assurance given that the preliminary ground has been well covered and working contingencies foreseen.

It is an excellent plan, wherever possible, to bring designer and detailer together for a consultation before proceeding with a job.

All possibility of misunderstanding is thereby eliminated, and the specification may be discussed in detail. Mistakes have occurred through lack of this precaution, and the draughtsman has been led unwittingly into a trap through some ambiguity in the design.

As in other departments of engineering concerns, the closer the co-operation betwen designer and detailer, the smoother will be the progress of the work, and chances of error coming under this heading will be reduced to a minimum.

The best guarantee of immunity from errors due to (c) is provided when the works management are taken into frequent consultation.

COMMON MISTAKES. HOW TO AVOID THEM.

Arithmetical blunders. Errors of judgment, resulting in failure of the structure or machine to do the work for which it was designed.

Faulty design of castings, forgings, etc. Mistakes resulting in difficult, or almost impossible, assembly of machine components.

To avoid errors, it is an excellent plan, whenever possible, to bring designer and detailer together for a consultation before proceeding with a job.

When Doubt Exists.

Wherever doubt exists as to the relative merits of castings versus forgings, or how best to dispose ribs to permit of ease in moulding, whether it is more economical to make a new pattern or to alter an existing one—these are points best referred to the practical man whose experience in such cases is of the utmost value.

For similar reasons the machine-shop foremen should be consulted. It sometimes happens that the machining on a casting may be done in half the time merely by the addition of an inconspicuous boss or lug or by a trifling rearrangement of the piece.

Information with regard to the maximum capacities of various machines, size of largest lathe gap, greatest stroke of planing machines, a list of cutters for spur-gears and of hobs for worm-gears, with any tooth numbers that should be avoided—all this kind of information is of frequent value to the draughtsman, and should be filed for reference in a convenient form.

Much may be learnt from an occasional visit to the shops while work is in progress, and most firms give every facility and encouragement to the draughtsmen to keep in touch with the practical aspect of their work in this way. When engaging the drawing-office staff it is usual to give preference to those candidates whose qualifications include some years of practical training in the shops.

The value of such training is obvious, not only in imparting a knowledge of shop processes, but in implanting a realization of the difficulties with which the shops have to contend, difficulties which are quickly grasped when the draughtsman himself has had first-hand experience of them. There is also a moral value in some years of shop training which is undeniable. Its effect on character and the broader outlook it conveys by reason of direct contact with the concrete elements of the profession and with those whose business it is to "deliver the goods," engenders a lasting realization of the necessity for co-operation between drawing-office and works which is of the greatest value.

Class (d) represents pitfalls which can be avoided only by adequate supervision, the exercise of imagination and watchfulness on the part of the draughtsman at every stage.

An excellent practice followed by many large concerns is to file a record of the behaviour of every machine under test prior to its despatch to the customer. In this way the designer is able, by reference to the record for machines of a similar type to the one he is dealing with, to avoid many pitfalls and so profit by the accumulated experience of the past.

It is not uncommon for mistakes to occur through lack of uniformity in the method of projecting views on drawings.

It matters little whether the "first angle of projection" method or the "third angle of projection" is adopted; but what does matter is that one system is adopted and is rigidly adhered to, otherwise there will be confusion, and sooner or later serious mistakes will be made.

There is no uniformity at present in drawing-offices regarding this question of projection, and should a man move from one firm to another it is quite likely that he may have to change his method of projection, and for a while at least he will be in some danger of falling into his former habit of regarding the different views. It seems a pity that this matter cannot be thrashed out and a standard system of projection adopted universally for engineering work. In conclusion, it may be worth while to point out for the benefit of those who have a bias towards "hustling" methods in the drawing-office, that the quantity of paper which a man covers is of secondary importance to the amount of care, deliberation, and forethought which is embodied in his work. There are doubtless men whose best work is done in a hurry, but they are the exception rather than the rule, and usually their efforts are spasmodic and their accuracy too often in inverse ratio to their speed.

The ultimate aim of the management should be to strike a just balance between rapidity and exactitude.

ALIGNING REAMER.

The Chadwick and Trefethen, Portsmouth, N.H., have brought out a new type of aligning reamer. In this new tool they embrace the general principle of their six blade adjustable reamer, with an adjustable bushing that forms a pilot for aligning. The back parts of the blade are ground cylindrical, also forming an adjustable guide after the cutting blade has passed through the first hole, retaining the reamer in line for the second hole. Cutting parts are made of special alloy semi-high speed steel. This design is adaptable to the reaming of automobile piston pins and work of similar character.



WELDING AND CUTTING



Oxy-Acetylene Welding Cast And Sheet Aluminum

Malleable Iron Also Included—Cast Aluminum—Preparation of Part—Preheating—Question of Flux—Puddling and True Method of Welding—Treatment After Welding—Similar Data on Sheet Aluminum.

In the March 24th issue of Canadian Machinery, we published, in our welding section, information on the welding of iron and steel. In the present material we will follow up the subject of oxy-acetylene welding and cutting considering the welding and cutting of malleable iron, cast aluminum, and sheet aluminum.

Malleable cast iron is probably more difficult to handle properly than any other metal. Castings to be made malleable are made of white iron where the carbon is in the combined state (not in the free graphite form, as in grey iron). During the process of making the casting malleable, some carbon is removed. The rest goes out of combination and remains in the iron where it remains free, not in the graphite form, but as true carbon. With the carbon in this form, the casting is soft and ductile like wrought iron. If a malleable casting is heated, as in welding, the carbon at once enters into combination with the iron and makes it hard, brittle and no longer malleable.

It is best to consider the welding of malleable castings from the viewpoints of two users of the welding process:

1st The manufacturers of malleable castings.

2nd The repair man.

When castings have to be repaired by the manufacturer, as they come out of the sand and before they are treated to make them malleable, prepare and weld exactly the same as cast iron. Use cast iron flux. Use a white iron welding rod. On no account use a filler containing silicon—iron containing silicon cannot be made malleable.

Castings that have been made malleable will lose their characteristic quality if welded and it is necessary that after welding, as described above, they be treated by the manufacturer. In the case of malleable parts broken in service and where the repair has to be made by the owner or a repair man, prepare as for cast iron, but as a welding rod use Tobin bronze with a brass or bronze flux. This will give an exceptionally strong joint, but one which of course can be detected by its appearance. Care must be taken to not bring the edges of the casting to a higher temperature than is necessary to make the Tobin bronze adhere satisfactorily. If this precaution is not observed the malleable properties will be destroyed.

Cast Aluminum.

The welding of aluminum castings at first offers some difficulties to the operator and experience with this metal is required before thoroughly satisfactory results will be obtained. The difficulties that arise are due to the fact that aluminum has a comparatively low melting point (1,200 deg. fahr.), whereas the conductivity and specific heat of the metal are high. Due to this fact, a comparatively large welding flame has to be employed on the work, thus calling for skillful manipulation of the blow pipe to prevent holes being burned in the parts operated upon. Aluminum in its pure form is seldom used for castings which are, as a rule, alloys of aluminum and copper, or aluminum and zinc. The aluminum-copper alloy is much easier to weld than the aluminum-zinc alloy, due to the facts that there is less tendency to crack on cooling and that oxidation is not so rapid.

To insure good work with aluminum it is essential that the work be absolutely clean. Most aluminum castings that have to be repaired have generally been in contact with oil or grease. To remove all traces of oil from the aluminum takes some considerable time, as the oil seems to penetrate into the metal. It is best to heat the castings slowly over a mild charcoal fire and carefully wipe away the oil as it "sweats" from the metal. In some cases gasoline can be used for cleaning aluminum or other castings to advantage.

Parts over ¼ inch thick must be bevelled the same as in the case of cast iron. Very careful setting up and aligning of the parts is necessary. As aluminum castings approach their melting point, the metal becomes very fragile and unless careful precautions are taken, the castings are apt to collapse or become distorted during the welding.

In order to prevent collapse during the welding and preheating operations, it is good practice to place a sheet of paper on the inside of the casting next to the crack to be welded. Back this paper with damp fire clay and pack up with asbestos fibre until a firm support is obtained. The paper prevents the fireclay from getting into the weld. With this light backing, or mould, the castings can be welded easily. The mould should be large enough to cover sufficient area around the crack so that the heated aluminum in the vicinity of the weld will not break down. Whenever a weld is to be made close to a bearing, it is necessary to remove the babbitt (which would melt) and then clamp mandrels in the bearings to keep them in alignment.

Preheating.

The beginner should preheat the casting except in cases where the part to be welded is a projecting lug or flange. After the welds are made, except in the case of a lug or flange, the work should be gently, uniformly reheated and cooled slowly, thus insuring the removal of any internal strains. Preheating or reheating when done must be carried on carefully and slowly. The casting should not be preheated to more than 900 deg. fahr. Above this temperature the metal gets very fragile and is apt to collapse. It is generally best to preheat aluminum work with an illuminating gas torch, using very little or no air, so as to give a large bushy flame and avoid localized heating. The torch, however, must not be left playing on one part of the casting too long. It should be controlled by a workman, who should keep the flame moving constantly. When preheating aluminum castings, it is advisable to test the heat of the metal with a stick of half and half

solder. As soon as this will melt, on touching the casting, it shows that the work is heated sufficiently, and is ready for welding.

For a filling material when welding aluminum castings, a rod preferably of the same thickness as the mteal to be welded should be used. Alloy aluminum rods should be employed.

Opinions vary as to the necessity or desirability of employing a flux when welding aluminum castings. A good deal depends on the method employed in making the repair—that is, whether the operator employs puddling or true welding. Remember that oxide of aluminum is very easily formed; it is heavier than the metal and consequently tends to sink into the body of the molten mass from the surface, where it is formed. The melting point of the oxide is much higher than the melting point of the metal. The presence of oxide in a finished weld will render it brittle and spongy. It is therefore essential that it be removed either mechanically, as is claimed can be done when puddling is employed, or by means of a flux. The flux must not only act on the oxide on the surface, but throughout the molten mass as well. The flux, when used, must be of good, proved quality and should contain no acid or alkali which might have an injurious effect on the weld if traces happened to be left in the body of the weld. Do not let low prices guide you in the selection of a flux. The ingredients in a good flux are costly.

The flux should be applied with a heated welding rod, as in the case of cast iron, and should be used sparingly. Aluminum flux should at all times be kept in air-tight cans as it quickly deteriorates. Repairs to aluminum castings by the oxy-acetylene process can be performed in two ways—the puddling method and true welding method.

The Puddling Method.

The operator must provide himself with a ¼ inch or ⅜ inch steel rod about 18 inches long, flattened at one end. The welding flame should be carefully regulated. A slight excess of acetylene is desirable and tends to prevent oxidation. Do not touch the work with the white cone of the welding flame. Play the blowpipe flame on the line of weld and bring it to a molten state, then scrape the surface with the flat end of the iron rod or paddle and remove traces of dirt and oxide; reapply the blow pipe flame and add welding rod, after a little rod is added lay aside the rod and take up the paddle, which should be kept hot at the flat end. Keep on playing the blowpipe flame gently over the added metal and skim the oxide formation from the surface with the steel rod. Then scrape the bottom of the joint through the molten metal and bring any dirt or oxide to the surface and skim off. Then add more metal and repeat the puddling until the repair is effected. Welds made by this process, although reasonably strong, are apt to be somewhat porous and are not as sound as welds made by the true welding method next described.

True Welding Method.

Regulate the blowpipe flame as in the puddling method. Play the flame along the line of weld and bring a short length of the line to a molten state. It is difficult for the beginner to judge when this is accomplished and at the start it is best to keep gently touching the work with the welding rod to find out. While melting the casting along the line of weld, warm up the end of the welding rod in the blue part of the flame which is not actually playing in the crack. Dip the rod in the flux powder, some of which will adhere to the rod. Then start and melt some of the rod into the weld, stir the molten metal with the welding rod and get it to flow uniformly. If uniform flow cannot be obtained add more flux. Repeat until the repair is completed.

Treatment After Welding.

Reheat when necessary. The work must be allowed to cool very slowly and should be protected from air draughts. Wash off with warm water any traces of flux. A welded joint is easy to finish. Experience shows that a Vixen file or wood rasp is preferable to the ordinary file for this work. Do not use any of the so-called aluminum solders as a filler when welding aluminum. Solder should be used only to build up worn surfaces, or to repair cracks in parts of castings which are not under strain and strength is not essential.

Sheet Aluminum.

Sheet aluminum is as a rule pure metal and has to be handled somewhat differently from an alloy. Where welding has to be done, the sheets are very rarely over ⅛ inch in thickness. If they are, they can be welded in the same way as a casting, except that drawn aluminum rod must be used as a filler and sheet aluminum flux used. Preheating is seldom necessary and any reheating or annealing that may be deemed advisable along the line of weld can be done with the blowpipe flame, using a slight excess of acetylene. Bevelling of the plates before welding has hardly ever to be done and practice will show that the plates tend to bevel themselves as they come up to the melting points. along the line of weld.

The welding of aluminum sheets less than ⅛ inch in thickness will be found to be a somewhat delicate operation and a good deal of practice is required before sound, neat joints can be made. The process is somewhat similar to lead burning, and a lead burner rapidly becomes efficient in welding thin aluminum sheets. To facilitate the operat it is desirable to use a light weight b pipe.

Sheets between 1/16 inch and inch in thickness need not be bevel or flanged. Sheets 1/16 in. thick under should be flanged to a height 1 to 1½ times the thickness of metal. Clean the work thoroughly leave it bright along the line of w For quantity work. the manufacture sets of good heavy clamps will repay the outlay, and will help sec sound, neat work.

Preheating of sheet aluminum p to welding is only necessary occasion and then only to counteract moveme of the plates due to expansion. Dra aluminum wire must be used. W work is flanged no filler is necessary

A sheet aluminum flux must be ployed. The flux must not contain or alkali which might have a corrod effect if traces were left in the body the weld or on the surface of the she When used dry it is applied by dipp the heated welding rod into the pow when sufficient will adhere for appl tion at one time. Some fluxes can used wet or dry, but before applica by the wet method is tried, assura should be obtained from the source supply that the flux is suitable to used wet.

To use the flux in a wet form, i mixed with clean water in suffic quantity to produce a cream consiste mixture. To apply, use a piece of cl rag or cloth, dip in the flux and ap along both edges of the metal to joined; let the flux be applied at l ⅜ inch away from the line of weld. effectually removes the surface ox Then apply a second coating with small, stiff brush. Any further flux quired to obtain uniform flow of m can be added by dipping the weld rod in the mixture.

Execution of Welds.

Careful regulation of the blow flame is necessary. A slight excess acetylene is recommended. Avoid tact between the metal and the w cone of the flame. It will be found the first fusion of the metal takes s time, due to loss of heat by conducti and on this account the rate of welc will increase as the work progresses as the edges ahead are gradually hea by conductivity.

For sheets 1/16 inch thick fusio obtained before conductivity has time to diffuse the heat. With thic sheets conductivity absorbs a great of the heat and a larger blowpipe must be used in order to produce r fusion and prevent oxidation which take place if the weld is made slo With sheet aluminum, expansion t bles are not so difficult to deal with a the case with iron or steel, due to

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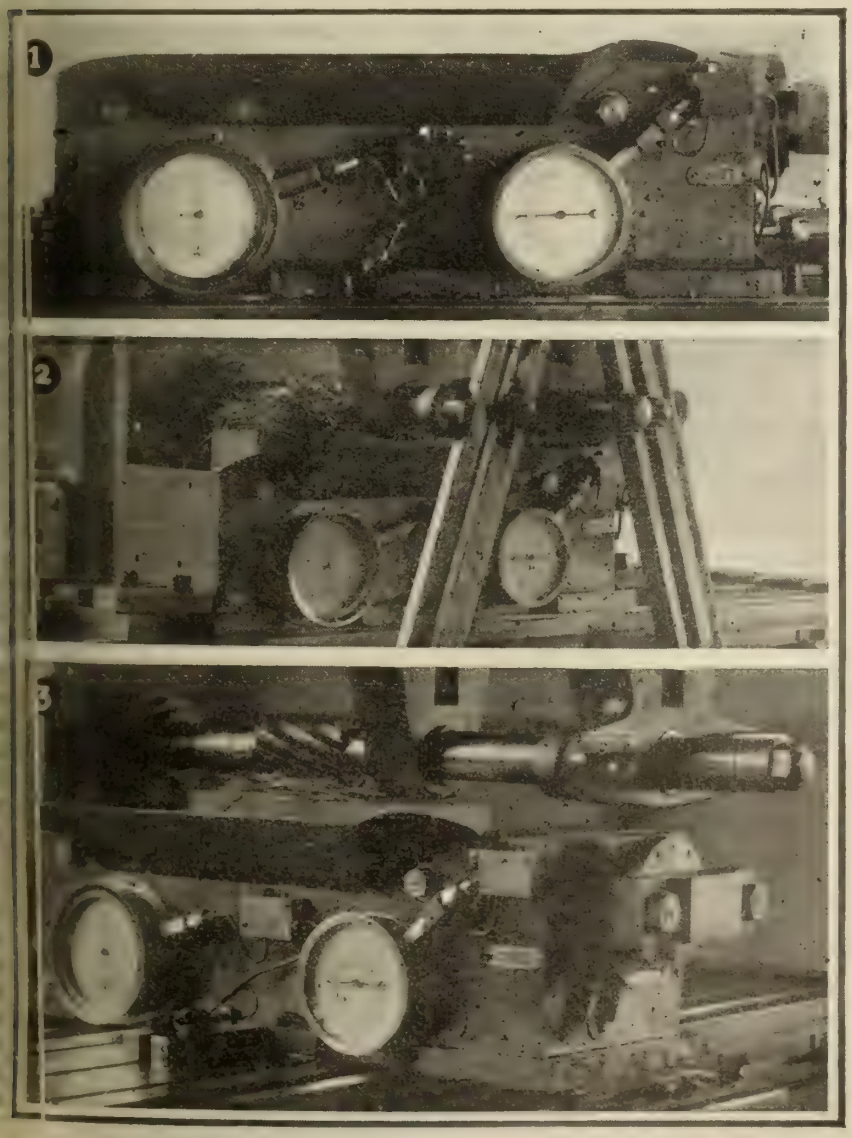
Determining Pressures Exerted By Cutters

A New Device Which Tells At a Glance The Pressures Exerted On The Various Parts of a Milling Machine—It Also Shows Difference in Pressure Exerted With Cutters of Different Form.

VARIOUS devices have been designed from time to time for determining the pressures exerted by a milling cutter on the various working parts of a milling machine, but up to the present time there has been no mechanism which could be relied upon to give accurate readings of these pressures so that the designer of milling machines as well as the designer of fixtures and milling cutters for use on them has been very much in the dark. It has long been recognized that accurate knowledge in this regard would also be a material assistance to the designer of machine parts, which are to be built, because in the final analysis, the pressure of the cutter is first exerted on the piece itself and transmitted to the fixture and then to the milling machine.

Another element on which there is practically no existing knowledge is the difference in pressures exerted by cutters of different form or different design when taking duplicate cuts. It is true that a carefully calibrated machine equipped with a direct connected motor drive and a meter provides the means of determining the difference in horse power consumed by various cutters, but means are entirely lacking for separating the vertical thrust, the horizontal thrust, and the longitudinal thrust, and thus determining the pressures in these three directions. Also, with different combinations of feeds and speeds, the efficiency of the milling machine varies, and it is therefore important to have the means of determining the actual cutter pressures entirely independent of the efficiency of the machine or any part of its mechanism.

In order to attain this object, the Poliakoff Dynamometer was devised. The accompanying illustration show it as it is now being offered by the Cincinnati Milling Machine Co. This Dynamometer provides means for reading the pressures exerted on any milling cutter while at work, in two directions, the reading being taken direct from the dials shown.



FIGS. 1 TO 3—SHOWING THE DEVICE IN USE.

Fig. 1 is an illustration of the Dynamometer. It consists of a working table which is supported by a base plate, which is in turn bolted to the table of the machine. Fig. 2 shows the Dynamometer in place on a very large miller, taking a heavy cut in steel. The vertical downward or upward pressure of the cutter is read direct from the right hand dial. The longitudinal pressure of the cutter is read direct from the left hand dial. These are the pressures with which the designers and users of milling machines, as well as milling cutters are most concerned. However, if it is desired to also obtain the crosswise pressure, that is, the pressure in line with the milling machine arbor, as for example, if it is desired to determine the end thrust pressure, of a spiral milling cutter or a face milling cutter, the dynamometer can be mounted crosswise on the table, as shown in Fig. 3, and the pressure is read from the right hand dial.

The work platen of the dynamometer is supported at each end by a wide "Emery" plate fulcrum, their lower ends resting on two levers which carry a definite portion of the vertical load on the platen to an hydraulic chamber placed centrally under the work table. This chamber is connected with the left hand gauge which is graduated by trial in terms of the vertical load in pounds.

The horizontal load is transmitted through bars which are flexible vertically, to the crosshead seen at the right in Fig. 3, and this crosshead transmits the load to the hydraulic chamber seen between this crosshead and the end of the main frame of dynamometer. This chamber is connected to the right hand gauge by the pipe shown. Heavy springs are used to put initial loads on each chamber so they will show loads in either direction.

The "Emery" plate fulcrums carrying the loads to the levers are so constructed as to be rigid against vertical and cross loads, but flexible to longitudinal loads and the bars to the crossheads are flexible to vertical loads so neither system interferes with the action of the other. Guards are provided

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Queenstown--Chippewa Power Project Is Visited

Even On A Short Tour The Magnitude Of The Work Is Apparent—Seldom Does A Single Job Embrace As Many Branches Of The Engineering Trades As This One—Huge Shovel Is Employed.

by J. H. MOORE

A STUPENDOUS Engineering Undertaking." "A sight never to be forgotten." "Something of which Canada can feel justly proud." The above opinions are but three of the many expressed by the party of engineers and executives who viewed the Queenston-Chippewa development on Friday, July 22nd, under special arrangements made by the Ontario section of the American Society of Mechanical Engineers.

Seldom is a task undertaken that embraces so many engineering problems as the new power scheme we are speaking of. It is hardly necessary to state at this late stage of developments what prompted the scheme. Everybody knows that the water will be brought in from the Niagara River, pass through a huge canal, later creating an enormous amount of power by its very volume. The problem of cutting a canal out of solid rock was itself a great one but practically every engineering trade enters into the successful completion of this project. The mechanical, electrical, structural and hydraulic branches are the chief ones interested, with the transport, and housing problems coming as secondary, yet important considerations.

Important Figures.

Before proceeding with the story of the trip itself, we will briefly review the more important figures connected with this great power scheme. When completed the power plant will consist of 9 units with 500,000 h.p. The effective head on the water is 305 ft., and the capacity of each power unit is 55,000 h.p. The length of the river section is four miles, and the length of the canal 9 miles, making 13 miles in all. The cut in both rock and earth is enormous, being 72 ft. in the earth and 85 ft. in the rock. The concrete water channel is 48 ft. wide, and under normal operations the depth of the water in this channel will be around 30 to 35 ft.

The maximum velocity in the canal will be 10 ft. per second, and the forebay, which is 1,000 ft. long, widens from the standard 48 ft. canal section to 500 ft. at the gate house. The penstocks used are 16 ft. in diameter, and not only is every joint riveted, but it is welded as well.

The power house when completed, will be 600 ft. long and 185 ft. high from its base. They figure the total earth excavation will be 13 million cubic yards, and the total rock excavation 4 million cubic yards. Work was really commenced on this project in May, 1917, and since that time great progress has been made.

To illustrate the detail necessary in a project of this kind, we will review very briefly some of the arrangements necessary to carry on the work. Seventeen highway and railway bridges have been built, two dredges and 14 shovels are used, also a cableway excavator. The writer viewed with interest the largest electric shovel ever made, working like a trojan on the job. Each bucket full means 8 cubic yards of earth and rock, and in some cases the material is lifted as high as 80 ft. Three trips of this shovel and a dump cart is full of material.

80 miles of railroad track have been laid, and over some of these lines pass more traffic than many a line owned by a large railroad company. 24 electric locomotives are used, 26 steam locomotives, and over 320 air dump carts.

The various concrete plants have capacities as follows: The crusher plant has a daily capacity of 3,000 cubic yards, the sand storage a capacity of 100,000 cubic yards, with a stone storage capacity of 250,000 cubic yards. There are 9 stationary concreting plants, 4 moveable paving plants, and 9 moveable lining plants.

Compressed Air.

The compressed air wants are well looked after, there being some 26 units electrically driven, which provide 30,000 cubic ft. of free air per minute. Over 500 temporary buildings are erected, and there are five camp districts for employees, providing accommodation for 6,000 men. With few exceptions electric power is used to drive the machinery at work, and the normal load for constructional purposes is 10,000 K.W.

Leaving these amazing figures to sink in, we will proceed to tell the story of the actual visit. The first place inspected was the power house. Here was to be seen some wonderful concrete work, both in the building itself and in the draft tubes, and ice chute provided. The form work on some of this work is nothing short of marvellous and shows what really can be accomplished with concrete. Without dwelling at length on any particular part of this portion of the plant, the party viewed the turbines, and various electrical units in connection with it. The penstocks with their massive proportions and extreme height came in for quite of lot of comment, and the men working on the face of the solid rock looked like mer scrambling to and fro.

After dinner the screen house w spected together with the wonderf tem of handling the pouring of co The method of transporting the vio materials used is wonderful. Con yors are used for everything. Centr sta- tions distribute the prepared mate al the different parts of the job, an on started, the flow is continuous un th particular portion is completed. T pouring tubes around this job are m numberless, and they are control gates operated at some central sp the case of the sand and stone, t y to a storage station, from there mixer or to some subsidiary poi in the case of the cement, a co e takes it direct from the car to th va ous mixing plants.

Change in Shape.

From this point on the party s ppe numerous times, inspecting the c al different points. At one porti canal channel changes from a t e. dial shape to a rectangular sh vice versa, as you would prefer. is where the old bed of the Niagar i crossed, and instead of a rock c portion is an earth fill, this fact a ing for the change in shape. Th crete work is so arranged that th again gradually assumes a rect section as rock is once more me

At another point in the canal, tain necessary curve has been ured out that the heat loss suff winter by the friction of the wat sing round this curve will preve ice sticking to the side of the c Readers of course will not care t to how his was arrived at, but i how much care has been exerc the preparation of the canal.

When completed the channel w a gradient of 1 ft. per mile, water will flow at a rate of about per hour. At first only two pow will be installed, and a flow o 6,500 ft. per second will be all required for these units.

In some of the concrete work canal channel portable forms a this being on the trapezodial portion. These forms are merely on top, the concrete poured, twelve hours the form can be lifted. For the main channel, the rectangular shape, special c pouring machines are used, these steel forms on either side which the correct distance apart, and

right from the machine, which is self contained. This machine runs on portable tracks on the bottom of the canal channel, and it is a treat to see it work.

The method of blasting rock is particularly interesting. Portable air drills go down for a depth of between 20 to 30 ft. in the solid rock, and holes are drilled about every 6 ft. across the channel bed. After drilling, the various holes are loaded with explosives, "Forcite" being chiefly used, and the charge is set off electrically The huge 8 cubic yards electric shovel then comes along and bites right into that depth.

The dredge "Cyclone" works away at the inlet to the canal, clearing away the earth, so as to allow the proper volume of work to pass through. In fact, to tell the tale properly and in detail would take a volume in itself. Even the huge stone crusher could take a lengthy description. There it appears, a massive mass of machinery, nothing to see inside, but crunch, crunch, crunch, it goes on, eating rocks and breaking them up like we would an ordinary chocolate. There is a spirit of romance to the whole venture, and one cannot help but feel the thrill of at least having been such a wonderful work being performed.

Col. Ellis was the chief guide, being ably assisted by Mr. Tobias, one of the designing engineers on the work. Twenty-one took advantage of the trip, these being H W. Price, Professor of Electrical Engineering, University of Toronto; W. F. Sutherland; Professor Gilchrist, of the Physics Section U. of T.; G. M. Smith; L. Tolson, and J. H. Moore, all of MacLean Publishing Co.; Col. A. D. Lepan, Supt. of Bldgs., U. of T.; Mr. Bradbron; Mr. Lewis, Supt. Machine Shop, J. Inglis Co.; Mr. Quesnell, boiler inspector; Mr. Howard, John Bertram and Sons, Dundas; Mr. Graham of the same firm; Prof. Angus, professor of Mechanical engineering, U. of T.; Harry Angus, constructional engineer; Robert Angus, Senior, retired constructional engineer; G. H. Raitt, Massey Harris Co.; Chester B. Hamilton, Jr., Hamilton Gear & Machine Co.; Mr. Crane; Mr. Boswell, and Mr. Moody of Powley & Townsley, Toronto.

WELDING ALUMINUM.

(Cont'd from Page 32).

Get that the high conductivity of the metal tends to even up the distribution of the heat in the whole.

Owing to the high conductivity of the metal and consequent even distribution of the heat, contraction does not as a rule cause cracking. Remember the metal is fragile at temperatures near the melting point and should therefore be carefully handled while cooling, which should take place slowly and away from draughts. Do not be in too great a hurry to remove clamps. After the work is cold wash away with warm water any traces of flux on the surface. Flux might, if left on the surface, have a corroding effect on the metal and also would be injurious to paint work and cause it to scale. Cold hammering along the line of weld after the flux is removed is good practice; it gives texture and grain to the weld. A spring power hammer is good for this work if available. Scbsequent annealing will remove hammer marks.

PRESSURES EXERTED.

(Cont'd from Page 33).

so that any desired lubrication or flooding of the cutter may be used.

The Dynamometer has the capacity to withstand loads of 25,000 lbs. longitudinal, and also loads of 4,000 lbs. in the opposite direction, vertical downward pressures of 10,000 lbs. and upward pressures of 7,000 lbs.

The working surface of the working table is 16" long x 10" wide, and is provided with three T-slots. The height of the working table above the bottom of the base is 8". The total size of the base of the Dynamometer is 35" long x 14" wide.

It is obvious that the Dynamometer is extremely valuable for manufacturers of both milling machines and milling cutters, as well as for shops where milling operations are studied and given proper attention (as automobile plants, experimental shops) for laboratories and shops of technical schools and colleges, etc. Problems attending standardization of machines and cutters can be more readily solved with its aid. This instrument has proven extremely satisfactory and very sensitive under tests. Its uses are not confined entirely to milling machines. but it is equally adaptable for making tests on planers, shapers, and with slight variations, drill presses.

REFRACTORY CRUCIBLES.

The making of crucibles from highly refractory oxides has been further investigated recently. It has been found possible to make such crucibles without the use of the clay or binder, which tends to reduce the refractoriness of the finished product. Usually this is effected by preparing a portion of the oxide in a colloidal state by grinding it extremely fine in the presence of soda or other suitable dispersing agent, or even by precipitating it from solution. A recent method is to make crucibles with the use of water by tamping the plastic mass inside a fireclay mould lined with plaster-of-paris. When the mould and crucible are fired to a red heat, remarks "Chemical Trade Journal," the plaster disintegrates and permits the crucible, which is then fairly strong, to be removed from the mould. The crucible is then fired to a high temperature in order to give it the necessary density and strength.

It is difficult to imagine that this method is likely to be any improvement on the ordinary use of plaster moulds when a plastic paste has to be used. If, on the contrary, the refractory oxide is suspended in water or other fluid, and is cast in a plast rmould, h eereatmy is cast in a plaster mould, there may be some advantage in the process, though this at least is doubtful, and the destruction of the mould would make the process costly.

Still another method is to mix linseed oil with a refractory oxide and to shape the crucible inside a detachable metal shell, the crucible being then baked in the shell in an oven—a similar process to that employed in the baking of cores for castings. After the baking, the shell is removed and the crucible fired to a high temperature, which results in the burning out of the temporary carbonaceous binder and the sintering of the refractory oxides, thus forming a dense, strong, and highly refractory crucible. This method is less objectionable, and has, in fact, been used to a considerable extent in making special crucibles for certain steel alloys where clay could not be employed.

WATER POWER IN FINLAND.

An important factor in the industrial development of Finland is the exploitation of its wealth of water power. The potential output of power from hydro-electric sources. chiefly from waterfalls, is estimated at 3,000,000 H.P., to which the River Ulea and the rivers south of it contribute 1,200,000 H.P. A considerable part of this water power is owned by the State. Among the important water-power resources entirely or partly in possession of the State are the following: Vucksen Falls, 300,000 H.P.; Imatra Falls, 211,000 H.P.; River Ulea, 542,000 H.P.; Pyhäkoski Falls, 100,000 H.P.

The output from existent hydro-electric power plants is only 170,000 H.P.

BOOK ON HANDLING

A most instructive illustrated book on tramrails as an economical means of handling and conveying materials has just been published by Cleveland Electric Tramrail Division of The Cleveland Crane and Engineering Company, Wickliffe, Ohio. A copy of this new book will be sent without charge to readers of this paper who are interested in cutting their material handling costs.



WHAT OUR READERS THINK AND DO



BORING WORK QUERY.

By JOHN S. WATTS.

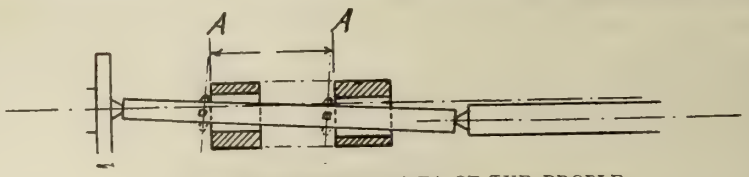
Replying to the query under the above title, in Canadian Machinery, page 37, of the issue dated June 23rd, 1921, The answer is that the holes would be parallel, but slightly oval in shape instead of being circular as they should be. Further in this case, as each of the two holes are bored by a separate cutting tool, their center lines would be out of alignment.

As many machinists do not take any care to align the lathe centers doing a boring job, as they mistakenly think it makes no difference to the accuracy of the work, it will be opportune to prove the above statements, and show just what effect the lathe centers being out of line will have upon the accuracy of the work.

Referring to the figure accompanying this article, AB represents the center line of the lathe, and consequently the path of the center line of the casting being machined. BC is the center line of the boring bar when the centers are out of line, and therefore the center of the circle through which the cutting tool D passes. It will be noticed that while the cutting tool D, must perforce travel through a true circle, the plane in which this circle lies is not at right angles to the center line AB, along which the work is traversed. The result of this is that the hole bored by the cutting tool, as measured one plane EF, will be a true circle, but when measured on plane GH, at right angles to the center line of the casting, will be elliptical.

As the casting travels in a straight line past the cutting tool, each hole must be parallel throughout its length, so long as it is completed by the one cutting tool. or by a double cutter located on a single plane as EF, and unless the centers are very far out of line the amount of the variation from a true circle will not be important on average work.

For example, if we are boring out a 5-inch hole, with a bar 40 inches long, and the centers are ¼ inch out of line. The distance X in the figure will be $\frac{5 \times \frac{1}{4}}{40}$, or .03125 inches. As EF is 5 inches, the diameter measured along GH, will be $5^2 - .03125^2 = 4.9999$, or one ten thousandth of an inch oval. There will be always one plane in which both center lines AB and CB will lie, and the diameter measured at right angles to this plane, that is on a line vertical to the surface of the paper in figure, will be the full diameter of 5 inches.



MR. OSBORN'S IDEA OF THE PROBLE

The area will vary with the diameter of the hole, and inversely with the length of the boring bar, that is if the hole in the above example was 10 inches, the error would be doubled; and if the boring bar was only 20 inches long, the error would be doubled again, the amount of misalignment of the centers remaining the same. It is clear then these dimensions are extreme, it is not necessary to exercise more than ordinary care to have the centers in approximate alignment.

In the example given in the query however, there are two holes bored, and each is machined by a separate cutting tool. A study of the drawing herewith, will show that these holes will be bored out of line with each other an amount equal to the misalignment of the centers, divided by the ratio of the distance between the centers of the tools, and the total length of the boring bar. That is if the tools are 20 inches apart, and the bar is 40 inches long, the centers being ¼ inch out of line would cause the holes to be bored one half of this amount out or ⅛ inch. It follows that when using a bar with two cutting tools in its length, such as is shown in the original query, it will be necessary to have the lathe centers in exact alignment.

BORING WORK QUERY.

By H. T. OSBORN.

In answer to Mr. James' boring work query in June 23rd issue. The lathe centers being out of alignment would not cause the holes to be bored taper. So long as all adjustments stay set and the tools hold their edges, the work would be affected to the extent of the center of the holes being out of alignment a amount to be determined as follows:—

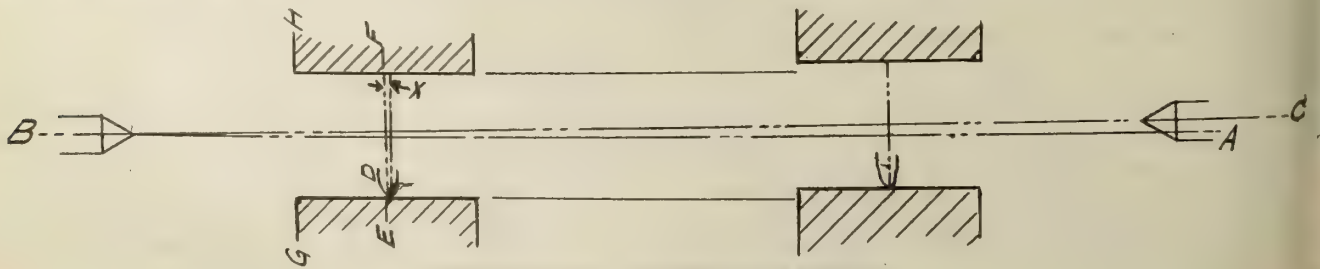
Find how much the lathe centers ar out, then set down in a simple propo tion sum:—The distance in inches b tween faces AA on accompaning sketc the length of the bar in inches; an the amount the lathe centers are out alignment in fractions of an inch. F example, suppose the bar is 36 inche the distance between faces AA 12 inch and lathe centers are out .015 inche

Then—36:12 = .015:x Solving, x .005 ins.

The lathe centers being out of li would of course throw the axis of t bar to a slight angle to the work axi This would, theoretically, cause t tools to bore the holes slightly ov and it would be interesting to know such shows up in actual practice.

MAGNETIC TESTING.

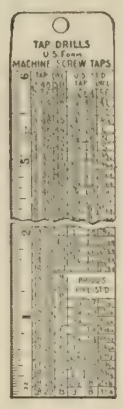
One of the committees of the Ame can Society for Testing Materials, h been carrying out an interesting inves gation, which has for its object the d velopment of apparatus which can used commercially for the non- destr tive testing of twist drills. The plan procedure is as follows: Steel, specia prepared by one member of the co mittee, is tested for homogeneity by magnetic method at the Bureau of Sta dards. The drills are to be manuf tured from this steel by another me ber of the committee under carefu controlled conditons, after which th will be tested again magnetically various members of the committee. F lowing the magnetic tests, the dri will be returned to the manufactur who is to give them a thorough mecha ical test.



THE SOLUTION AS JOHN WATT SEES IT.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

As already promised, we give two scales this issue. Of those received, we had four correct answers. Angus A. Smith, Mt. Forest, and B. Back, of the P. B. Yates Co., Hamilton, were the two picked out in the elimination test. George Land, Peterboro, and F. E. Regan, Hamilton, also had correct lists. We still receive letters stating that scales have not reached winners. Readers will confer a favor by writing us should they not receive their scales one week after announcement.

CONTEST FOR JULY 28TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—A product that costs more, yet is said to be worth the difference.
2—Three good thoughts for mechanics.
3—Free opinion which will be unbiased.
4—Something which has five features.
5—How to handle cotton lint, or stringy material.
5—Something that does not depend entirely upon bulk or weight.
7—A product air tight under all pressures.
8—Something that modern practice has discarded.
9—An organization always at your service.
10—Something which has proved of value in the mining field.
11—A machine which requires no special fixtures.
12—Something said to do better work in less time.

These are Correct Answers for List from July 7th Issue:

1—John T. Hepburn, Ltd.
2—Bilton Machine Tool Co.
3—The Royal Bank of Canada.
4—The Warner & Swasey Co.
5—Algoma Steel Corporation, Ltd.
6—National Acme Company.
7—The Bristol Company.
8—United States Machine Tool Co.
9—Canadian Hanson & Van Winkle Co., Ltd.
10—Canadian Hart Products, Ltd.
11—Greenfield Tap & Die Corporation.
12—George Ellison.

Closing Date for This Contest is Aug. 11th



DEVELOPMENTS IN SHOP EQUIPMENT



SPECIAL GRINDER.

The Landis Tool Co., Waynesboro, Pa., have placed on the market a special grinding machine for regrinding all parts of automotive engines. Utility has been the chief feature aimed at. The crank carrying fixtures have been designed to handle crankshafts easily and all loose attachments such as chucks, dogs, blocks and so-called throw blocks have been eliminated. Work carry heads which are a part of the headstock and the footstock are equipped with three jaw universal chucks, to grip each end of the crankshaft. Bushings are not necessary. An indexing dial is used for locating the chucks for the different size strokes of crankshafts. The work carrying heads are centered and brought in line by use of locating pins, after which the machine is ready to receive the work.

The shaft is then placed in the three jaw chucks, brought in line and trued radially by use of the trueing device located on the top of the work rest. The chuck jaws are next drawn up fairly tight, not however, as tight as is necessary for lathe work. The trueing device is then removed and the work of regrinding proceeds. This operation is accomplished in from one to one and one-half hours for four throw shaft, and one and one-half to two hours for six throw shafts.

This machine will also grind all other parts of automotive engines with the exception of the cylinders cast en-bloc. The wheel carriage has power speed and all traverse speed changes are controlled by one lever. The machine is designed to carry a 24" diameter wheel with 5" belt for driving same and the wheel can be worn down to hole or safety point. The machine is driven with a small countershaft and requires 5 horsepower to operate. The chief features of this special machine are the heads or work carrying fixtures and the automatic balancing weights which can be moved in and out from the center according to size of crankshafts.

COMBINATION WORK BENCH.

The Meyers Machine Tool Corporation, Columbus, Pa., have placed on the market a combination work bench which is intended for use where a small machine equipment is required, such as in automobile repair shops, inventors' workshops, etc.

All the units are mounted on a table 39 in. wide by 78 in. long by 33 in. high, the top, sides and shelf being made of 1½-in. and the legs of 3 x 4-in. lumber. Two drawers are provided for holding small tools. The motive power is furnished by an a.c. electric motor, mounted on the shelf under the table, and delivering ½ h.p. when running at 1,750 r.p.m. on 60-cycle, single-phase current of either 110 or 220 volts. The motor is belted to the countershaft, which permits the use of the machines either individually or simultaneously.

The machine equipment consists of a geared automatic hacksaw having a capacity of 6 x 6 in.; a 10-in. sensitive drilling machine having a ⅜-in. chuck; a grinding head equipped with one abrasive wheel and one muslin polishing wheel, and 4-in. machinist's vise having hardened steel jaws. The outfit is complete with the belting, and weighs 750 lbs. when crated.

REVERSING TAPPING CHUCK

A new design of tapping chuck has been placed on the market by the John Chuck Co., of Milwaukee, Wis. The chuck is equipped with a five-point sensitive clutch, and it is stated that it will automatically release within a limit of .001 inch of the pre-determined depth of tapping. The reverse speed is in the ratio of 2 : 1. The internal gears all run in oil and the chuck is provided with an oiling device for supplying oil to the tap or the work. The body of the chuck is made of aluminum so that the weight is reduced to a minimum. Three sets of standard tap drivers and retainers are furnished with the chuck, and special drivers and retainers will be supplied when desired.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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A Great Power Scheme

Another portion of this issue is a short description of a tour through the Queenston-Chippewa Development. What a fair idea may be gleaned from the story, the work itself must be seen to be appreciated. The science of engineering has reached a wonderful stage of development. Schemes such as the Chippewa project would be impossible were it not for the ingenuity of the various branches of the engineering trade. First of all we have the designers. These men are experts in the higher forms of mathematics and can tell with certainty what size, shape and strength everything should be. Next comes the various construction operations. Each department of engineering has its work. The rock drillers, blasters, dredgers, concrete men, electrical engineers, transport, hydraulic, and general mechanical trades all enter into the finished work. Each is equally important. One must work in harmony with the other if satisfactory results are to be obtained.

The machinery used in the constructional work on this project is nothing short of marvellous. Imagine an 8 cubic yard shovel a few years ago. Such a thing was unthought of. The shovels then in existence were considered quite large enough, but it would seem that the larger the job the bigger designers will build shovels. The development by no means ends with the shovel. All the mechanical means employed are of the very latest. Even the method of conveying the materials for the concrete to the work is perfect. There is no lost motion. Everything has been studied with a view to efficiency, and such a result has been obtained.

Canada can proudly point to their Quebec Bridge as a great engineering attainment, but for romance and vision, they will have a still greater cause for pride when the water flows into the canal of this great Queenston-Chippewa power scheme.

A Danger Easily Remedied

Coming in contact with a live wire, a Hydro lineman recently met his death in Toronto. Upon investigation it was found that he had not used the added protection of leather gloves over his rubber ones. The cause of death was also attributed to faulty gloves.

The fact remains the man is dead, and that he is not the first who has passed out in like manner. Forgetting for the moment that the lineman did not use his leather gloves how about the rubber pair?

It was proved that the gloves used had not been tested since June 2nd, although it is supposed to be a hard and fast rule that gloves must be tested once a month. It would be interesting to know who was at fault, the company, or the men. When men work with electricity constantly they have a tendency to become careless. "Oh, those gloves are all right," is a usual statement, and the fact that this particular lineman did not use his leather gloves proves that men do get careless.

What is the remedy? Someone suggests testing the gloves each day. This, to our mind, is hardly necessary. If every pair of gloves in use throughout Canada were tested each day, it would entail a considerable amount of unnecessary work. A better plan, if a month is considered too long a period, would be to test the gloves every two weeks. Personally we believe once a month sufficient, if the gloves are taken proper care of. We have on two occasions witnessed the testing of such gloves, nnd it is very thorough, 13,000 volts being passed through the testing apparatus. If a glove is weak or damaged, a hole is blown out at the weakest spot. The men at this work are extremely careful, and if the linemen on the job were half as careful of their gloves after they get them there would be fewer fatalities.

A very good emergency test would be for linemen to take their gloves top up; fold the top over once, then holding this firmly to seal the air inside, twist the glove slowly until all the air was pushed to the top. In the event of a flaw, the escaping air could be plainly heard. But all this is unnecessary if workmen will take the proper care of both their rubber and leather gloves, wearing the latter on all occasions where any object is liable to damage the rubber.

A Bonus Plan That Gets Results

THERE are Bonus systems of all kinds, but here is one that Edward Hungerford describes in the New York Evening Post. He speaks of the wage dividend plan in operation in the Eastman plant, this concern having about 18,000 employees. The first dividend was distributed July 1st, 1912, and since that time it has been paid yearly.

In this case the management regards a 10 per cent. dividend to stockholders as parallel to the employees' regular wage. Any earnings over this amount are considered as extraordinary and, to a certain extent, the common property of the stockholders and employees. An arbitrary division is made in which 35 per cent. of the extra dividend goes to the employees.

To illustrate how this has worked out, during 1911, 1912, and 1913, the extra earnings were 30 per cent., and 35 per cent. of this is 10.5 per cent. of the total extra earnings. This amount goes to the employees. The award is made on a basis of five years of service with the company. This does not mean that employees who have not been there for five years do not participate, but that they participate in proportion to the time they have been employed, as well as to their average earnings.

One employee with five years' service averaged $30 a week and received $163.80 on dividend day. If he had been there but four years he would have received $131.04, and if he had had but one year's service his dividend would have been $32.76.

Building An Industrial City—Not A Population

Business Is Simply The Supply Of Human Wants—Intelligence Essential To Business Expansion and Contentment—Community Schemes Are Good—Industrial Service Desirable—Labor Turnover Very Low

By HUGH M. BELL, Manager Chamber of Commerce, St. Catharines.

"THAT Civics and Commerce are linked up in no unmistakable way, and that Business is not something remote from all the other phases of community and national life, is the opinion of the directors of the Chamber of Commerce at St. Catharines, Ont. The day is past for all special regard for business as something sacred and not to be understood, and has arrived for the logical coordination of schools, homes, parks, playgrounds, hygiene and all the arts of living with the industrial possibilities of any community or country."

Business is simply the supply of human wants and as the standard of living advances, human wants grow, so business expands. Business is better where there is a high average intelligence than a mass population without culture. Compare Ontario's buying powers with that of Black Africa's, yet the blacks outnumber the whites four to one, at least. We in St. Catharines have determined upon a definite community program of work. It covers definite tasks to which the Chamber of Commerce of 500 members is pledged. It is remarkable for its breadth and has in the past six months of this year covered such phases as:—Playgrounds scheme, which removes children from the streets; bus line to outside points, which develops the trade territory; new public park in the artisan locality; an industrial survey which lists the industrial properties and improved transportation facilities.

On top of this we have had community dances, bands being in attendance; moonlight excursions; half fare weeks; and educative trade tours.

Industrial Service.

Definite data has been secured on wage costs—land costs—freight rates, city taxes, lake freight rates, floor space, factory sites, and in the past six months, over sixty manufacturers (or promoters) have met the Board of Directors of the Chamber of Commerce and explained their propositions. We do not endorse stock promoting campaigns, or stock selling industries. It is the belief of good business men here that the city has been developing the sort of atmosphere essential to industrial stability.

We place "factory grabbing" last, because housing and right conditions are the first care of any community organization. Yet from following out this policy we believe we are in a position to serve industry with a better conscience than on the old poetic "town boosting" stuff. We give no bonuses, offer no bribes, tell no lies. We sell our city on its merits. are conscious of its demerits and by the co-operative effort



HUGH. M. BELL

of our members in the Chamber are solving them. Business needs all things, not just one of them—a free site. Free sites like charity cover a multitude of sins. Our land is valuable because it has the town advantages of rail and canal. We do not desire it to become a graveyard of empty factories. therefore, propositions that cannot make the grade do not get free chunks of it. On the other hand, a going concern temporarily embarrassed has no reason to fear lack of support.

Over sixty different concerns have been in town since January, 1921. Two have purchased land and are awaiting the lowering of costs. Options are held on several other properties, awaiting certain signs of a trade revival to start up. A rubber tire plant is going into operation in June. Many concerns were passed up, neither they nor we could see eye for eye, and with the best of feeling they went elsewhere.. Tragedies followed some of them, and in other cases the law.

When we make a mistake we admit it, but do not cry over it. It is the duty of the Chamber of Commerce of any city to offer such service and protecti[on] it is invited to give. An industrial [com]missioner is not a miracle worke[r] is an analyst whose job it is to ge[t] right sort of industries into the [city] area for them, because afterward he must live with them or the indig[nant] citizenry whose property values [have] been disturbed.

"Getting a factory first" and "a [good] place to live in afterwards" is a fal[lacy] One must accompany the other. The responsibilities are so great that [slums] populations are a result. Foster [civic] conditions, help make home owners [of] one company does here at easy r[ates] think in terms of social well being [and] get "uplift," be human, kind, and [the] city will win in the long run against its "booster" neighbor with unp[aved] lanes, rickety babies, stinking ho[les] poor parks and little civic spirit.

Te labor turnover in one plant [here] has not changed twice in ten years In another the Manager and Vice-Pr[esi]dent knows all his men by their [first] names. He polled the highest vot[e for] the Board of Education. We have [had] no big industrial deadlocks in the [city] in ten years. We are planning to [meet] trade revival with a contented com[mun]ity, and fifty-five per cent. own [their] own homes.

THE SPEED CHECKER.

As a means of checking up or [the] speedster a device has been invente[d by] Col. Charles Gore, of Los Angeles, [it] consisting of an attachment secur[ed] the front of the car, which is sup[plied] with three lights. As soon as th[e car] commences to move, a white lig[ht is] thrown into action. This continue[s] til the rate of travel passes the [limit] of the city ordinance, when the [white] light comes on, showing that the [safe] try rate is being used. If the d[river] exceeds that the red light flashe[s a] signal of danger to all within seein[g] tance. Since the mechanism can n[ot be] manipulated from within the car, [it is] impossible for the motorist to f[ool] his speed. These lights lock auto[matic]ically; hence if a driver breaks the law for only a few minutes the [red] light will continue to burn after h[e has] slowed down to the white range. [Should] this means a traffic officer or any[other] server outside the car can tell [at a] glance what has been the rate of s[peed].



MARKET DEVELOPMENTS



Looking For An Improvement In The Markets

Pittsburgh Says That In Some Cases The Demand For Steel Is Slightly Better—Scrap Metal Markets Are Still Away Off—Price Is Not A Determining Factor In Present Transactions

THE steel trade has reached the point where it is trying to look hard enough to see in passing events the start of better days. Others are working from the standpoint that things are bound to turn for the better if they move at all, as they are about as bad now as they can be.

Pittsburgh reports that inquiry is better for steel in some places, although there is no attempt made to turn this into a claim for all-round betterment.

Prices are not showing any tendency to hold firm in any of the lines. Many of the schedules are more or less nominal, as the buyers are still very much in control of the market, and in many instances they are not hesitating to take full advantage of their position.

The scrap metal market shows no improvement. Dealers state that business is about as low as could be imagined, and it would pay them much better were their yards closed up for the present.

PITTSBURGH TRYING TO SEE START TOWARD A BETTER DEMAND FOR STEEL

PITTSBURGH, July 28.—In last letter it was said that a turn had probably occurred in the matter of the volume of demand upon the steel mills. In the past week there has been some confirmation of this view. Some mills report a larger volume of inquiry, also somewhat larger bookings. Other mills assert that they see no improvement. None say that conditions have grown worse. It is a very delicate matter to see an improvement in the volume of business for the reason that the volume was so small to start with. That is, if mills had a demand equal to 80 per cent. of capacity and the demand increased to 90 per cent., the difference would be easily noticeable. It would be an increase of 12½ per cent. on an 80 per cent. demand. If, however, demand was 16 per cent. (and it has been something like that, not much more at any rate) and there was an increase of 2 per cent., that would only be to 18 per cent. and the difference between 16 per cent. and 18 per cent. would not be very conspicuous.

In other words, the business was so extremely light that the beginning of improvement is necessarily very gentle indeed, yet it is absolutely necessary that the thing start with a beginning.

The improvement is most noticeable in the case of sheets, for which there is a demand from practically all sections of the country and in nearly all classes of consumption or distribution. The independents have been getting more orders and the leading interest has been getting some, but of course its increase is chiefly in specifications against contracts, which are reported as much better. The orders and specifications are largely for single carloads, with the specifications quite mixed. In merchant steel bars there is a similarly widespread demand, though little increase in total tonnage, with also the showing of specifications being widely distributed. In both commodities the evidence is that jobbers and manufacturing consumers are running out of stocks and must order to fill in. As stocks go down farther the orders will, presumably, have to be larger.

In plates and shapes there is little or no improvement. In standard steel pipe there is reported a much better distribution by jobbers, suggesting that there will soon be heavier demands upon the mills. Wire and tin plate are out of season, show no change, and could not be expected to show any at this time.

Consideration of all the information obtainable indicates that the liquidation of stocks of steel in the hands of jobbers and manufacturing consumers, and the liquidation of stocks of manufactured goods in the hands of manufacturers using steel, has proceeded to such a point that these buyers must call upo the mills for somewhat more steel than formerly. The steel market shows no indication that the amount of activity in business generally has increased, nor does it show any increase in railroad buying. Those are favorable developments that are still awaited. The point is that the demand upon the steel mills was below a normal relation to the amount of business generally, or the degree of industrial activity as a whole, by reason of the stocks that stood in the way, and it appears that now the demand for steel has begun to work up to a normal relation. This readjustment may bring steel demand up to 30 or 40 per cent. of capacity instead of less than 20 per cent., as it has stood since late in June. When business generally improves, when more construction work is undertaken and when the railroads get in shape to buy, there will be further improvement. Not a great deal along such lines is expected within the next few months.

Steel Prices.

The competitive character of the steel market is still more clearly established. There are few, if any mills, except some small mills that are closed completely, that will not name a special price to get an order of special attractiveness. Many make the rule that anything from two carloads up is a specially attractive order. Whatever price the mill has as its "regular" price is likely to be the price only on single carloads. The price may or may not be the price publicly announced early in July, when the mills made certain formal "reductions." On plates the July 5 price was 2c, but some mills would probably do 1.90c even on a single carload, so that in this respect the formal price has practically disappeared. It has disappeared in another respect, in that Pittsburgh basing is wholly abandoned, as to plates, and it is disappearing as to some other commodi-

ties. Chicago mills have quoted as low on plates, f.o.b. their mills, as Pittsburgh mills have quoted. It is approximately as easy to buy plates at 1.85c Chicago as at 1.85c Pittsburgh, instead of there being a differential of .38c, the amount of the freight.

The July 5 prices of 3.50c on black sheets and 4.50c on galvanized sheets have practically disappeared in favor of, say, 3.40c and 4.40c on single carloads and lower prices on really good sized orders.

The rank and file of buyers are not showing any keen interest in steel prices. They are buying simply from hand to mouth, and buy only when they can distribute the material at once or when they have sold manufactured products against the steel desired. Prompt shipment buyers are not only interested in but insist upon.

The probability is that the period of formal or clear cut reductions in steel prices has ended, and that any further declines will be gradual and by small amounts at a time. Prices may recede by an average of 50 cents to a dollar a ton per week for several weeks. Pre-war average prices are unlikely to be reached within a few months, while pre-war low prices could not be reached for years. The steel mills are not thinking about price advances in future. What they are thinking about is getting costs down and they hope to get them down year by year for many years.

Wages.

While several mills in the Pittsburgh and valley districts reduced wages early in July, putting the common labor rate at 30 instead of 37 cents, the Steel Corporation is still on the 37-cent basis, together with a few remaining independents. This reduction will no doubt come in time. Some steel mills observe a feeling on the part of steel buyers that they cannot have any confidence in whatever steel prices are quoted until wages are down, on the basis that if a steel mill can quote a certain price when paying certain wages it will be able to quote a lower price when it reduces wages. A 30-cent rate for common labor is likely to become established for the longer future. This would compare with 19 cents before the war and 13 cents in 1898.

Pig Iron.

In most districts pig iron prices have sagged a trifle in the past week, while the Buffalo market has had rather a sensational decline. There is a report that one lot of foundry iron sold at $18, Buffalo. The valley market is down $1 on foundry and 50 cents on steel making grades, being now quotable as follows: Bessemer, $20.50; basic, $19; foundry, $19.50. Freight to Pittsburgh is $1.96, but furnaces nearer Pittsburgh would probably sell at lower delivered prices than the valley market, plus the $1.96 freight.

POINTS IN WEEK'S MARKETING NOTES

Pig iron prices in Pittsburgh still continue at low ebb. Some small lots are still going at $23.50 to $24.00, furnace, for No. 2 plain. Copper free, low phosphorus iron is featureless.

Chicago reports that foundry iron activity has somewhat improved. No large tonnage is in evidence, but the small orders for pig iron have increased in number. One deal for three carloads of resale foundry iron at $21.00 delivered, is reported.

New York states that Buffalo and other eastern Philadelphia furnaces are competing for any attractive pig iron offers that are available. In some cases the silicon differentials are being disregarded entirely. Inquiry in this district is greater than it has been for some time.

In Cleveland the prices are about as low as dealers expect to see them. Cleveland iron is quoted at $21 to $22 base furnace. Enquiries are better all around and actual orders are more than a mere possibility.

Scrap is still in the dumps, and no noticeable improvement is looked for at present. The majority of mills now in operation are well supplied, therefore it can be expected that sales will not climb to any appreriable extent for some time to come.

The recent cut in wire and wire products have not increased business to any extent. Present activities are mostly confined to the revision of outstanding quotations new enquiries being few and far between.

The sheet market has been visited with a price cutting wave which seems to have petered out at last. Keen competition is in evidence in this market, but the amount of buying going on is no real test of the market.

In the steel market the reaction following the new prices has been very disappointing. Buyers seem to be holding off for a further drop, the recent reduction in wages seeming to make them imagine another cut is coming. Leading steel manufacturers say that the new prices are as low as they should be. In fact some state that should labor go down to 25c per hour, prices should drop no lower until the industry obtains the benefit of lower freight rates.

WANT RESULTS FROM NEW PRICES

That Seems to be the Attitude of the Trade—Business Done is on a Small Scale.

TORONTO.—It is not unusual to find dealers who base their opinions on future business on peculiar facts. For instance, one often hears the remark in the machine tool or steel market that business is bound to improve because it has got to the point where it would be hard to imagine it approaching anything nearer stagnation.

There are bright spots here and there, but they are local conditions, and no one has the nerve to rise up and claim them to be a reflection of general changes.

More tariff regulations are coming into operation on the first of October, and the trade is studying the effect of some of these, especially as they will apply to the machine tool business.

Stamped With Origin.

One provision is that every part brought into Canada must be stamped with the name of the country in which it is made. The idea is that this will do away with deception regarding the origin of any machine or part of a machine. When discussing the matter with a local machine tool dealer, this paper secured his views on the matter, to this effect: "Suppose I bring in a machine from United States. We handle a good many American lines. In three or six months there may be a part needed for purposes of repair. It will be a peculiar business if every one of those pieces of that machine will have to be stamped 'Made in United States,' and yet as I understand the new law that is what it will mean. Will these firms go to the trouble to comply with that ruling just for the benefit of the Canadian trade, as I do not believe it is asked for elsewhere?"

Little Talk of Prices.

Another tool dealer is quite sure that prices have little or nothing whatever to do with sales now. From that he figures out that the reduction of prices is not desirable now because it will not bring any business into the market.

"Here is a case that will show what I mean. I have in mind two tools made by different firms. For a long time these sold at $3,600. The trade knew them both and there was very little difference between them as far as actual work was concerned. Of course each tool had its talking points, but when a man was fitted up with either of them he had a good machine. One firm started a few months ago to let down the price in order to see if they would get

LeBLOND
HEAVY DUTY
Universal Millers

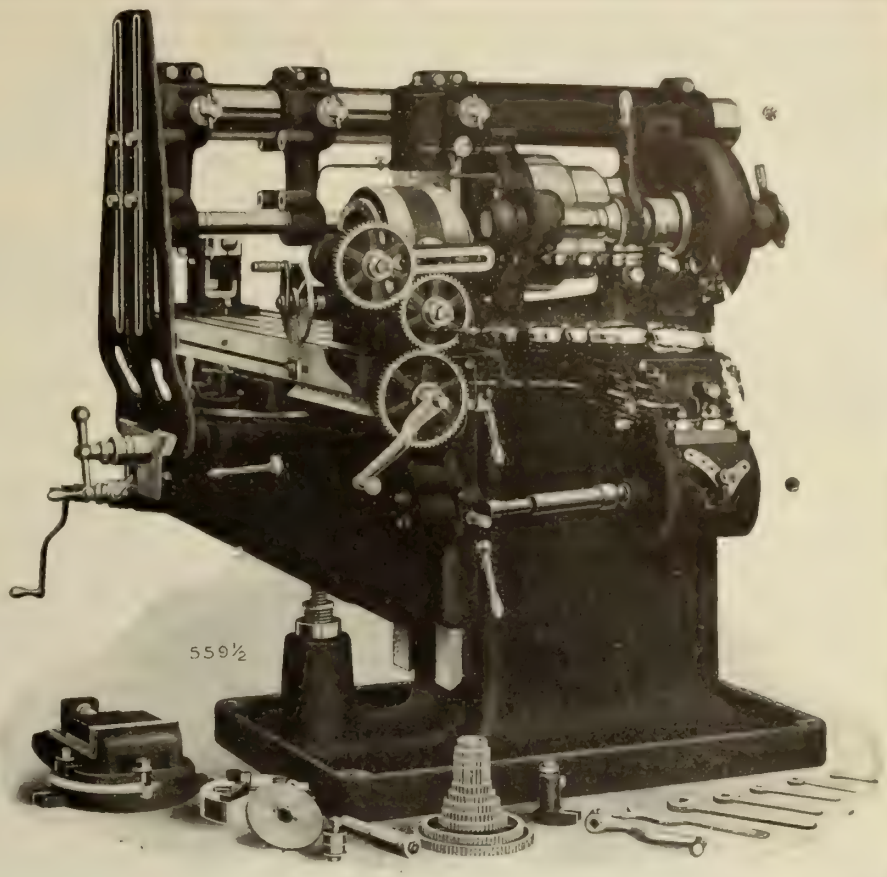
Are not only Tool Room Machines, but as a manufacturing proposition appeal to the careful buyer.

Their long life insures ample returns for the investment made.

May we explain to you their many advantages and the convenience of their control?

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The A. R. Williams Machinery Co.
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TORONTO



HANNA
IRON ORE - PIG IRON

Sales Agents:

Cleveland Cincinnati Pittsburgh Toronto Buffalo Detroit

...ual. They were in close touch with ... force in Canada, and the first ... brought them to $3,400. Within ... weeks they had come down again to ... and to-day the price is around ... It is just as good a machine ... ever was and it is probably costing ... as much money as ever to turn ... because there are such a few ... through the shop, but there is no ... difference in the sales. We are advised ... there is nothing to show where the ... reduction has brought the sale of a ... machine. We are coming more and ... more to the belief that it will be time ... to arrange new prices when the buying public show some signs of coming along and taking hold again."

In firms where both wood and metal working machinery is handled, the opinion seems to be that the former is leading in sales.

Waste Revisions Hold.

The reductions recently announced on both white and cotton wastes are being generally maintained. No further price revisions have been recorded, and dealers state that few changes, if any, are now expected. Market conditions are generally reported fair, with some signs of a more optimistic tone developing in the trade.

A slight increase in the number of inquiries of steel has been reported, but only a proportion of these have developed into new business. Many of such inquiries are generally calculated as movements to sound out the market tone, and the buying prices. The quiet period, therefore, is stated as continuing, with the recent announcement of price recessions on the primary steel markets, being reflected in local circles by one or two gradual reductions. Last week, both band and hoop steel quotations were lowered, and reduced prices are now recorded on spring steel.

Some lower prices were announced in the sheet markets and merchants are awaiting the results of these revisions. Whether business will respond to these more attractive levels, is considered contingent upon the degree of business activity, but it is stated that any worth while reduction is likely to uncover buyers. The formal announcement of a lower scale of steel prices recently made by the Bethlehem Steel Company, has not directly affected local conditions, due to the fact that such nominal recessions, were only in reality bringing the official prices down to levels which were already in existence on the primary markets. The chief object in such a formality is stated as being a desire on the part of the steel mills to relieve the industry generally from the appearance of securing higher prices than were really being obtained. No new development has been recorded this week in sheets and plates, the prevailing tendency being an abnormal proportion of inquiries compared with the current volume of business.

Non-Ferrous Metals.

Conditions in the ingot metal markets are still described as listless, and very little trading has been recorded. Quotations on the local markets are nominally unchanged, but a little variation is recorded in conditions on the various metals, as follows:

No immediate improvement in the copper market is looked for, but it has been pointed out that the formal reduction in prices, recently announced by various steel mills, is regarded as a favorable development, due to the fact that high prices on iron and steel have had their effect in retarding purchases of copper. Signs of a more optimistic tone developing, are therefore apparent, but local quotations remain unchanged at 17½ cents.

The tin market has recently been quiet, with prices practically stationary. The recent reduction in quotations on tin plate had no effect, as the new price has previously been in effect through independent activities. The outlook for any marked improvement is not considered bright, and consumers are not purchasing as previously. The range in local quotations of from 37 to 38 cents is still evident.

A firmer tone has recently been recorded in the lead markets, and reports from southern centres indicate that inquiries have been more numerous. The increase in the number of inquiries appears to be the chief factor at this time. Prices locally are still maintained at $6.75.

While the dull trend still prevails in spelter conditions generally, yet the opinion has been expressed that even if the present small demand shows no material improvement, the current prices are expected to remain firm. The desire to sell at any costs among producing circles, in order to move stocks at a time when there was no particular market evident for the metal, is what is quoted as the cause for the recent drop in quotations. The price of $7.00 still prevails locally.

This market is virtually at a standstill, as far as demand from consumers is concerned, but current quotations are unchanged. The local price is from 8 to 10 cents.

The movement on aluminum has shown no improvement whatever, but prices are being maintained at previous levels. The local quotation is unchanged at 30 cents.

Pig Iron Markets

Pig iron prices in Pittsburgh are about the same with very little demand even at the present price. In Chicago the output is limited as there is now only one furnace operating on merchant iron exclusively. Another furnace is chiefly employed on Bessemer for an allied company, making very few casts of malleable or foundry. The buying is very limited, and what orders exist are for small quantities.

In Philadelphia the same condition holds good. Once in a while someone places a half decent order, the trade feels the turn has been reached, then away flops the market back into its featureless groove. In Boston 200 tons looks like a good sized order. Of course it isn't—but dealers are glad to get even that.

Buffalo reports that enquiries are better, but that this is as far as the improvement goes. In actual sales the result is poor. Dealers in this market are not very hopeful so far as any immediate improvement is concerned. There are several reports of $19.50 sales, but these figures cannot be verified.

The market is still weak in New York. A flurry occurs occasionally, but it does not last. Enquiries come in all right, but orders do not always follow. Dealers feel that the most encouraging feature to them is the fact that stocks of foundrymen are being so reduced that when sales are made they call for almost immediate delivery.

Scrap Metal Markets

The scrap market in Pittsburgh still remains dull. Quotations show no marked changes except that cast i
borings are a little lower than bef
Sheet bar crops and heavy breaka
scrap are also somewhat lower than
fore. On machine shop turnings, d
ers state that $7 per ton is the best t
can get.

Chicago reports practically ident
with Pittsburgh. Dealers there
that even a slight revival in dem
would cause an advance in prices.
various railroads are advertising a la
amount for sale, the Baltimore & O
and the Southern, each offering 15,
tons each. The other lines range fr
2,500 tons down. In Philadelphia t
are beginning to believe that a sc
metal market no longer exists.

Boston states that the market t
is at a standstill. Steel mills are o
ating on such a small scale that t
have ceased to be old material ma
factors. Many yard owners have rea
a point where they are unwilling to c
mit themselves further. In Buffalo
situation remains the same, namely
and uninteresting.

The various other markets all te
somewhat similar tale. True, it is
in different ways, but the chief poi
the same on all markets, viz., very
business.

LARGE RUSSIAN ORDE

**Fifty Ton Tank Cars to be Made—P
dent Believes Canadian Manufa
turers Have Nothing to Fear.**

The Canada Car & Foundry, L
have received an order for 500 fifty
tank cars for the Russian Soviet
ernment. Work has been started o
order and should be completed by
end of November.

W. W. Butler, who is president o
above concern, has been on a
months' tour through Europe
brought the above order back with
It was obtained in Berlin in the fa
vigorous competition from German
other manufacturers. In Mr. But
opinion, Canadian manufacturers ca
outside and get business against w
competition.

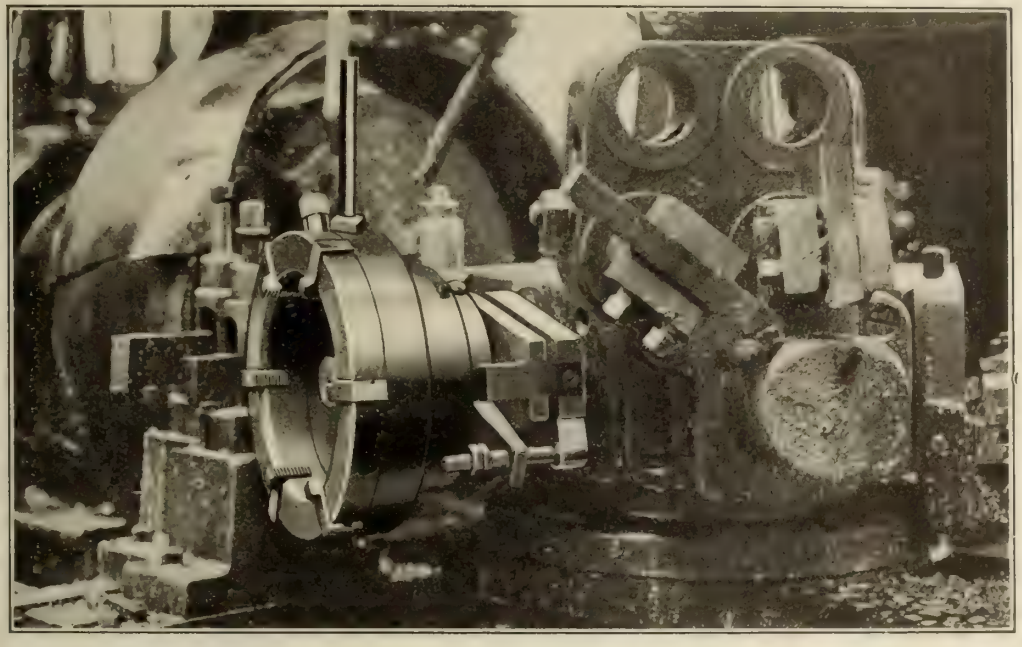
W. F. Sparling & Co., Toronto,
building a residence and garage w
will cost $20,000.

ERRATA.

In the June 23rd issue of Cana
Machinery we published an articl
"Steel Belting." Through an error
name of the Canadian Represent
for this style belting was omi
The Jones & Glassco Co., Montreal
sole representatives in Canada.

Right on the Lead

A Big Job And A Big Die Head To Cut The Thread



In less than one minute's time the big 5⅜-inch Geometric Die Head cuts the thread on the bearing plate of ball-bearing journal jacks, and then releases automatically and makes way for the next tool.

The Foreman of Tool Supply in that Shop says he knows of no other tool that will do the work as they require it done like a GEOMETRIC.

Geometric Screw-cutting Tools help the man at the Lathe and at the Screw Machine give the best possible showing on a day's work. These tools are built to fit the work —to handle it in the easiest manner and produce threads that are true in every particular.

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



CANADA AND BRITAIN CAN WORK TOGETHER TO GOOD ADVANTAGE

SPEAKING on the subject of "Reciprocal Trade With Canada," Sir Peter Rylands, President of the Federation of British industries, comments as follows:

"In the first place, the United Kingdom needs Canadian products. The British Isles are dependent upon supplies from overseas both for raw and semi-manufactured materials, to keep its factories working, and for food for its 50,000,000 inhabitants. Great Britain can never hope to supply her own requirements, either in the way of food or raw materials; both must be imported from abroad.

Canadian Products Needed.

"Canada, one of the world's greatest existing granaries, is in a position not only to supply food for the teeming population of industrial Britain, but to a large degree those raw materials of which the industries of the north stand to need. The Dominion is one of the richest potential sources of minerals and timber. Her vast natural wealth in iron, lead, copper and silver, is still, to all intents and purposes, unexploited. She is already the world's largest producer of nickel, corundum and asbestos, while her wealth in timber is larger than that of any other country in the world.

"All these products are needed by Great Britain. From what source could they be more conveniently obtained than from Canada, which of all the countries within the Empire is within easiest touch of the great west coast ports, such as Manchester, Glasgow and Liverpool. The United Kingdom must pay her bill for food and raw materials by exporting her manufactured articles, of which Canada, as a country still relatively undeveloped, stands in need.

"This raises the second point, that Canada needs English goods and English capital for her development. The industrial prosperity of Canada will depend to my mind, upon her successful resistance to foreign competition, which may be confidently expected to become increasingly fierce as the years go on. Standing alone, the danger exists that the growing industries of the Dominion may be swamped by the activities of her competitors. This danger may be appreciably minimized by the British Empire presenting a united front to competition from outside it. The Empire is able to do this owing to the fact that it is in reality an economic entity; in other words—the requirements either in raw materials, foodstuffs, or manufactured goods of one part of the Empire can in almost every case be supplied from some other member within the Imperial comity. Everything that can be done to strengthen inter-Imperial commerce must react to the benefit of Canada.

Should Erect Factories.

"Any increase in the exchange of goods between the United Kingdom and Canada will make for a better understanding and better relations, but manufacturers in Great Britain can also help in the development of the Dominion by investing capital in Canada. One of the most important ways by which this can be effected is by the erection of British factories there. The United States has already recognized the importance of such action and it is significant that in 1919, in the city of Toronto alone, twenty-one American branch factories were opened as against one British. In fact, it is only to be expected that the United States, favored as she is by her geographical juxtaposition, will do everything in her power to exploit the great riches of the Dominion.

"Difficult though it may be at the present moment for industrialists in the United Kingdom to find the capital necessary for opening up works in Canada, it should not be lost sight of that the chance of securing a share for the United Kingdom in the great industrial future of Canada, which exists to-day, may be gone to-morrow.

"From both standpoints, therefore it is to the best interest of both nations that every effort should be made to strengthen the commercial ties between them."

MOVEMENT TOWARDS NORMAL LEVEL EXISTS

Export Trade Impossible at Present—Rates of Exchange are Getting Better—Once This Difficulty is Removed Things Will be Better.

Speaking to F. W. Field, H. M. Trade Commissioner for overseas trade, on the subject of exporting, he said that at no previous period since the beginning of the war has the position of United Kingdom metal products industries been in gled, for the time being, all those in-between the coal miners' organization and the mine owners, occasioned by the proposed reduction in wages, has strangled, for the time being, all those industries depending on coal, which include practically the whole range of the trades under this heading, as well as transport and other vital services.

"It is apparently agreed by all the best informed authorities," he continued, "that the steel and allied industries cannot afford to pay the price for coal hitherto asked, and make even the barest margin of profit. The result has been that for some time prior to the dispute now in progress, Continental steel was (and still is) being imported for finishing processes. It all comes down to the basic fact that in order that these industries may exist in this country cheaper fuel must be available.

"One natural development has been to turn attention to oil as fuel. Fortunately there is no lack of this commodity and it is being used wherever possible as fast as plant can be converted.

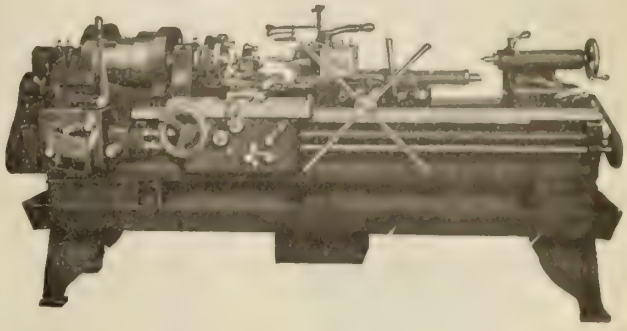
"With such conditions in the leading industry it is of little use to discuss export trade. The chief sign affecting future trade is the gradual approach, in number of cases. of rates of exchange to the normal. The movements towards a more normal level are not uninterrupted, but for some time past the tendency has been in that direction. As an instance may be quoted the value of the French franc. A year ago the London exchange on Paris was about francs to the £, but it has gradually fallen, with a number of interim fluctuations, until it is now varying between 45.65 and 47.25. Apart from European countries, this tendency has been shown in the U. S. A.—although jut recently this exchange has again moved

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We have the tool you want

Is it a lathe, a planer, a shaper, a grinder, or a drill—or perhaps it is one of the miscellaneous list shown below? At any rate we have it—and at a price considerably lower than you'll expect to pay. Drop us a line. Or better still come and give us the pleasure of showing you over our 20,000 square feet of warehouse, filled with modern equipment of every conceivable type.

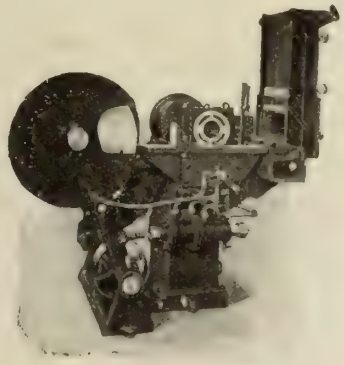


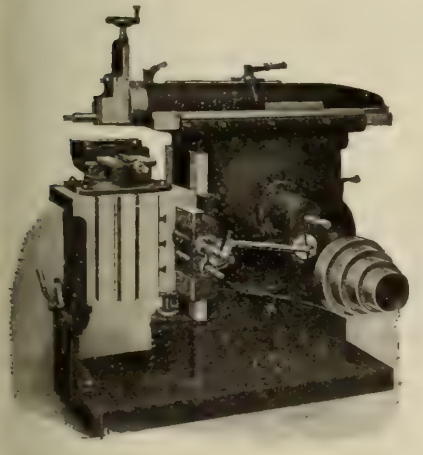
Planers

1—42 in. x 42 in. x 20 ft. Putnam, 1 Head (used)
1—48 in. x 48 in x 14 ft. Patch, 4 Heads (new)
1—36 in. x 36 in x 24 ft. Sellers, Open Side, 3 Heads
1—30 in. x 30 in. x 10 ft. Pond, 1 Head

Shapers

1—16 in. Rae B. G. Crank Shaper (new)
1—24 in. McGregor-Gourlay Crank Shaper (used)





Lathes

1—36 in. x 18 ft. Putnam (used)
1—30 in. x 12 ft. Blaisdell (used)
1—30 in. x 14 ft. Niles-Bement-Pond (used)
1—26 in. x 14 ft. Niles-Bement-Pond (used)
1—24 in. x 10 ft. Milwaukee (new)
1—20 in. x 6 ft. Le Blond Heavy Production (used)
1—18 in. x 8 ft. Bertram (Rebuilt)
1—18 in. x 8 ft. Rae (new)
1—16 in. x 6 ft. Reed (used)
1—12 in. x 8 ft. Le Blond (used)
1—8 in. Rivet, Bench, Cabinet and Attachments (used)
1—7 in. Cataract precision, Standard Equipment.
20 in. "Sibley," "Champions," "Rockwell" and "Silver" (new and used)

Grinders

1—Landis No. 4 Universal (used)
1—Landis Plain, self-contained, 36 in. x 12 in. (used)
Tool and Cutter Grinders, new and used. "Globe", Stevens, Le Blond and Cincinnati



Drills

1—10 in. Burke Sensitive Bench (new)
1—15 in. Rockford (new)
1—16 in. No. 2B Edlund H. S. Sensitive (new)

Miscellaneous

1—No. 4 Jno. Hall Pipe Machines (1 used), (1 new)
1—No. 4 Jno. Hall Nipple Machine (used)
1—Lenox Rotary Bevel Shear, 1 in. cap (new)
1—6 in. Curtis Pipe Machine (used)
1—Beaudry Champion Power Hammer, No. 9 (used)
1—Grant Rivet Spinning Machine, No. 80A (new)

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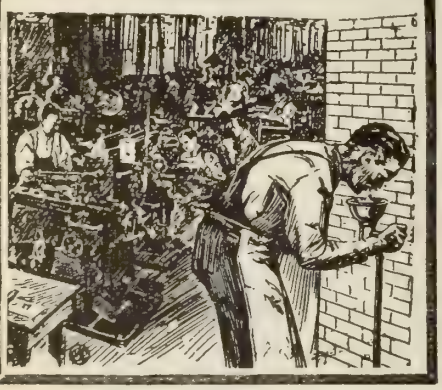


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from normal—Argentina, Japan and several other countries, where improvements have been shown since the beginning of the year.

Exchange difficulties have been one of the chief hindrances facing export trade, and improved conditions in this respect are looked upon as a very hopeful factor.

PRICE REDUCTIONS REASONS FOR THE DROP

The Bethlehem Steel Co., South Bethlehem, Pa., made an important reduction in steel prices recently. The table below shows the old and new figures:

	Old Prices	New Prices
Bars	2.10	1.90
Structural Shapes	2.20	2.00
Plates	2.20	2.00
Sheet Bar	39.00	35.00
Billets, 4 x 4	37.00	33.00
Slabs	38.00	34.00
Blue Annealed Sheets	2.85	2.65
Black Sheets	3.75	3.50
Galvanized Sheets	4.75	4.50
Tin Plate	6.25	5.75
Skelp	2.20	2.00

These new prices represent a reduction of $4.00 per ton on bars, structural shapes, plates, skelp, billets, sheet bar, slabs and blue annealed sheets; $5.00 per ton on black and gavanized sheets; $10.00 per ton on tin plate.

According to a report issued by the company the present manufacturing costs do not in any sense warrant these reductions, but it is stated that they hope this action will help to bring the market to a normal basis. They state that the increase in freight rates has been the largest factor in increasing the cost of manufacturing steel products because the making of a ton of finished steel involves the transportation of more than 5 tons of raw materials. The cost factors next in importance are materials and labor.

Taking as an example the price for structural shapes, under the new schedule prices, 2c a pound or $44.80 a gross ton, the comparison with pre-war prices, reflecting concretely the three more important cost factors are as follows:—

1. The increase over pre-war cost in transportation on ore, coal, limestone, scrap and miscellaneous supplies amounts to $7.85 per ton of finished steel. 2. The increase in the cost of coal, ore, limestone, alloys, refractories, lubricants, and miscellaneous supplies at point of shipment amounts to $7.10 per ton of finished steel. 3. The incretse in the cost of labor under the present wage scale, as compared with pre-war wages, in the steel plant proper, is $5.64 per ton of finished steel.

These items account for an increase in present day costs over pre-war costs of $20.59 per ton of finished product. The new price of $44.80 for structural steel is equivalent to a pre-war price of $24.21 per ton, or 1.08c per pound. Statistics covering the last twenty years show in only one month (December, 1914) has structural material been sold as low as this figure (1.08c). The ten-year pre-war average (1904-1913) was 1.51c per pound. The figures used are the results of actual compilation made by the company's comptroller in the every day conduct of the business.

EXPANSION REAMER.

The New Britain Tool & Mfg. Co., New Britain, Conn., have placed on the market a six blade expansion reamer that is said to be adapted for use in machine shops and garages. The ends of the blades are ground in such a manner as to serve as a pilot, and the range in sizes is from 15/32 in. to 4 1/16 inches.

TRADE GOSSIP

Work on the new St. Clair river channel is now nearing completion, and will soon be ready to accommodate the Great Lake freighters. Inspectors have stated that only a few lumps remain in the channel bed, and these are being removed by the dredge. Heretofore all large ships have had to use the same channel on the Sarnia side, a number of serious collisions having taken place as a result. When the new channel is ready, which it is expected it will be within the next two weeks, upbound steamers will take the Sarnia side and down-lake boats will pass on the other side.

Henry Ford seems to be at it again. This time he is said to be after the great nitrate plant at Muscle Shoals, Alabama. Reports claim that he has offered the Federal Government $5,000,000 in cash, and a yearly lease of $1,500,000 for its rental. As far as is known, it is his intention to manufacture commercial fertilizer, to be used in connection with his Ford farm tractor industry.

The investment house of H. L. Coombs Co., Ltd., who have a representative in Three Rivers, announce that they have added three new depts. to their busines, viz., pulp and paper machinery equipment, pulp and paper products, also an engineering and contracting dept.

Mr. L. H. Jenssen will have charge of the latter dept., and he has had a varied experience in different parts of the world on such work as railroad construction, bridge building, and concrete work.

TRADE GOSSIP

The Diamond State Fibre Company Canada, Limited, will be represented the Canadian National Exhibition be held in Toronto during the two eks beginning August 27th. The Exbit will be in the Industrial Building. e different grades of raw material ll be shown as well as the finished oduct in the shape of noiseless waterof gears, machined parts for elecal use, receptacles, automotive parts, There will also be exhibits of arles in which Diamond Fibre has been ilized for machined parts in the place wood, metal, rubber and other subnces.

Representatives of the Company will at hand every day to thoroughly exin its uses to anybody interested.

The Canadian Chicago Bridge and n Company, Limited, of Bridgeburg, tario, and Montreal, Quebec, has nged its corporate name to Horton el Works, Limited, according to an nouncement made by C. H. Scheman, neral manager of the company. The nadian organization was first incorated in 1913 and the plant at Bridgeg, Ontario, was constructed in that r.

Mr. Horton is said to have been one the pioneer engineers of North erica. Starting with a timber bridge Orinoco, Minnesota, in 1865, he deoped a large business in the design, fabrication and erection of bridges, el tanks, etc. In the early nineties, revolutionized the steel tank busins by inventing the hemisphericalbottom elevated steel tank of which usands are now in use throughout world. A few years ago his son, George T. Horton, now president of Horton Steel Works, Limited, inoted the elliptical bottom tank with ted steel riser which was a further ance in the art of steel tank buildn Mr. Scheman and Mr. G. S. Sangill will be located at Montreal, while C. C. Gregory is manager of the t. Mr. F. E. Gregory will be superndent of erection.

e Westinghouse Electric & Mfg. Co. nounces a ten per cent. reduction on s of practically all of industrial ors and motor control apparatus, inhing also all direct current generrs and motor generators. This is the nd cut of ten per cent. made by company in motor prices during this r. There is also a reduction in prices n eating appliances, such as toaster s, irons, chafing dishes, cozy glow ors, etc. The new prices to take effect immediately.

S. V. McLeod has been appointed purchasing agent for the Algoma Steel Corporation, Ltd., with headquarters at Sault Ste. Marie, Ont.



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" 82—Cincinnati Plain Miller, Lincoln Type.
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" 456—500 H.P. Goldie & McCulloch Boiler.
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" 187—
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" 198—Hooker Tap Threading Machine
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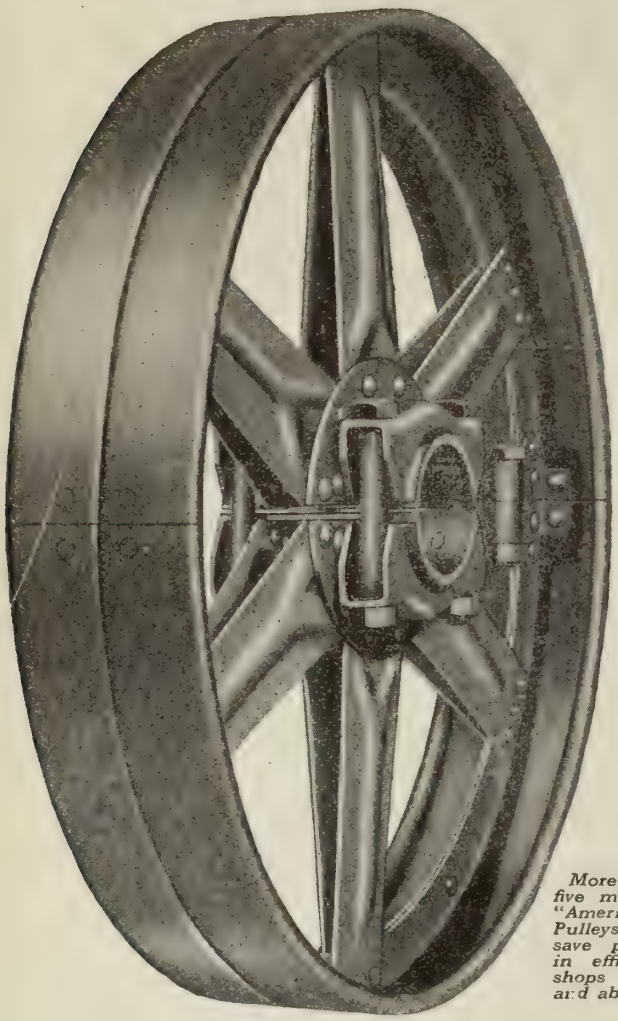
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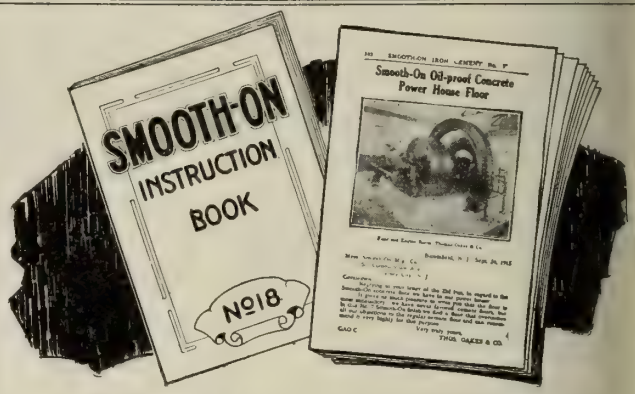
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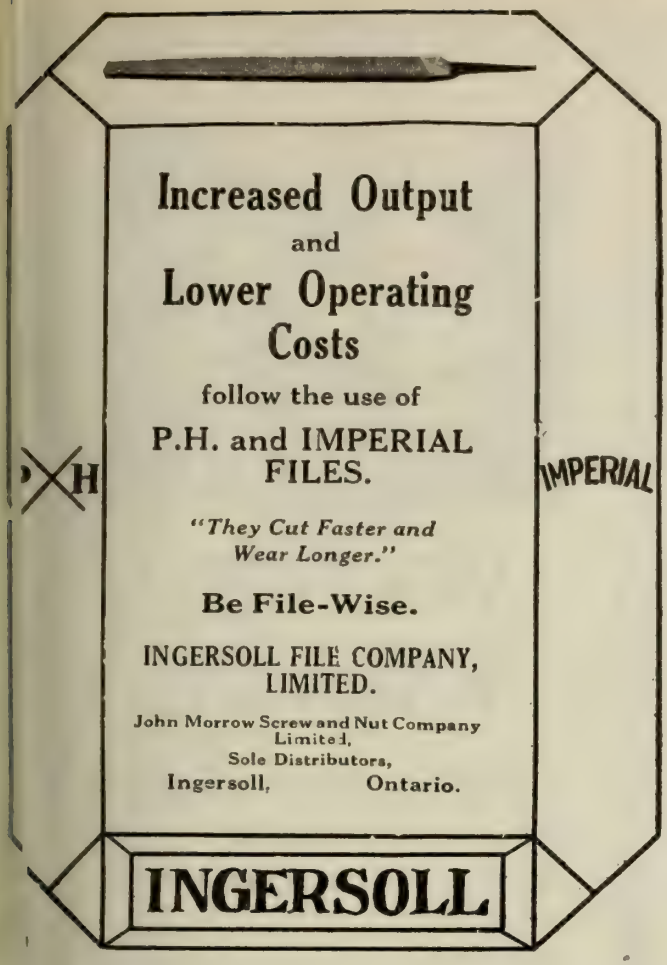
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1—144" x 12' Berg Pit Lathe (used).
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1—30" x 12' Blaisdell (used).
1—30" x 14' Niles-Bement-Pond (used).
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1—24" x 10' Milwaukee (new).
1—20" x 6' Le Blond Heavy Production (used).
1—18" x 8' Bertram (rebuilt).
1—18" x 8' Rae (new).
1—16" x 6' Reed (used).
1—12" x 8' LeBlond (used).
1—8" Rivett, Bench, Cabinet and Attachments (used).
1—7" Cataract Precision, Standard Equipment.

GAP LATHES

1—22" x 40" x 16' McDougall (used).
1—20" x 38" x 12' C. M. C. (used).
1—18" x 24" x 10' Rahn Meyer (used).

TURRET LATHES & SCREW MACHINES

Several No. 4 Millhollands. Davis, Oliver, Garvin, Warner & Swasey, and National Acme.

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1—16" Rae B. G. Crank Shaper (new).
1—24" McGregor-Gourlay Crank Shaper (used).

PLANERS

1—42" x 42" x 20' Putnam, 1 Head (used).
1—48" x 48" x 14' Patch, 4 Heads.
1—36" x 36" x 24' Sellers, Open Side (3 Heads).
1—30" x 30" x 10' Pond, 1 Head.

MILLING MACHINES

1—Briggs High Duty Type "A", 22" Traverse (new).
1—Briggs High Duty Type "B" 42" Traverse (new).
1—Ryerson-Owen No. 3, Universal (new).
1—Ford-Smith, No. 3 Universal (used).
Several Plain and Small Hand Millers.

DRILLS

1—10" Burke Sensitive Bench (new).
1—15" Rockford (used).
1—16" No. 2B Edlund H. S. Sensitive (new).
20" "Sibley," "Champions," "Rockwell" and "Silver" (new and used).

BORING MILLS

1—Universal No. 2½ Horizontal, Table 42" x 22" (used).
1—Bullard "New Era" Type Vertical Turret, 36", Complete Equipment (new).

POWER HACK SAWS

1—No. 10 Racine 8" x 8" Cap. (new).
1—No. 7 Watkins, 9" Cap. (used).
1—No. 1 Racine, 6" x 6" Cap. (used).

GRINDING MACHINES

1—Landis No. 4 Universal (used).
1—Landis Plain, self-contained, 36" x 12" (used).
1—Fitchburg Cylindrical, 8" x 36" (new).
Tool and Cutter Grinders. New and used. "Globe," Stevens, LeBlond and Cincinnati.

AIR COMPRESSORS

1—8" x 8" Sullivan, Class W.G.-3, belt driven (used).
1—8" x 10" x 8" Bury, steam driven (used).
1—12" x 18" Ingersoll-Sargent, belt drive (used).
1—12" x 12" Can. Ingersoll-Rand, N.-E.-1 (used).

PRESSES

1—No. 0 Consolidated Inclinable Power Press (used).

MISCELLANEOUS

2—No. 4 Jno. Hall Pipe Machines (1 used), (1 new).
1—No. 4 Jno. Hall Nipple Machine (used).
1—Lennox Rotary Bevel Shear, 1" cap. (new).
1—6" Curtis Pipe Machine (used).
1—Beaudry Champion Power Hammer, No. 9 (used).
1—Grant Rivet Spinning Machine, No. 80A (new).
1—Grant Rivet Spinning Machine, No. 80B (used).
1—Greenerd Arbor Press No. 4 (used).
Transmission Equipment, Pulleys, Belting, Shafting and Hangers.

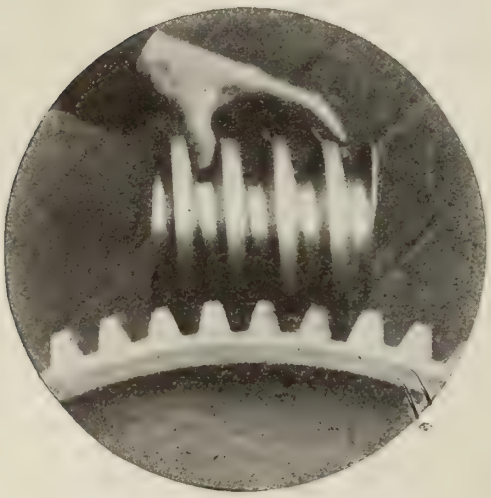
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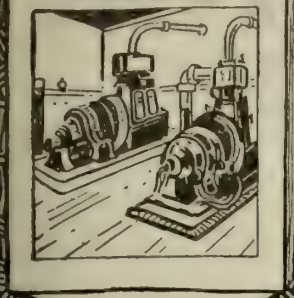
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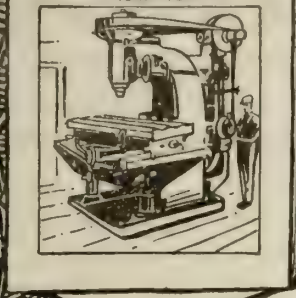
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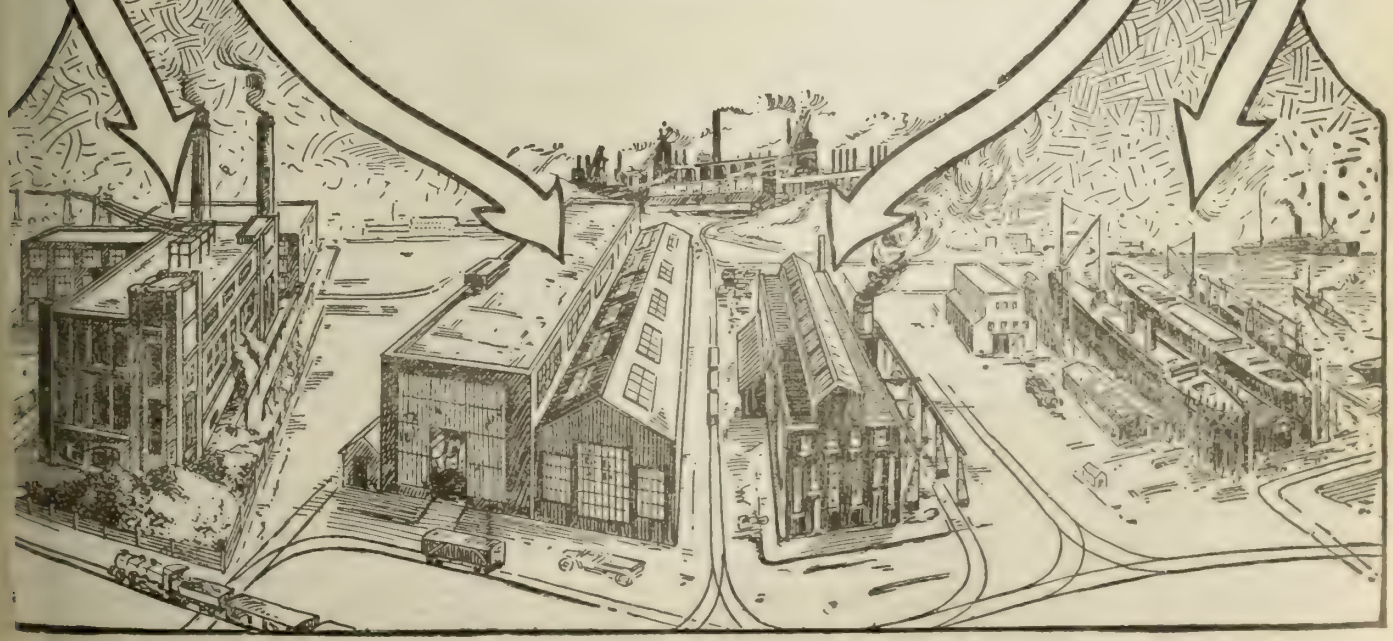
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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
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Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Independent Pneumatic Tool, Chicago, Ill.

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Toronto Testing Laboratory, Toronto, Ont.

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Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
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Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
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Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
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Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
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Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

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McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
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Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
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(See also Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
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Flexible Steel Lacing Co., Chicago, Ill.

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Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain
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Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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Can. Fairbanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
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Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
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National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Machines, Vertical
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

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Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

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Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Can. Hanson & Van Winkle Co., Ltd Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati,

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Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Burners, Oil and Gas
General Combustion Co. of Can., Ltd Montreal, Que.
Rockwell Co., W. S., New York City.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See also Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
MacKinnon Steel Co., Sherbrooke, Que

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an. Hanson & Van Winkle Co., Toronto, Ont.
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stings, Brass and Bronze
lgoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
anada Electric Castings Co., Ltd., Orillia.
an Hanson & Van Winkle Co., Toronto, Ont.
anada Metal Co., Ltd., Toronto, Ont.
n Driver-Harris Co., Walkerville, Ont.

Ctings, Copper
anada Metal Co., Ltd., Toronto, Ont.
n Hanson & Van Winkle Co., Toronto, Ont.

Ctings, Marine
n. Steel Foundries, Montreal, Que
ominion Foundries & Steel, Ltd., Hamilton, Ont.

Ctings, Die Molded
isher Motor Co., Ltd., Orillia, Ont.
anklin Die-Casting Corp., Syracuse, N.Y.
tle Foundry Co., Galt, Ont.
llman Brass & Metal, Ltd., Hamilton, Ont.

C ings, Ferro-Alloy
n Steel Foundries, Montreal, Que.

C ings, Iron
goma Steel Corp., Ltd., Sault Ste. Marie, Ont.
rnard Industrial Co., A., Fortierville, Que.
ton Machine Co., Bridgeport, Conn.
own, Boggs & Co., Ltd., Hamilton, Ont.
n. Hanson & Van Winkle Co., Toronto, Ont.
nada Electric Castings Co., Ltd., Orillia.
nna & Co., M. A., Cleveland, Ohio.
pburn Ltd., John T., Toronto, Ont.
tle Foundry Co., Galt, Ont.
nnedy & Sons, Wm., Owen Sound, Ont.
Dougall Co., Ltd., R., Galt, Ont.
toria Foundry Co., Ltd., Ottawa, Ont.
lker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
nion Engineering Works, Limited, ontreal, Que.

Ctings, Hyd. Press
n Steel Foundries, Montreal, Que.

Ctings, Malleable Iron
ternational Malleable Iron Co., uelph, Ont.
nedy & Sons, Ltd., Wm., Owen und, Ont.
th's Falls Malleable Castings Co., mith's Falls, Ont.

Ctings, Monel Metal
Driver-Harris Co., Ltd., Walkerlle, Ont.

Ctings, Naval Bronze
lman Brass & Metal, Ltd., Hamilton, nt.

Ctings, Nichrome
C. Driver-Harris Co., Walkerville, Ont.

Ctings, Nickel
Hanson & Van Winkle Co., Toronto, Ont.

Ctings, Semi-Steel
idson Mfg. Co., Thos., Montreal, Que.
Iron & Steel Foundries, Hull, Que.
e Foundry Co., Galt, Ont.
nitoba Steel Foundries, Ltd., Winnipeg, Man.
nion Engineering Works, Limited, ontreal, Que.

Ctings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
C Steel Foundries, Montreal, Que.
nnedy & Sons, Wm., Owen Sound, Ont.
itish Crucible Steel Co. of Can., Ltd., ndsor, Ont.

Castors, Iron
Smith Mfg. Co., Jersey City, N.J.

Centering Machines
Brown & Son Co., Ltd., The John, Dundas, Ont.
Gurney-Walker Mchy. Co., Toronto, Ont.

Chain (See Sprockets and Chains)
Mills Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Mayo Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Reid (Hans) of Canada, Ltd., Montreal, Que.
Weed Mfg. Co., Lisbon, Ohio.

Chain, Driving
Coe Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Glassco, Montreal, Que.
Mayo Chain Co., Ithaca, N.Y.
Reid (Hans) of Canada, Ltd., Montreal, Que.
Weed Mfg. Co., Lisbon, Ohio.

Chains
Brown & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chains
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg Co., Providence, R I
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Stemle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co of Can., Ltd., Hamilton, Ont

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Fine
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Middleton, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Milling Machine Co., Cleveland
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jones & Lamson Machine Co., Springfield, Vt
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Alkenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Alkenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Que
Ont.

Flexible Shafts
Alkenhead Hardware Ltd., Toronto, O

Flux, Galvanizing
British Smelting & Refining Co., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The J
Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton,
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Mont
Garlock-Walker Mchy. Co., Toronto,
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow,
Steel Co. of Canada, Ltd., Hamilton,

Forgings, Drop
Canada Foundries & Forgings Co., land, Ont.
Dominion Forge & Stamping Co., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Montreal, Canada.
Canada Foundries & Forgings Co., land, Ont.
Can. Atlas Crucible Steel Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine,
Dom. Foundries & Steel, Hamilton,
Hepburn Ltd., John T., Toronto, On
N. S. Steel Co., Ltd., New Glasgow,
Steel Co. of Canada, Ltd., Hamilton,

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherb
Que.
Can. Ingersoll-Rand Co., Ltd., Sherb
Que.
Ford-Smith Machine Co., Hamilton,
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, O

Foundry Supplies
Atkins & Co., Inc., E. C., Indianap
Rice Lewis & Son, Ltd., Toronto, O
Sturtevant Co., B. F., Boston, Ma

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Qu

Fuel Oil Burning System
General Combustion Co. of Can., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., delphia, Pa.
General Combustion Co. of Can., Montreal, Que.
Rockwell Co., W. S., New York

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Montreal, Que.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York Ci

Furnaces, Heat Treating Oil an
Armstrong-Whitworth of Canada, Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sher Que.
Can. Fairbanks-Morse Co., Ltd., Mo
General Combustion Co. of Can., Montreal, Que.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York Ci
Walker & Sons Metal Products, Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., delphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Hiram, Walkerville, Ont.

Furnaces, Tempering and Ann
Brown & Sharpe Mfg. Co., Providen
Electric Furnace Construction Co., delphia, Pa.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York C
Walker & Sons Metal Products, Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toront

Gages, Comparator
Jones & Lamson Machine Co., field, Vt.
Herbert Ltd., Alfred, Toronto, Ont
Johansson Inc., C. E., Windsor,
Perdue, W. B., San Francisco, C
Starrett Co., L. S., Athol, Mass

Gages, Measuring (See Tool W
Chesterman & Co., Ltd., J., Sheffie
Crescent Machine Co., Ltd., Mont
Greenfield Tap & Die Corp., Galt,
Johansson Inc., C. E., Windsor,
Starrett Co., L. S., Athol, Mass

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor,
Taylor Instrument Co., Toronto,

Ackworthle, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ages, Standard
Armstrong Whitworth Co. of Can., Lt. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis,
Johansson Inc., C. E., Windsor, Ont.

ages, Thread
Ackworthle, Ltd., John, Birmingham, Eng.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

s, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

s, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

skets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

uges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

ar Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Smith Engineering Works, Limited, Montreal, Que.

ar Counters
Root Mfg. Co., R. A., Battle Creek, Mich.

ar-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whilton Machine Co., D. E., New London, Conn.

ar Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

ars, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Smith Engineering Works, Limited, Montreal, Que.

ars, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Ingersoll Ltd., John T., Toronto, Ont.
Kerr Engine & Co., A. B., Hespeler, Ont.
Lines & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Reinhold (Hans) of Canada, Ltd., Montreal, Que
Smith Engineering Works, Limited, Montreal, Que.

ars, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

ars, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

ars, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

ars, Machine Moulded
Can. Steel Foundries, Montreal, Que.

ars, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

ars, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Jos. Renold of Canada, Ltd., Montreal, Quebec

ars, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

BUYERS' DIRECTORY

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Fetique, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthle, Ltd., John, Birmingham, Eng
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Fetz Sheet Metal Co., Hamilton, Ont.
Fox, Machinery & Supply Co., E., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can Consolidated Rubber Co., Ltd., Montreal, Que.
Can Foamite Firefoam Co., Hamilton, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow Scot
Smith Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que
Crescent Machine Co., Ltd., Montreal, C

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ort.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal-Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd. Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Beaford, Que.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto Ont
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Graton & Knight Mfg. Co., Worcester Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Wood working Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal.
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

BUYERS' DIRECTORY

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pig Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass.
Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Fairbanks-Morse Co., Ltd., Montreal.
Fraser Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kerr Line & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Mackey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Dunbead Hardware Ltd., Toronto, Ont.
Fraser Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Sole Turret Machine Co., Madison, Wis.

Pliers, Parallels
Lee P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fraser Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Lee P. Mfg. Co., Niagara Falls, Ont.
Moon Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Can. Sanitary Drinking Fountain Co., Adenville, Mass.

Pneumatic Tools
Canadian Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Churchill, Ltd., John, Birmingham, Eng.
Arnold & Co., Chas. P., Montreal, Que.
Blickensderfer Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Oscar Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gorton & Co., John C., Birmingham, Eng.

Press, Steel
Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Press Steel Parts
Churchill, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Ford Motor Co., Ltd., Orillia, Ont.

Press Arbor
Arbor Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada P. Manufacturing Company, Ltd., Niagara Falls, Ont.
Canadian Engineering Co., Sarnia, Ont.
Fraser Ltd., H. W., Toronto, Ont.
Shaw-Box Crane & Hoist Ltd., Manchester, Eng.
Shaw-Stenger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gorton & Co., John C., Birmingham, Eng.

Presses, Forcing
Arbor Press Co., Kalamazoo, Mich.
Shaw & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Bartlett Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canadian Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Lauer Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Shaw & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Alkenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Alkenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Sawing Machines, Power Hack
Ackworthic, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal. Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
& Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Sorelsteel Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.

Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Qu
Greenfield Tap & Die Corp., Galt, Ont
Jones & Lamson Machine Co., Springfield Vermont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfiel Vermont.
Landis Machine Co., Inc., Waynesboro, P

Threaded Wires
Torrington Company, Ltd., Upper Be ford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio
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Murchey Machine & Tool Co., Detro Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
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Thread Lead Testing Machines
Jones & Lamson Machine Co., Spring field, Vt.
Pratt & Whitney Co., of Canada, L Dundas, Ont.

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Bliss Co., E. W., Brooklyn, N.Y.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago.
Bilton Machine Co., Bridgeport, Conn
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbro Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The J Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Toronto, Ont.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Montreal, Canada.
Armstrong Bros. Tool Co., Chicago.
Bertrams Ltd., Edinburgh, Scotland
Burgess & Marchand, Montreal, Que
Can. Fairbanks-Morse Co., Ltd., Mont
Chesterman & Co., Ltd., J., Sheff Eng.
Foss Machinery & Supply Co., Geo. Montreal, Que.
Geometric Tool Co., New Haven Co
Greenfield T & Die Corp., Galt, O
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National Machine Tool Co., Racine,
Rapid Tool & Machine Co., Lachine,
Rice Lewis & Son, Ltd., Toronto, On
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Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mic
Williams Machinery Co., A. R., To Ont.
Williams Machinery & Supply Co., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., To
Crescent Machine Co., Ltd., Montre
Ford-Smith Machine Co., Hamilton

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National Electro Products, Ltd., Toronto, Ont.
Pfaff, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
R. Lewis & Son, Ltd., Toronto, Ont.

Trimmers, Railway
Can. Steel Foundries, Montreal, Que.

Trimmers, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Gosk-Walker Mchy. Co., Toronto, Ont
Jno. & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Pedr. Ltd., H. W., Toronto, Ont.
Prime Clutch & Pulley Works, Toronto, Ont.
Reid (Hans) of Canada, Ltd., Montreal, Que.

Transportation Systems (See Trucks)
Mikowa Gravity Carrier Co., Port Hope, Ont.

Tread Rims
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Troughs and Tramways
Can. Link-Belt Co., Toronto, Ont.
Mills Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Fearn Ltd., John T., Toronto, Ont.
Gilbert Leaf Mfg. Co., Montreal, Que.
Mills Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

Trucks, Industrial Motor
Gilbert Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

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Fuller Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Fuller Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Fuller Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Imperial Steel Products Co., Brantford, Ont.
Lyon Tube & Supply Co., Montreal, Que.
Metallic Metal Products Co., Ltd., Toronto, Ont.
Mullan Brass & Metal Co., Hamilton, Ont.

Tubing, Welded
International Nickel Co. of Can., Ltd., Toronto, Ont.
Metallic Metal Products Co., Ltd., Toronto, Ont.

Tubing, Welded Steel
Fuller Co. of Canada, Toronto, Ont.

Turbines, Water
Canadian Engineering Works, Ltd., Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Wilson Engineering Works, Limited, Montreal, Que.

Turret Heads
Alfred Herbert, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Cincinnati Machine Tool Co., Cincinnati, Ohio.
Colt Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Universal Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turret Tool Post
Universal Machine Co., Madison, Wis.

Union Pipe
Canada Ltd., Montreal, Que.

Universal Joints
Dominion Machine Co., Hamilton, Ont.
Hardy Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis
Charles Parker Co., Meriden, Conn.

Vises, Metal Workers'
Athenhead Hardware, Ltd., Toronto, Ont.
Columbia Hdwe. Division, Cleveland, O.
Charles Parker Co., Meriden, Conn.

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Crescent Machine Co., Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
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Kearney & Trecker Co., Milwaukee, Wis.
Foss Machinery & Supply Co., Geo F., Montreal, Que
Oliver Machy Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bullock Co., Gananoque Ont.

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Northern Electric Co., Montreal, Que.

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Washers
Barnes Co., Wallace, Bristol, Conn.
Diamond State Fibre Co., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

MACHINE SHOP AND FACTORY SUPPLIES

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O

Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.

Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Davis-Bournonville Co., Jersey City, N.J
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont
National Electro Products, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont
Union Carbide Co. of Can., Welland, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont
National Electro Products, Toronto, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.
Union Carbide Co. of Can., Welland, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Co., Wallace, Bristol, Conn
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Northern Electric Co., Montreal, Que
Steel Co of Canada, Ltd., Hamilton, Ont

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Welding
L'Air Liquide Society, Toronto, Ont
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que
Greenfield Tap & Die Corp., Galt, Ont.

Wrenches, Tap
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont

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Steel Co. of Canada, Ltd., Hamilton, Ont.

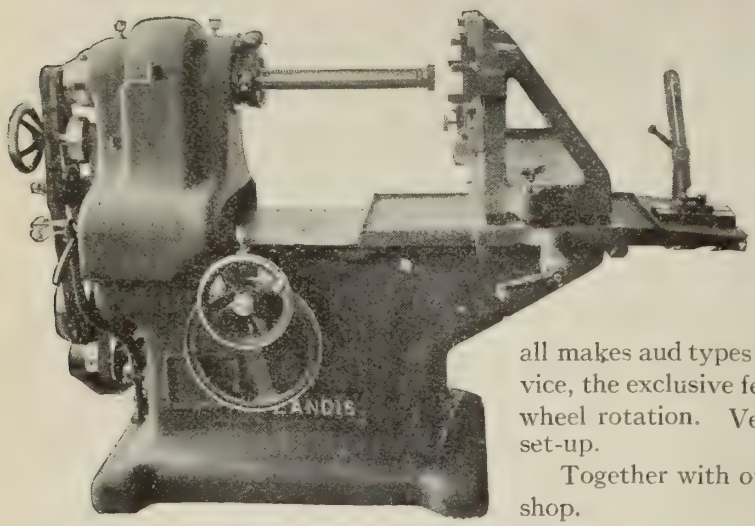
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Asphalt—The asphalt compound is used for the first coating because scientific experiments over a long period of years have demonstrated that it forms the best protector of steel against corrosion.

Asbestos—Asbestos felt also completely covers the steel and is firmly bonded to the asphalt. Because of its fibrous-crystal formation asbestos is indestructible. It cannot rot or decay. Acids and alkalies do not affect it.

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You are replacing with permanency. You stop painting expense. You reduce heating expense and you give your employees greater comfort in summer.

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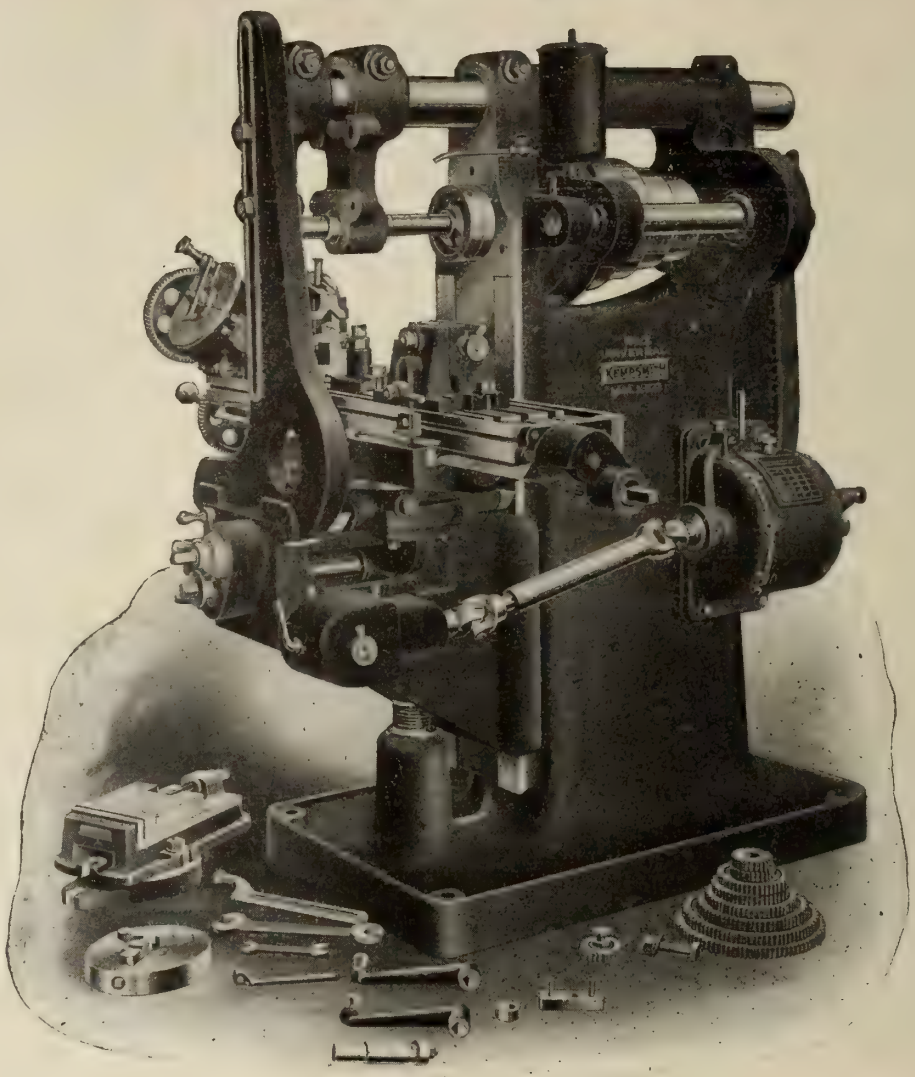
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It has always been, and will continue to be, the purpose of the Kempsmith Company to produce machines of the highest quality only, suited to the most advanced practice.

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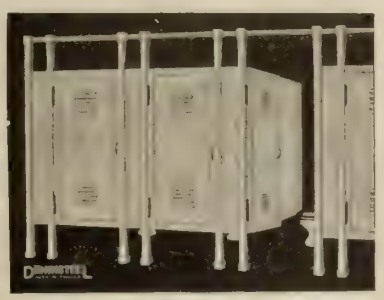
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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

DENNISTEEL
Made in Canada



Steel Stationery Cabinet



Lavatory Compartments



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NO industry can be up-to-the-minute without the sanitary, space-saving equipment for factory or office shown here.

We specialize in products of steel. For years we have had leadership in the manufacture of equipment of this kind, and we are retaining leadership by turning out superior products.



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The name **DennisteeL** is an assurance of quality.

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"All Dennisteel Products are Fireproof."



P & W

Pratt & Whitney Taps

"With the 'Con-eccentric' Land"

P & W Taps are **Good** taps—easily the best where accuracy and high speed are essential. They cost more to buy, but less to use than others.

If you're doing work that calls for big production and for unusual precision, give them a trial. You'll be back for more when you see them prove themselves.

The "con-eccentric" land — the special feature of Pratt & Whitney Taps, permits sharpening on face of the cutting edge without affecting size. It lengthens life and assures accuracy hitherto thought impossible in a commercial tool.

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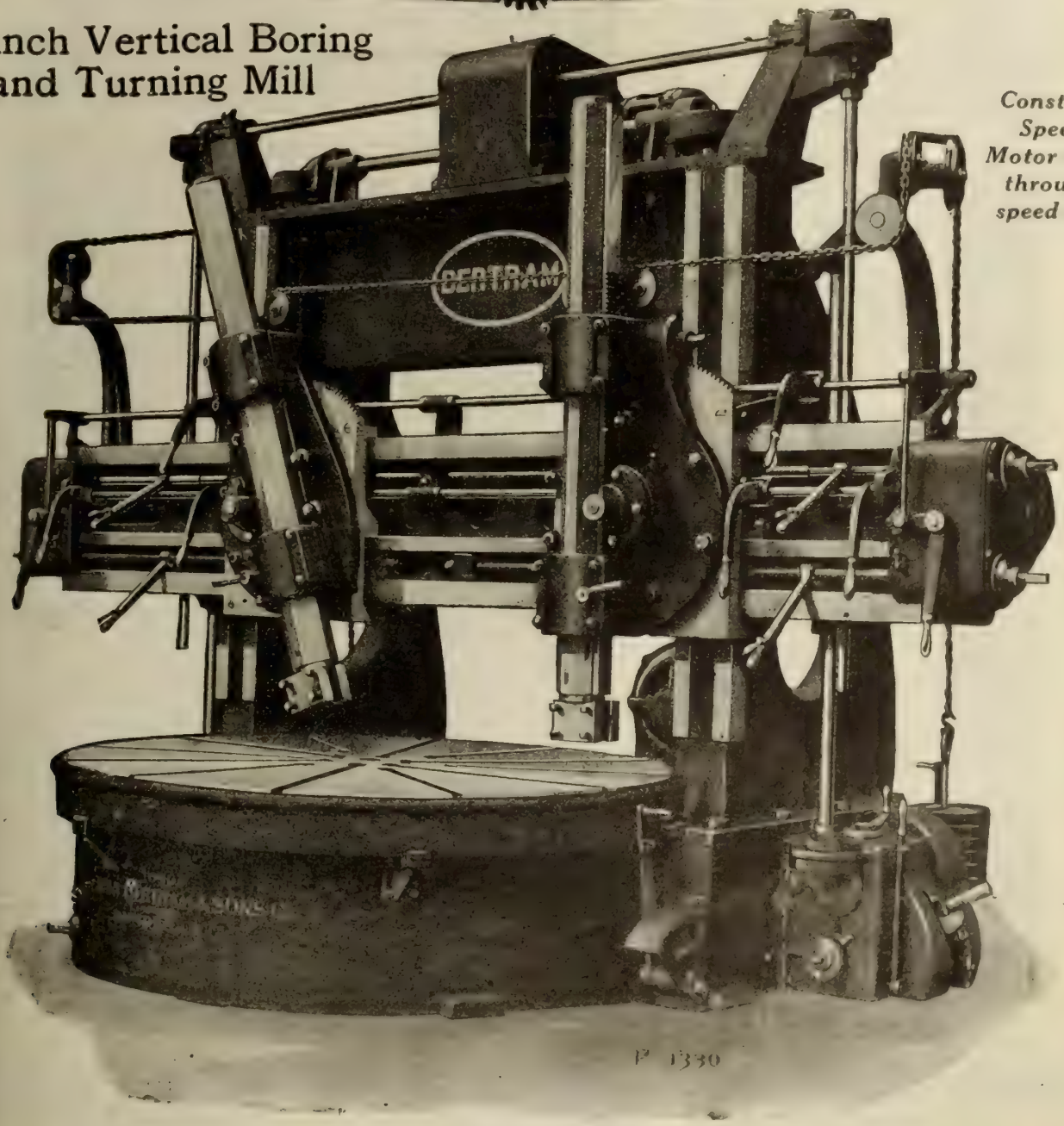
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MACHINE TOOLS

34-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



P 1330

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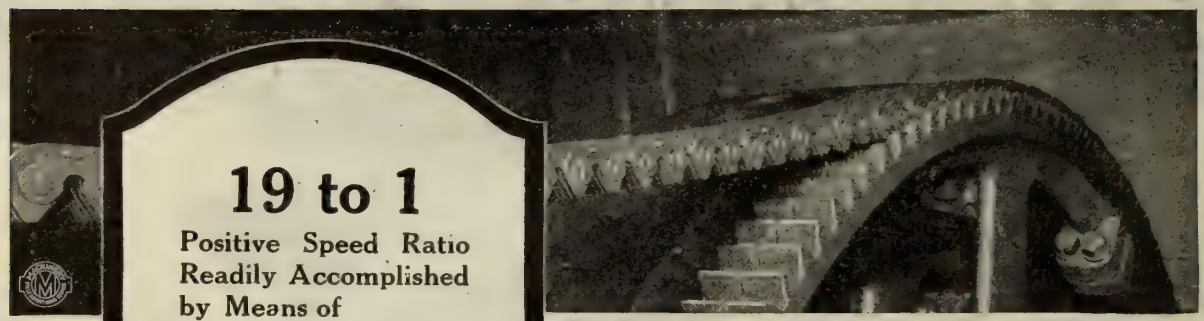
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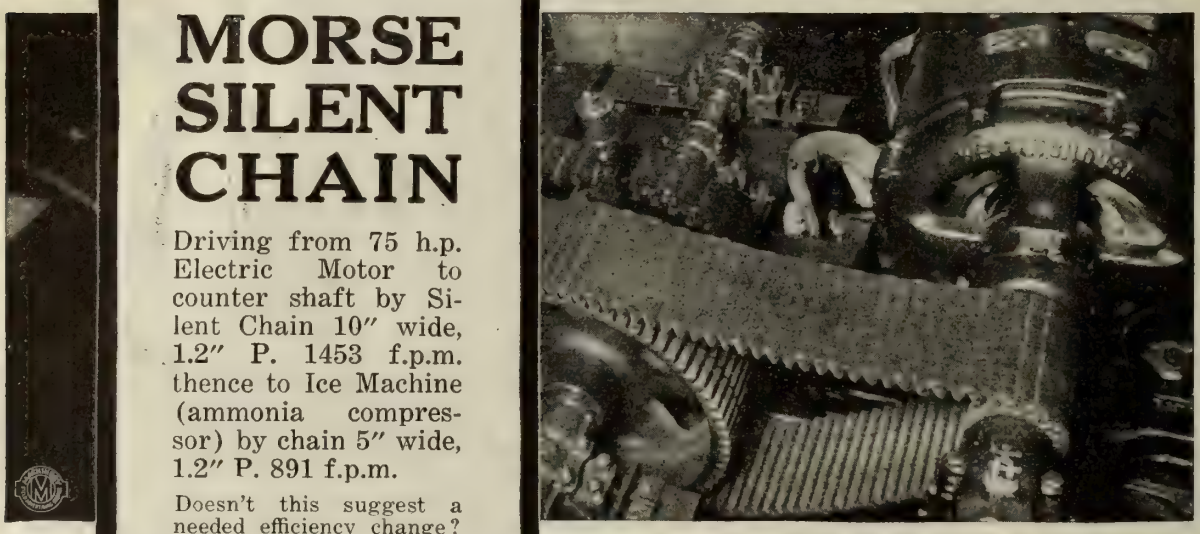
Driving from 75 h.p. Electric Motor to counter shaft by Silent Chain 10″ wide, 1.2″ P. 1453 f.p.m. thence to Ice Machine (ammonia compressor) by chain 5″ wide, 1.2″ P. 891 f.p.m.

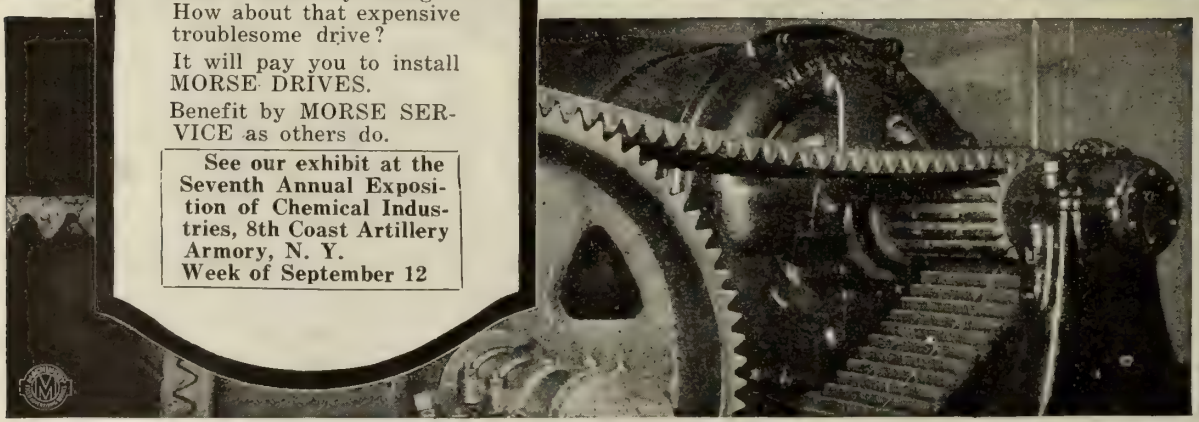
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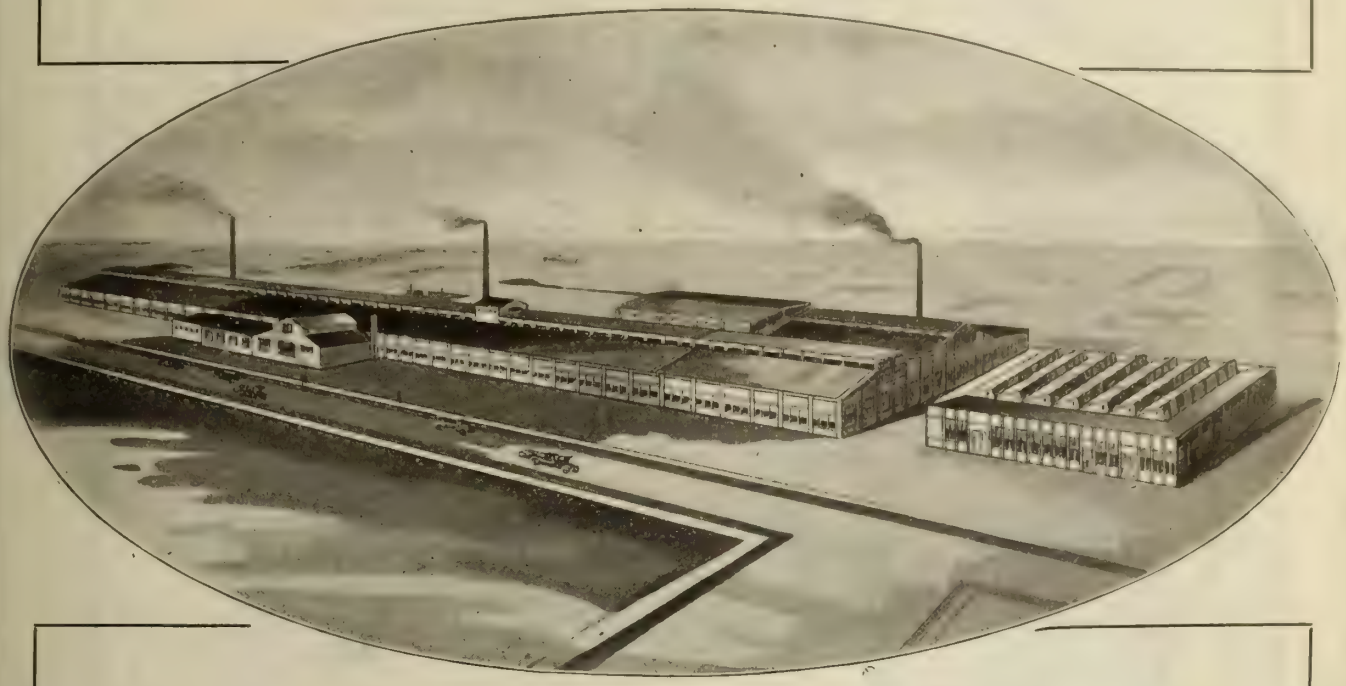
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GUELPH, ONTARIO, CANADA



Malleable and Cast Iron PIPE FITTINGS

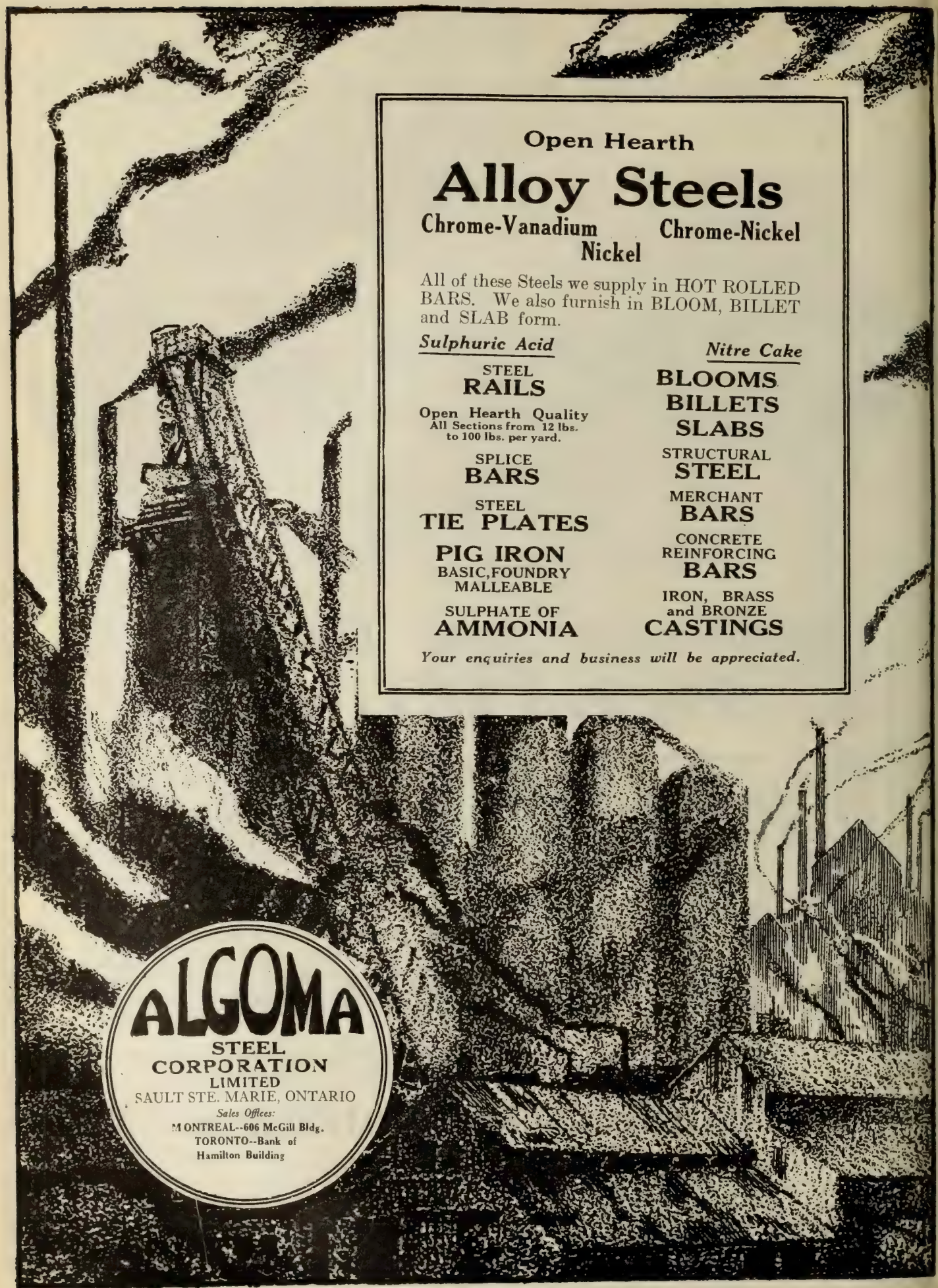
Made in Canada and Exported Abroad

A LARGE plant, up-to-date facilities and thoroughly experienced staff place us in a position to offer unequalled quality, price and quick delivery on Malleable and Cast Iron Pipe Fittings; both screwed or flanged, black or galvanized. All sizes from 1/8 inch up.

We make a specialty of exporting our products and can furnish designs required in any country, such as the Whitworth or "V" thread in use in England, the Metric Pitch in France, or the W. S. Standard in use in Canada and United States.

We will be glad to answer your enquiries.

International Malleable Iron Co.
Limited
GUELPH, ONTARIO, CANADA


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All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.
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All Sections from 12 lbs. to 100 lbs. per yard.
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MADE IN CANADA

Torrington

MACHINE SCREWS

Something You Get Without Paying for



You're way ahead---in fact money in pocket---when you specify Torrington Machine Screws because the same price asked anywhere else for ordinary Machine Screws when invested in Torrington buys you additional, "free gratis" value.

You obtain Machine Screws that are made by high-salaried, thoroughly-experienced workmen—you do not pay for the practice work of beginners. *Yet this guarantee of uniform quality costs you nothing extra.*

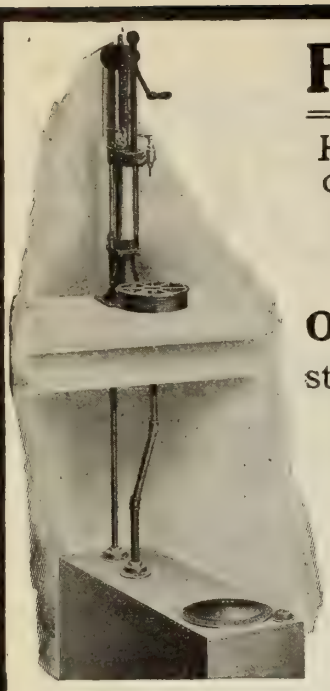
You have a wide choice of STANDARD SCREWS to choose from (standardization enables the user to provide correct style and make of taps) and the most complete facilities available for the manufacture of SPECIALTIES. Yet this *costs you nothing additional.*

Are not these points worth investigating? The Torrington Line includes Standard and Special Machine Screws, Rivets, Threaded Wires and specialties in Headed Work.

A small representation of the many styles we make.

The Torrington Company, Limited.

Upper Bedford, Quebec.



Plan Your Oil Storage

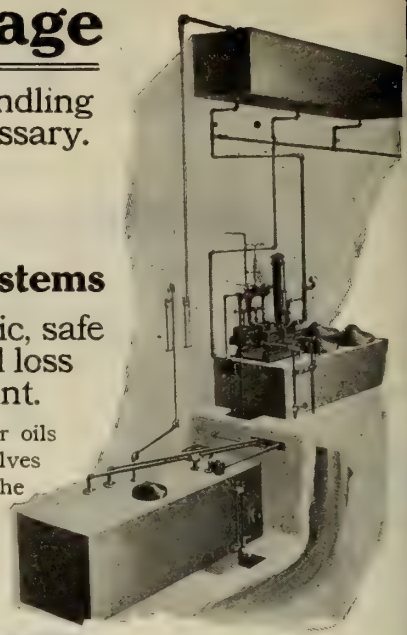
Haphazard methods of storing and handling oils are costly, dangerous and unnecessary.

BOWSER ESTABLISHED 1885

Oil Storage and Distributing Systems

store and handle all oils in a systematic, safe and saving manner—they prevent all loss of oils—make every drop of oil count.

In factory, machine shop, power plant or wherever oils are used, BOWSER Storage Systems pay for themselves many times, through the saving in oils, besides the saving in labor and floor space.



S. F. Bowser Co., Ltd.

66-68 Fraser Ave., Toronto, Can.

BOWSER Oil Storage GIVES Convenience AND Safety



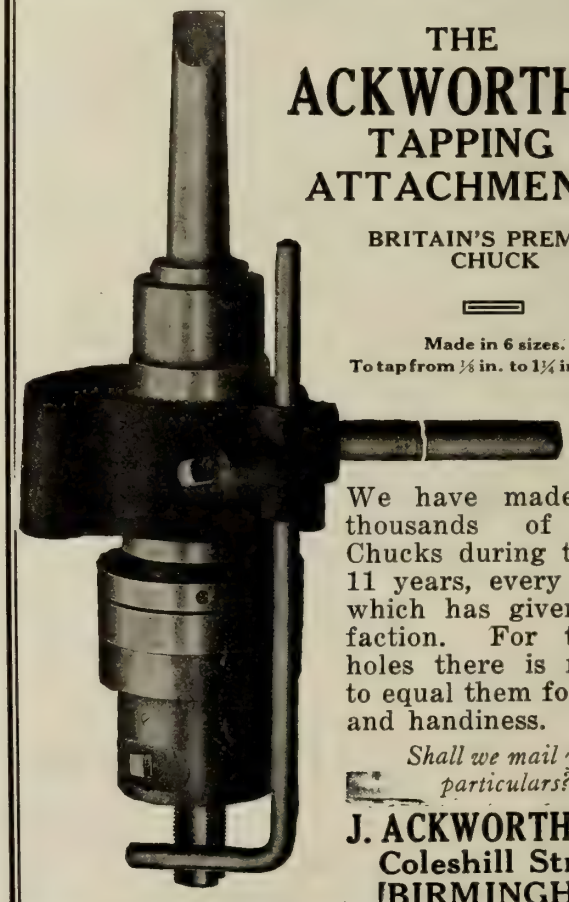
BOWSER Oil Storage IS Systematic AND Saving

How to Plant an Advertising Crop

Until the advent of the Audit Bureau of Circulations, advertisers sowed their business seed in a vast but fallow field. Some of it grew and returned a fair harvest—much of it was cast upon barren ground and was lost. There was no standardized method of determining the fertility of a publication's field. Experimenting was expensive.

The A. B. C. has eliminated the barren spots of circulation. Planting an advertising crop is no longer an experiment. Advertisers **Know** the field through audit reports. They know whether it is fertile ground and sow their seed accordingly.

The Canadian Machinery circulation has been audited by the A. B. C. Advertisments placed in this publication are seeds well sown.



THE
ACKWORTHIE TAPPING ATTACHMENT.

BRITAIN'S PREMIER CHUCK

Made in 6 sizes.
To tap from ⅛ in. to 1¼ in. Whit.

We have made some thousands of these Chucks during the last 11 years, every one of which has given satisfaction. For tapping holes there is nothing to equal them for speed and handiness.

Shall we mail you particulars?

J. ACKWORTHIE, Ltd.
Coleshill Street,
BIRMINGHAM

BANFIELD

Metal Stampings of the better Quality.
We have the equipment--the knowledge--and men who know how.
Estimates cheerfully furnished.
Tools and Dies, our specialty.

W. H. BANFIELD & SONS, LIMITED

370-386 Pape Ave. - - TORONTO

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to



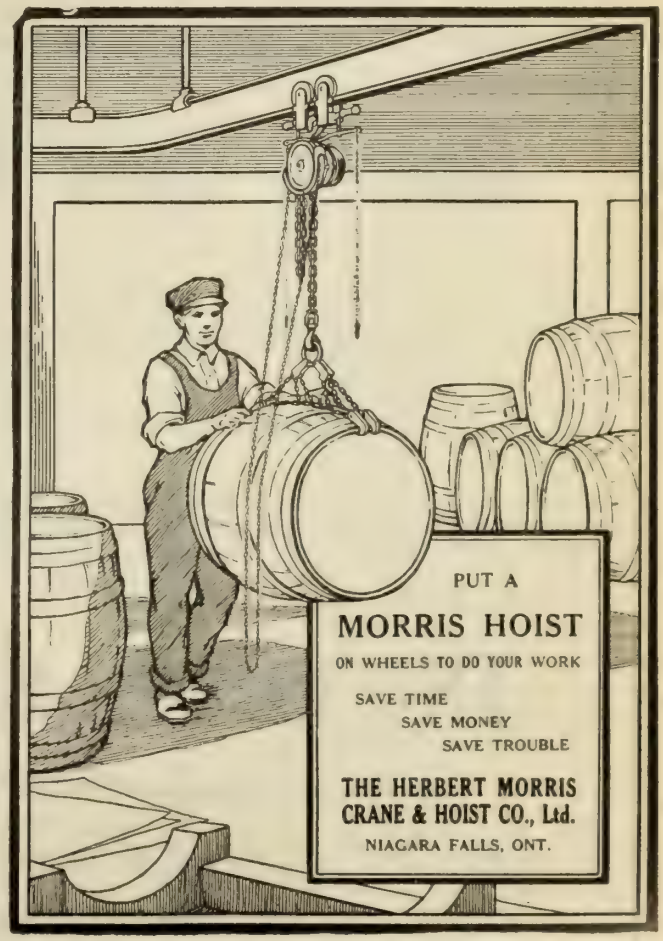
The U.S. MILLER

The Miller for Small Work

A small machine takes up less space, requires less power, is easier to operate and is more accurate.

The Paramount Miller of its size. Drop us a line for full details.

United States Machine Tool Company
Cincinnati, Ohio, U.S.A.



THE JOHNSON FRICTION CLUTCH



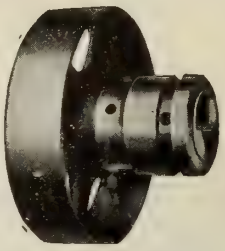
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

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The present abnormal exchange situation between Canada and the United States is affecting trade relations between the two countries. Exporters in the United States can meet this by opening Bank Accounts in Canada.

This Bank has 730 Branches, of which 626 are located in Canada from the Atlantic to the Pacific Coast. Write for a complete list of Branches and for terms respecting a Canadian account.

THE ROYAL BANK OF CANADA

Capital and Reserves $40,000,000 **Total Resources $544,000,000**

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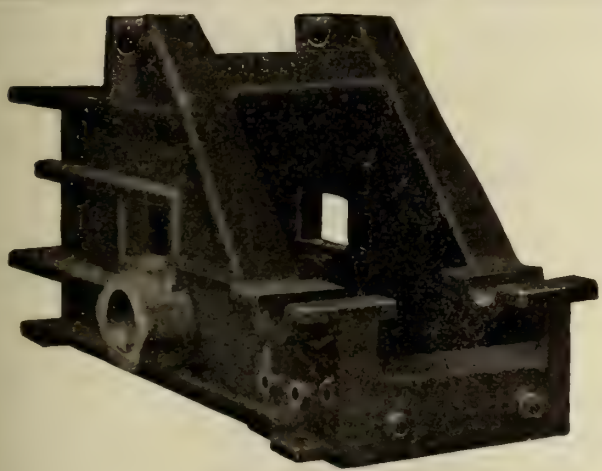
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Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal



Cast Steel
Stone Crusher Frame

Machinery Parts

of every description

in

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Chrome-Nickel

and other forged gear blanks

Forged Shafts

Dominion Foundries & Steel Limited

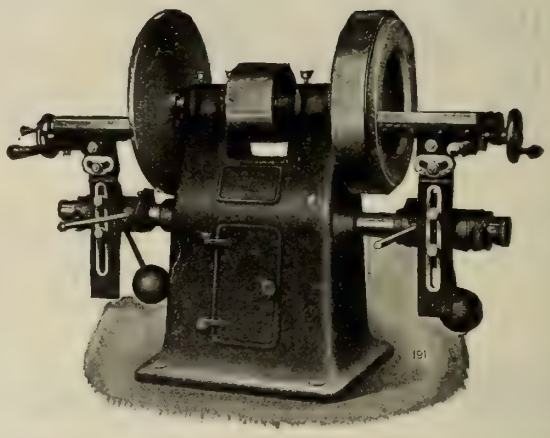
Hamilton, Canada

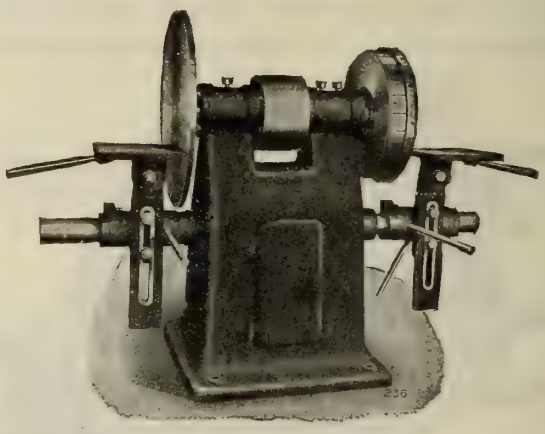
FORD-SMITH

DISC

Grinders

High-Class Made-in-Canada Machines





MACHINES which bear a reputation for doing quicker, better work, and whose upkeep expenses are practically nil, merit investigation.

Such machines are Ford-Smith Disc Grinders; every model of the Ford-Smith line—and there's a model for practically every purpose—is designed to give quality production as well as quantity.

Before leaving the factory all Ford-Smith Grinding Machines are subjected to a series of exacting tests, covering every detail of their construction. These tests prove that the machine is capable of filling all our claims.

Many manufacturing operations show possibilities of exceptional economies by the use of suitable grinding processe. Have one of our engineers call and see just what saving grinders would effect on your work.

Any information with regard to Ford-Smith Grinders will gladly be furnished.

Send for our latest Disc Grinder Bulletin.

THE FORD-SMITH MACHINE COMPANY, LIMITED

HAMILTON, CANADA

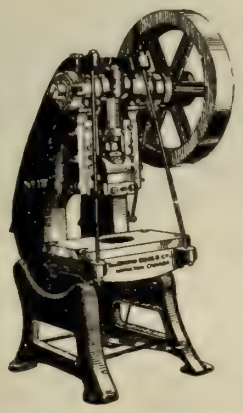
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BROWN-BOGGS

B B

Builders of Volume Production



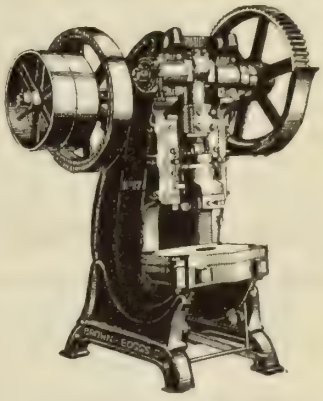
No. 15--Power Press

The "B-B" line consists of machines and tools for sheet metal, tinsmiths' tools and machine dies, shears and punches of every description.

Almost every present day manufacturer is looking for the same thing—a machine capable of turning out more top-notch quality work in a day than has ever been produced before. In this way—and in this way only—can present industrial conditions be met with profit.

You realize this fact. We realize it. That's why we earnestly urge you to investigate the sturdy quality and production ability of *B.B. Power Presses.*

Canadian Machinists and Metal Workers have, in the past, been well acquainted with the B.B. stamp of never-failing service. To-day it stands forth conspicuously as the mark of thorough workmanship — through and through.



No. 17--Power Press

A complete line of canners' processing machinery; evaporating machines, special machines. and power presses for punching, forming, embossing, blanking, etc.

Let us know the machine you are interested in and complete information will be promptly supplied. If you wish advice consult us freely.

B B

THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.

Bilton

GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

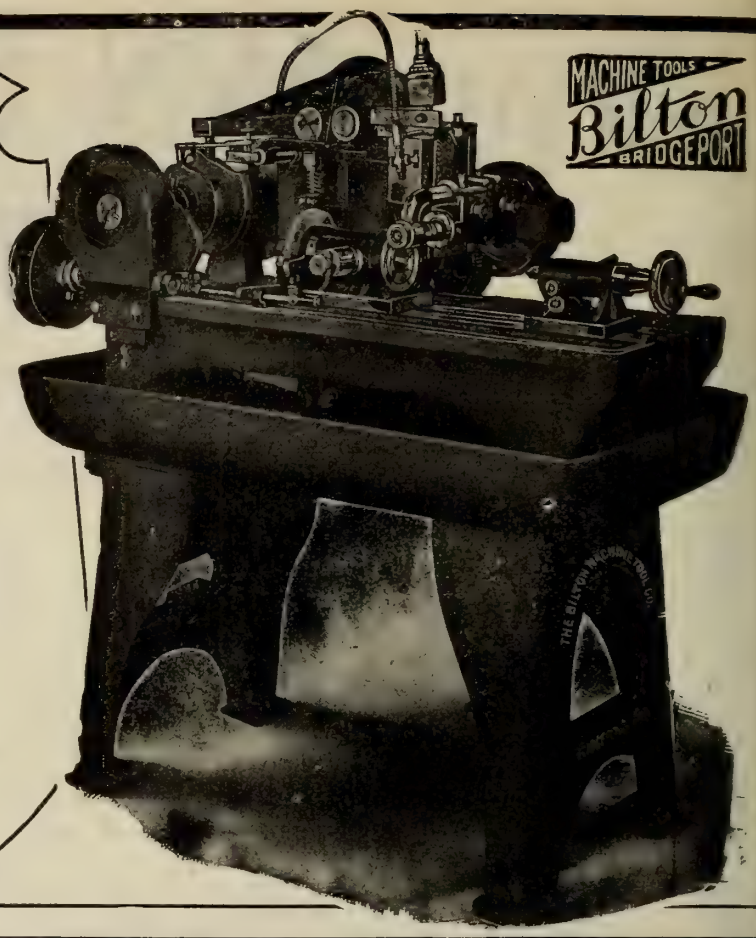
Big business everywhere is adopting the Bilton for high production on accurate work.

May we send you our catalogue?

Bilton Machine Tool Company

Bridgeport, Conn., U.S.A.

Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co., Ltd.,
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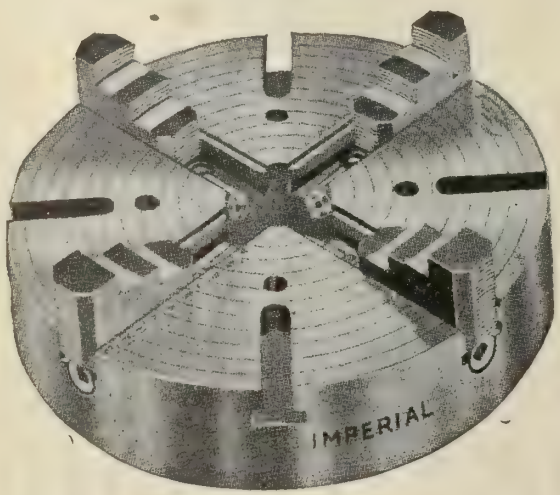


IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.

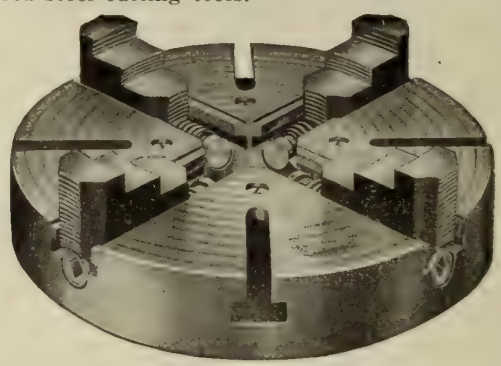


Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

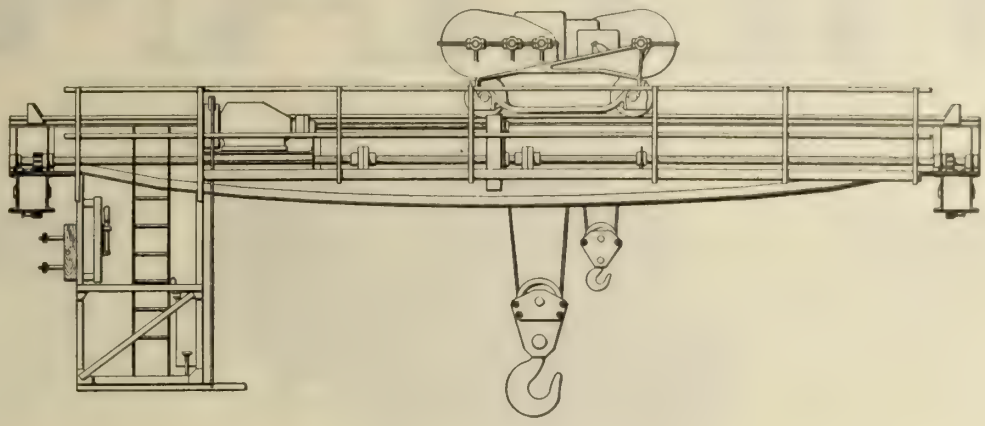
Union Manufacturing Company
New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

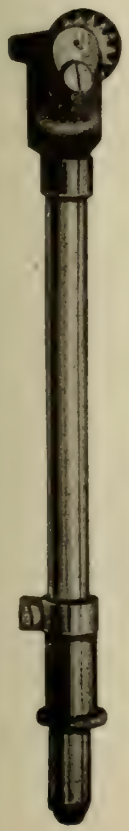
CRANES

ELECTRIC AND HAND OPERATED



DOMINION BRIDGE COMPANY LIMITED

HEAD OFFICE & WORKS: MONTREAL BRANCHES:-OTTAWA, TORONTO, WINNIPEG



Combination Dresser

We make grinding wheel dressers in a large variety of regular styles suitable for every type of wheel.

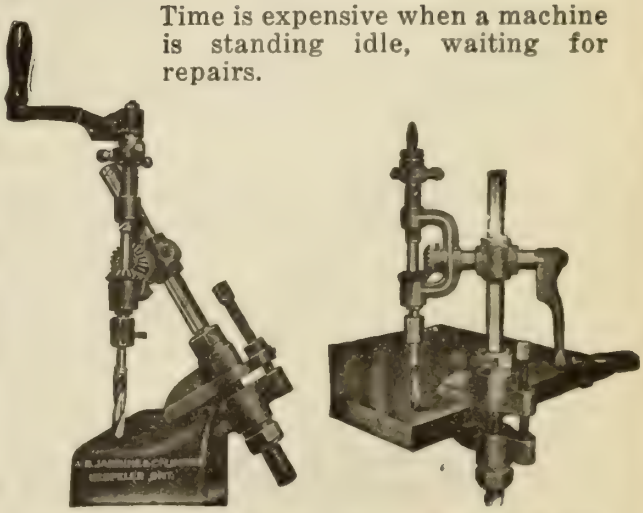
This is our "Combination Dresser"—a Diamo-Carbo abrasive at one end and a Sherman or Huntington at the other, thus making a dresser suitable for all classes of wheels.

Write for Catalogue.

Canadian Desmond-Stephan Mfg. Company, Limited
Hamilton, Ontario

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.

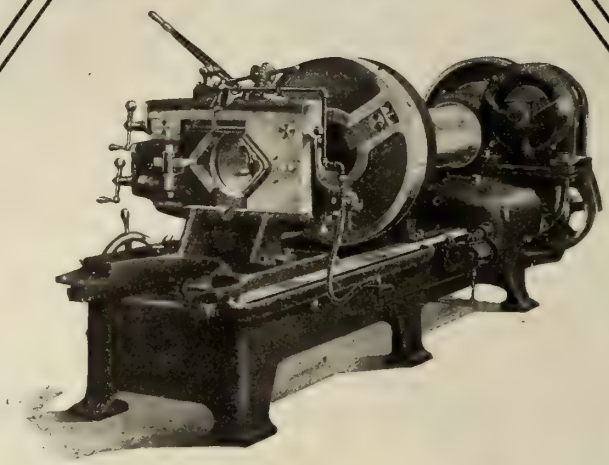


On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

WILLIAMS



PIPE MACHINES

Outstanding Features:

1—Single Pulley Drive, through.
2—Dodge Friction Clutch, on machine.
3—Clutch Lever at operator's left hand.
4—Rigid Bearing Bracket on drive shaft.
5—Gear Box Drive away from operator.
6—Individual Adjustment for each bearing.
7—Large Spindle Bearings are ring oiling.
8—Compact Control Levers on operator's side.
9—Large Die Cabinet and Tool Tray.
10—Substantial Oil Trough around top of ways.
11—Specially constructed Reservoir and Filterer.
12—Low-down Sliding Head.
13—Rotary Geared Pump reversible for left-hand thread.
14—Specially designed Carriage to drain off oil and cuttings.
15—All Gears amply protected.

Send for Catalog of Various Styles

WILLIAMS TOOL CORPORATION

of Canada, Limited — Brantford, Ontario

Successors to

JOHN H. HALL SONS, LIMITED

"ROYLITE" CLEANER

Cleans All Metals

Made In Canada

Oil, Grease, Paint, Varnish, Enamal

All Quickly Disappear before "ROYLITE"

Ask any man who has ever used "Roylite" Cleaner, why he prefers it and this is what he'll tell you. "Roylite" is the fastest, most effective cleaner we have ever used. It lasts longer and costs less than any other.

Here's the reason "Roylite" is different to most cleaners. It emulsifies or lifts grease from the work and does not lose its strength in saponification like Caustic Soda, Lye, Soda Ash, etc., by creating a soap in the solution. This enables the use of both with less additions of this cleaner than others.

"Roylite" is easy to apply. All chemicals are soluble, quickly dissolve in water, and are ready for immediate use, "Roylite" is guaranteed not to discolor or tarnish the brightest surface.

Order a barrel today on approval

Manufactured by

CANADIAN HANSON & VAN WINKLE CO., LIMITED

TORONTO, ONTARIO, CANADA

Would You Like to make some Extra Money?

Of course you would. Well then, why not do so? Canadian Machinery is always on the lookout for well-worth-while ideas, and are willing to pay a good price for them.

We are often asked, "What sort of ideas do you want?" Briefly, what we are desirous of obtaining is this, "Any idea that has proved of value in the machine shop, drafting room, or tool room." Think of how you got over some difficulty, a ticklish piece to hold in the lathe, or perhaps how you increased production on some particular piece. Any idea that saves time or money in the machine industry will appeal to us. Never mind the style. Write it as best you know how. We will put the finishing touches to both the wording and the sketch. Start in **NOW** and send us something of such a nature.

Address it to

The Editor, Canadian Machinery

143 University Ave., Toronto, Can.

Real Belt Service is Measured by--

Slippage reduced to a minimum.
Stretch reduced to a minimum.
Breakdowns and power losses practically nil.
A flexible, tough belting that wears indefinitely.



The Oak Leaf is the sign to go by.

D. K. McLAREN'S *Genuine British* *Oak-Tanned* LEATHER BELTING

Gives the closest approach to this **ideal** belting service.
It is because McLaren Belting is made from only the **toughest** part of the choicest hides; backed by fifty-seven years of successful experience in producing a belt unsurpassed for long life and durability.
Scores of plants have cost records that prove this statement. Write us for their names.

Oak-Tanning

The most approved process known for preparing belts that last. It preserves every bit of the hide's natural strength.

GENUINE OAK

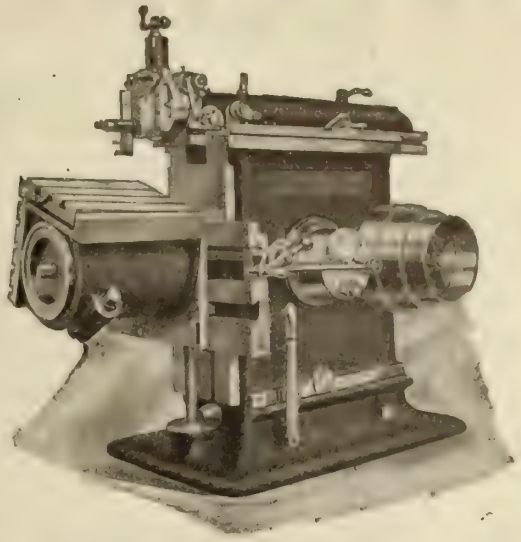
D·K·McLAREN LIMITED

GENUINE OAK

HEAD OFFICE AND FACTORY:
351 ST. JAMES ST., MONTREAL, P.Q., CANADA

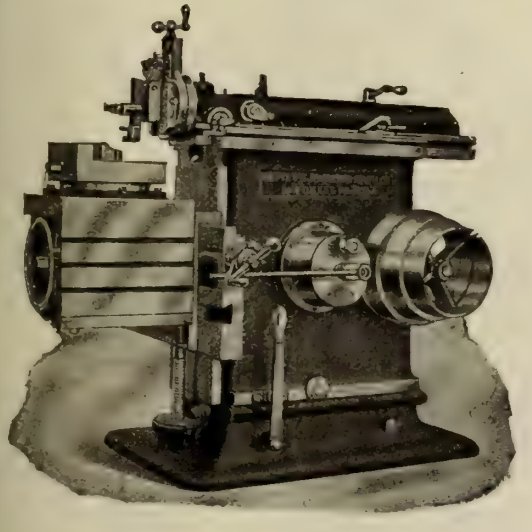
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UNIVERSAL SHAPING MACHINES



No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to—

Die Work, Tool Making and General Manufacturing.



Machines regularly furnished with—

Swivelling Graduated Table,
Auxiliary Tilting Side for Compound Angles,
Power Down Feed on any angle, with any variation of feed,
Automatic Feed Stop,
Graduated Collars on Tool Head Feed Screw and Table Feed Screw,
Swivel Vise and Graduated Base,
Table raised and lowered by power on 24-in. size.

We carry large stocks of our 15-inch and 24-inch shapers in our Toronto show rooms—all ready for immediate shipment.

Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., Limited

Head Office and Showrooms:

11 Wellington Street East, Toronto, Canada

SPECIAL FORGINGS

A Variety of Intricate Shapes Impossible with any other Machine

INCLUDING within their range all kinds of bolts and forgings that are possible on Forging Machines, Acme Forging Machines are capable of intricate shapes **not possible** on ordinary types. Acme machines are universal because bolts and forgings are made with equal facility by exactly the same mechanical movements. This is a distinctive feature.

Note the powerful, simple and efficient construction of the 2½-inch All Steel Heading, Upsetting and Forging Machine shown below. It may be used in continuous or intermittent motion.

The Acme Machinery Co.

4530 St. Clair Ave., CLEVELAND

Canadian Agents :

THE JOHN BERTRAM & SONS CO.
LIMITED

Dundas, Ontario



The Acme Forging Machine Catalogue proves its worth many times as an education in Forging possibilities.

Write to-day for a copy.

ACME

Heading and Forging Machines

Canadian Hart Wheels

Dependable wheels — correct in grade and grain— for every class of grinding work.

Don't choose the wrong wheel. You'll waste time and money. Specify HART. Hart Wheels are uniform. Tell us the class of work and we'll tell you the right wheel to use.

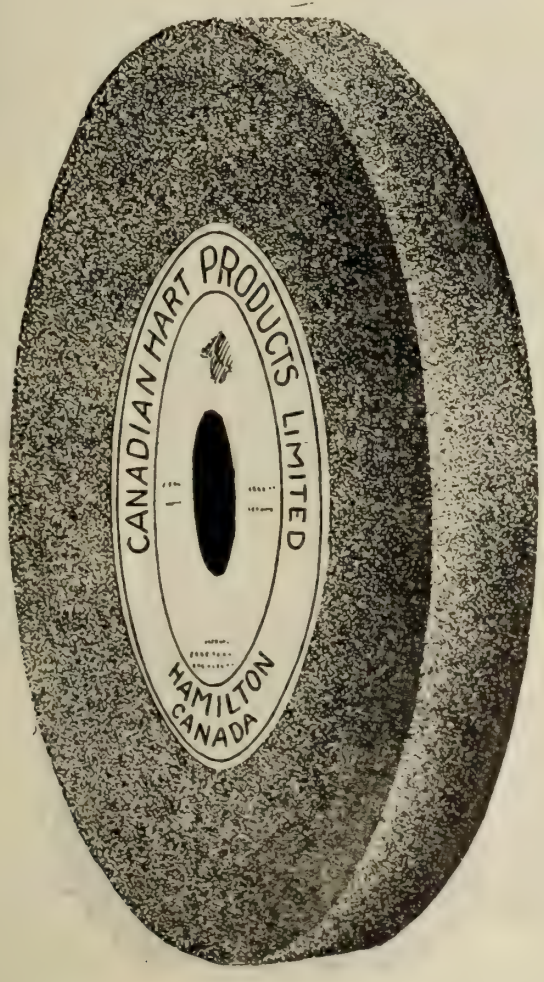


Vitrified
Grinding Wheels

These wheels are the most generally used and give the greatest satisfaction for the majority of grinding jobs, since the bond is less affected by heat and may be used wet or dry. It takes from 20 to 30 days to manufacture a wheel by this process.

Silicate
Grinding Wheels

Silicate Wheels may be manufactured in 24 hours. These wheels derive their name from the large portion of silicate contained in the bond. We manufacture Silicate wheels with or without web as specified by the customer.



Made in Canada
By

Canadian Hart Products
LIMITED
Hamilton - Ontario

BUTTERFIELD

Tools with an Established Reputation

Butterfield Taps, Dies, Drills, Reamers and Milling Cutters will give you the satisfaction expected of high class tools. For 35 years they have been the choice of discriminating buyers of tools for the machine shop. They are "The Tools You Buy Again."

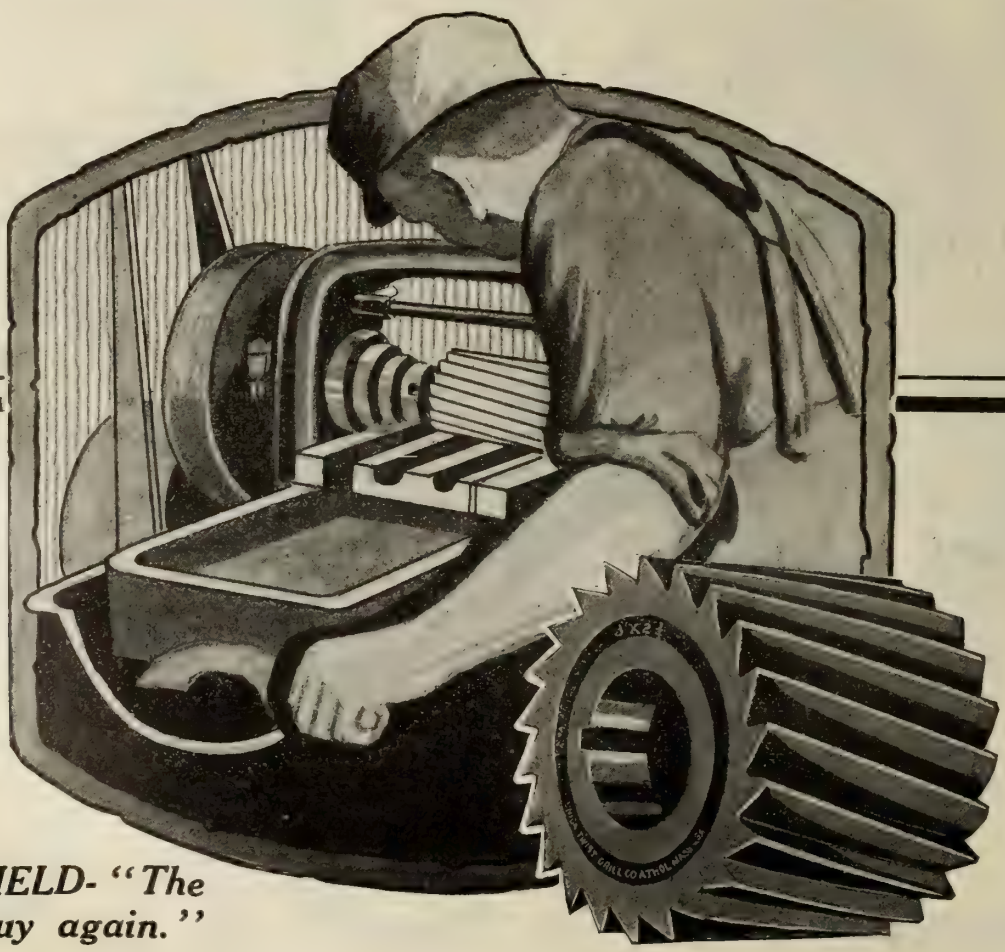
BUTTERFIELD & COMPANY DIVISION

UNION TWIST DRILL CO.

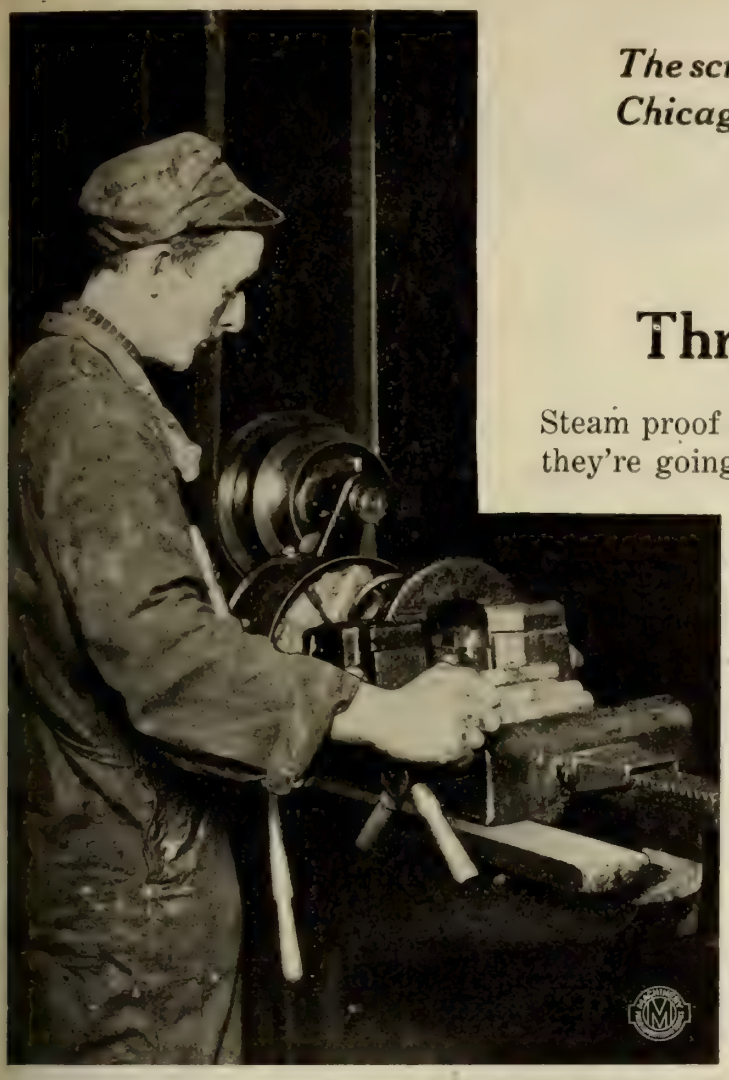
Rock Island, Que. - Canada

Stores:—220 King Street, West, Toronto; 131 St. Paul Street West, Montreal
Agents:—D. Philip, 138 Portage Ave., Winnipeg, Man.; The Triangle Co., Standard Bank Bldg., Vancouver, B.C.

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BUTTERFIELD- "The tools you buy again."

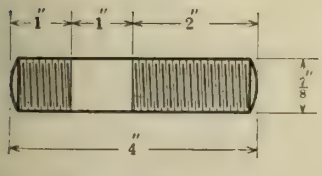


The screw fittings of boilers for the Chicago Stock Yards are finished on the

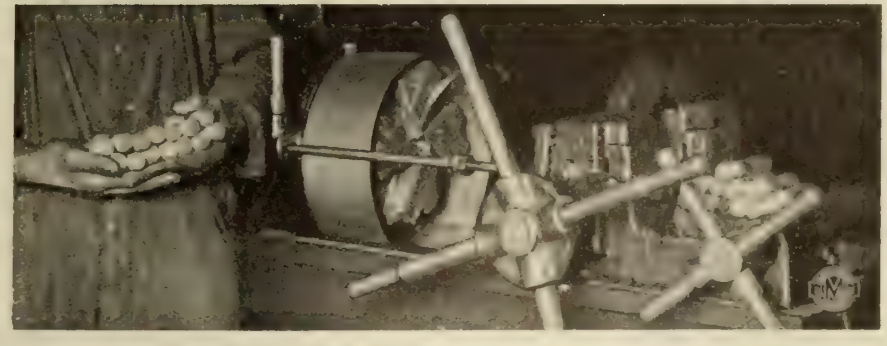
LANDIS
Threading Machine

Steam proof screws must have accurate threads if they're going to be worthy of the name, and the Hamler Boiler & Tank Co. of Chicago found that the Landis Threading Machine was the best way to get them.

This machine is used for threading nuts, bolts, rods, etc., for boilers and tanks used in the packing house and other stockyard industries, and is located just on the border of the famous "Yards" district.



Stud
Open Hearth Steel
U. S. S. Threads.



On this particular Landis Threading Machine 700 studs were being threaded on both ends in 9 hours. This is a total of 1,400 threading operations in that time. The foreman tells us that neither the operator nor the machine were going anywhere near the limit, and also commented on the endurance of the dies, which are "so much longer lived than other dies that there is no comparison."

He summed up the performance of this Landis Threading Machine and Landis Die Head in the following words: "Absolutely O.K., the best threader in the world."

Ask for the latest Landis Catalogue.

LANDIS MACHINE COMPANY, Inc.

WAYNESBORO, PA.



Production "Cost Cutters"

Specify "Barnes-made" Spring Washers and Stampings, and reduce your cost of production !

In our Stampings Department we have a multitude of special tools and special automatic machines, all "Barnes-made" and designed for cutting washers and stampings . That's why we can save you money.

We make these parts of cold-rolled steel, tempered steel, brass, bronze, copper, German silver—or any required material—according to your needs.

This work is done with the exact same care, skill and accuracy we employ in our spring making. It merits the confidence of manufacturers of even the most delicate and intricate mechanical devices.

Catalogue No. 9 is worth asking for May we send it ?

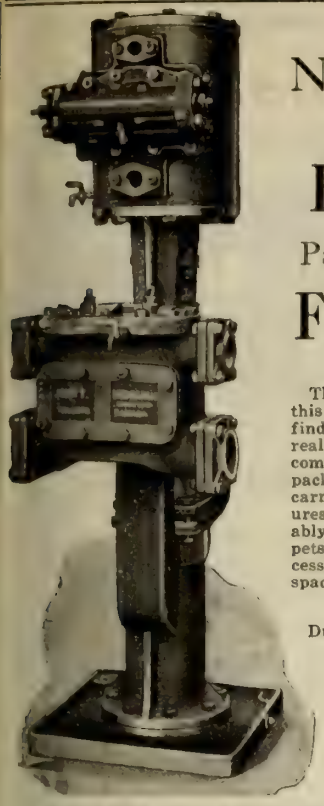
Springs of steel, brass, phosphor bronze or vanadium —flat, coil, spiral, —compression, extension or torsion. Wire Forming. Spring Washers. Small parts of steel, brass, etc., in any finish. Assemblies. High Carbon Cold - Rolled Steel.

The Wallace Barnes Co.

"Spring Makers for Three Generations"

Main Office and Works
Bristol, Conn.,

Western Sales Office
Book Bld'g., Detroit



NO EXCUSES

With the

HEPBURN

Patent Vertical Ram

FEED PUMP

There are no excuses attached to this Hepburn Patent Pump. You'll find that out if you give it some real work to do. It is a sturdy, compactly constructed, outside packed type for Feeding Boilers carrying the highest steam pressures. The construction is remarkably simple and eliminates all tappets and levers. Every part is accessible, and it takes little floor space in the Power House.

Duplex Pumps, Vertical Engines, Compressors, Hand and Electric Overhead Cranes for Power House Service are also products of the Hepburn plant.

JOHN T. HEPBURN, LIMITED

Engineers and Iron Founders

18-60 VAN HORNE STREET, TORONTO, CANADA

WHY EXPERIMENT ?

WE DID IT FOR YOU YEARS AGO



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

Write For Prices

THE CANADA METAL CO., LIMITED

TORONTO HAMILTON MONTREAL WINNIPEG VANCOUVER

Asbestos Fibre (Liquid) Cement

—a rubber-like adhesive and tough preparation made from finest asbestos fibre, creosote and durable oils. Makes any roof, no matter in what condition, absolutely proof against climatic conditions. Easily applied over any kind of roof; metal, gravel, paper or composition.

Jewel Roofing

Comes in 1, 2 and 3-ply, guaranteed respectively for 3,5 and 8 years. We think it is the best value on the market for this quality of roofing.

Hexagon Slab Shingle

Hexagon Slab Shingle is durable; it will give years of consistent roof service without repair costs. It is fire-resisting, too.

The hexagonal figures present a distinctive and attractive surface. The patented design produces a beautiful shadowed effect that adds to the pleasing appearance of the roof.

Excello Roofing

In 1, 2 and 3-ply, guaranteed for 5,10 and 15 years respectively. Place your orders early.

English Millboard

We have a large stock of the finest Grey English Millboard ready for immediate shipment. The high quality of this board is very well known. If you have not already seen it, we shall be glad to send you samples.

We can supply the millboard in three thicknesses—3-16″, ¼″ and 5-16″. Shall we quote you prices?

Asbestos Sheathing

There is a constantly growing tendency to consider fireproof buildings as a necessity. Asbestos Sheathing is a recognized fire-prevention material.

We also carry a full stock of regular lines of plain and tarred felt in 10, 12 and 16-oz. eights.

RICE LEWIS & SON, LIMITED

Established 1847 TORONTO, ONT. 19 Victoria Street



"Hisco" Machine—Molded Gears

The fact that "Hisco" Machine Molded Gears require no pattern is a factor of considerable importance when the price of lumber and labor is so high. "Hisco" quality insures accurate, dependable gears. Remember — **the price of "Hisco" gears does not include the cost of patterns.**

We are also manufacturers of Steel, Chrome, Manganese and Nickel Steel Castings, Annealed and Unannealed; Cement Mill and Mining Machinery; Castings; Stamp Mills; Crushing Plants; Excavating Outfits; Steel Car Wheels; Locomotive Driving Wheels and Frames, etc.

Let us know your requirements—we do the rest.

Hull Iron & Steel Foundries, Limited
HULL, Quebec

Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force cannot replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every month will keep you posted on the latest developments for machinery equipment.

It's Safe to Follow a Good Lead

"Cylinder Grinding is Our Business—that's why we use Healds"

HEALD

Cylinder Grinders

That's the statement of Joseph Buckley, Shop Superintendent of the P. J. Durham Company, Inc., New York City. This Company has been in business for ten years, during which time it has always used Heald Machines. Mr. Buckley says he knows of no other grinder or method which will give as satisfactory and economical job.

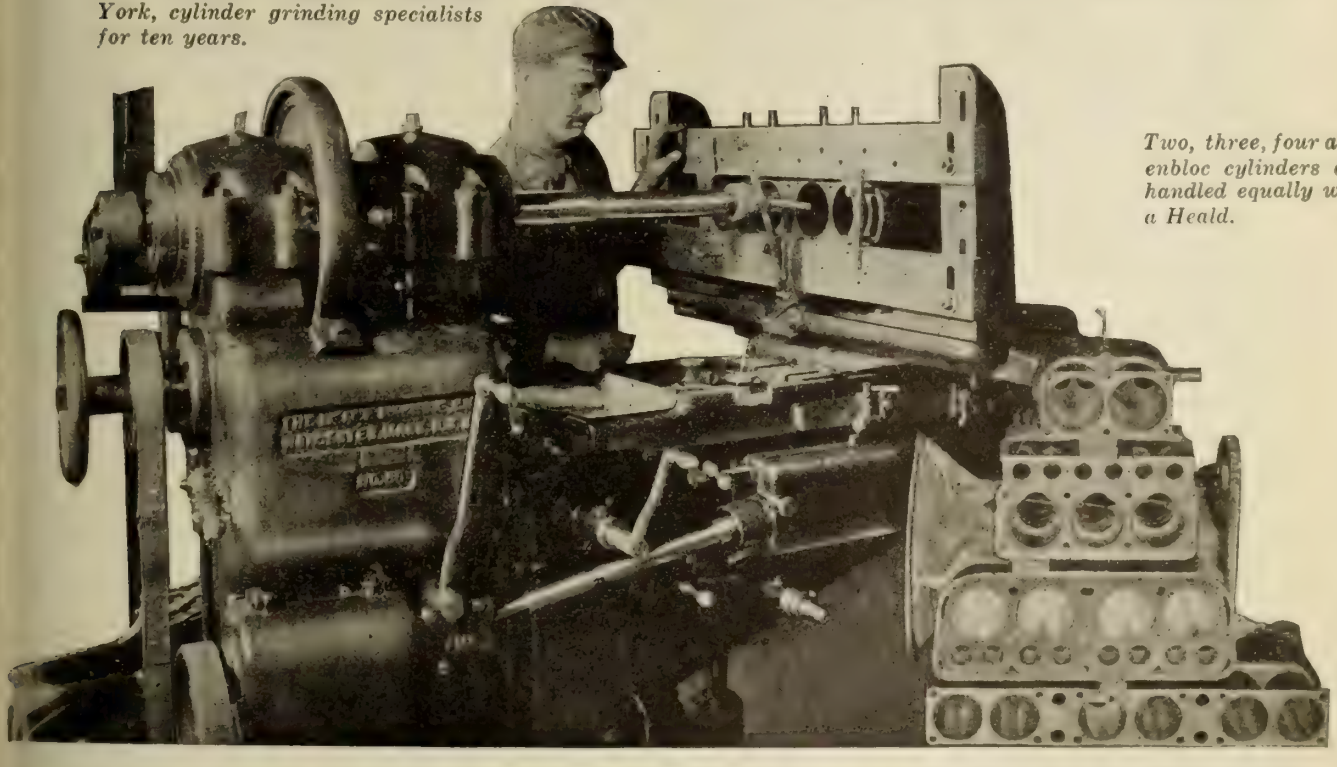
Mr. Buckley is right, and his statement is backed up by over 500 other concerns using Healds in the United States for this work.

In Canada there are 402,929 registered cars with only 12 concerns Heald-equipped to do this work. Can't you see the opportunity when three four-enbloc cylinders a day will bring handsome returns to a two-man shop? There are many localities without a single shop suitable for regrinding, and further, remember that the first to start gets the cream of the trade.

It is high grade work, pays big profits on the investment and does not require skilled workmen for operators.

We would like to get in touch with you personally or by mail. Write today while you need the business.

Regrinding a Saxon block at the P. J. Durham Company, Inc., New York, cylinder grinding specialists for ten years.



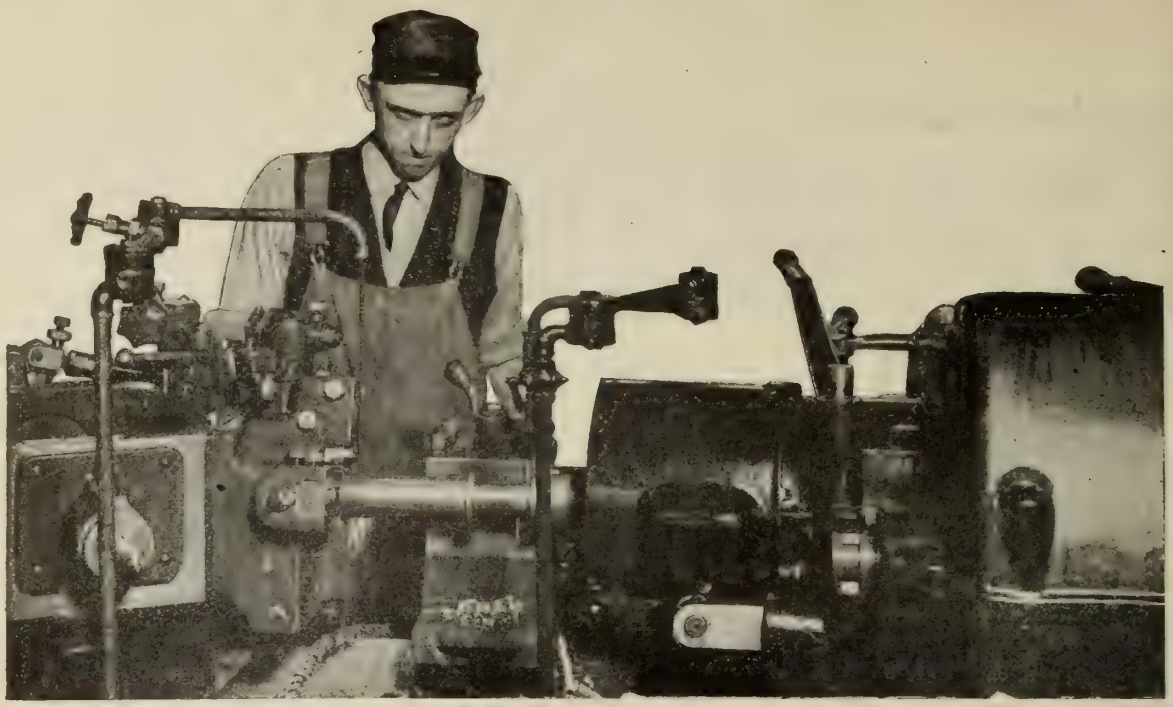
Two, three, four and six enbloc cylinders are all handled equally well on a Heald.

THE HEALD MACHINE COMPANY

51 New Bond Street, Worcester, Mass.

BRANCH OFFICES:—New York, 839 Singer Bldg., Philadelphia, 1302 Stephen Girard Bldg. Chicago, 26 South Jefferson Street. Detroit 400 Marquette Bldg. Cincinnati, 311 Provident Bank Bldg. Cleveland, 721 Engineers Bldg. Buffalo, 331 Jewett Ave.

CANADIAN AGENTS:—H. W. Petrie, Ltd., Toronto, Ont. George F. Foss Machinery & Supply Co., Ltd., 305 St. James, St., Montreal.



To Decrease Operating Costs

The side carriage is an important part of the W. & S. turret lathe. It reduces operating costs, often by as much as one-half. It operates simultaneously with the turret and independently of it. The side carriage has a separate feed rod.

Take some of the simplest bar jobs; by cutting off with the side carriage while the turret tools are finishing their work, you save most of the cutting off time.

Here is the picture of a W. & S. 2-A. in a railroad shop. This machine makes bolts, pins, oil cups, valve parts, piston rods, and many other parts used in the repair of locomotives and cars.

On all these parts both turrets operate together.

Take this feature and the fact that the machine operates easily and accurately, and you know why the machine is popular with the shop men. It delivers the goods.

Send us blue prints of your parts and we'll tell you how long it will take to do your work the W. & S. Way.

The Warner & Swasey Company

Cleveland, U.S.A.

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ALLOY STEELS

OPEN HEARTH AND ELECTRIC FURNACE

BARS
Hot Rolled and Cold Drawn

BILLETS
Slabs—Blooms

Chrome-Vanadium
Nickel (3½ and 5%)
Chrome-Molybdenum
Chrome-Nickel
Magnet Steel (Tungsten and Chrome)
Carbon-Chrome
Nickel-Chrome-Molybdenum
Nickel-Chrome-Vanadium
Chrome
Ball and Race Steel
Electric Furnace Hi-Carbon
Special Analyses

WHEN you purchase or specify our Alloy Steels for your product, you get with the steel the assurance that a competent metallurgist is at your service in the working and treatment of that steel.

Our standard analyses embrace all types of Commercial Alloy Steels — open hearth and electric furnace grades, and our specialization in the manufacture of Alloy Steels enables us to assist our customers in the selection of the correct steel for their requirements.

We melt—roll—cold draw — heat treat our steels in one large plant and under expert supervision.

Avail yourself of our consultatory service:

If you have any place in your manufacture where you think you could use an Alloy Steel to advantage, give our engineers the opportunity of assisting you in the selection of the proper grade and type.

UNITED ALLOY STEEL CORPORATION
CANTON, OHIO

DETROIT
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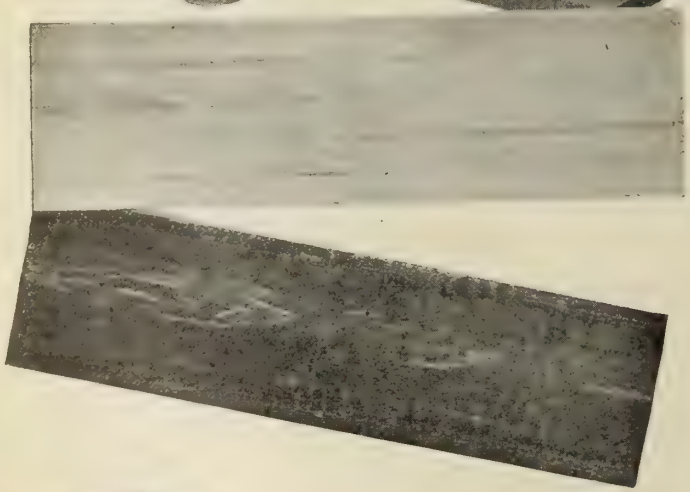
CHICAGO
SAN FRANCISCO
PORTLAND

If interested tear out this page and place with letters to be answered.

Two years' experience adds weight to this opinion

"we have found the 'Oliver' Surfacer very satisfactory"





That is what a prominent Pattern Shop operator in Pittsburg says about

The "Oliver" No. 61
Single Cylinder Surfacer

They have had this machine in use over four years. The machine is shown here putting an extra-smooth surface on 10-inch pattern lumber. Rate of feed 33 ft. per min. Depth of cut 1/8-inch. Three hundred pieces are finished per hour to the dimensions shown. The "Oliver" Surfacer will do equally well for you. Investigate it. Get our general catalog of "OLIVER" PATTERN MAKING MACHINERY the only complete line built for the purpose.



Highest Award, Paris, 1900

Finished Size 1¾x10-in.x 6 ft.
Rough Size 2 x10 in.x6 ft.

Over twenty years of steady progress in building Wood-working Machinery of Quality

Oliver Machinery Co.

Grand Rapids, Mich., U. S. A.



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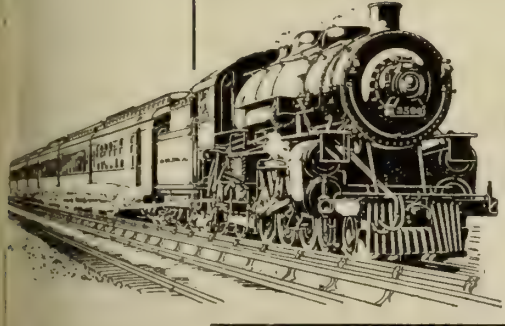
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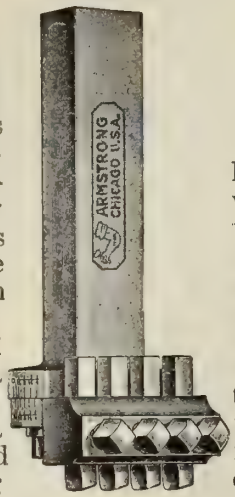
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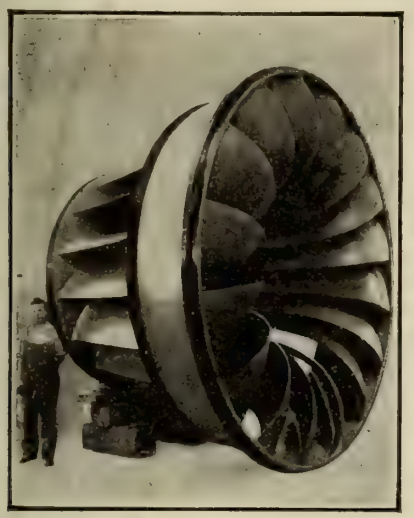
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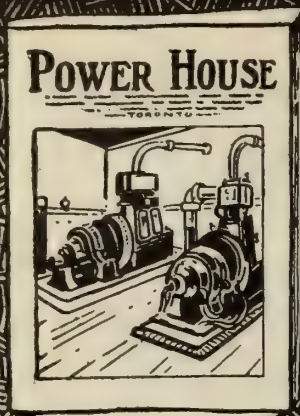
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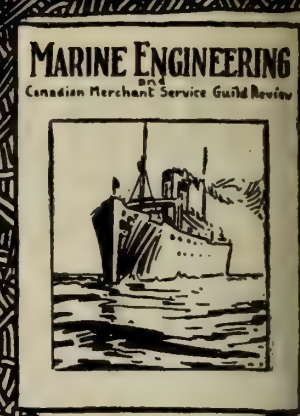
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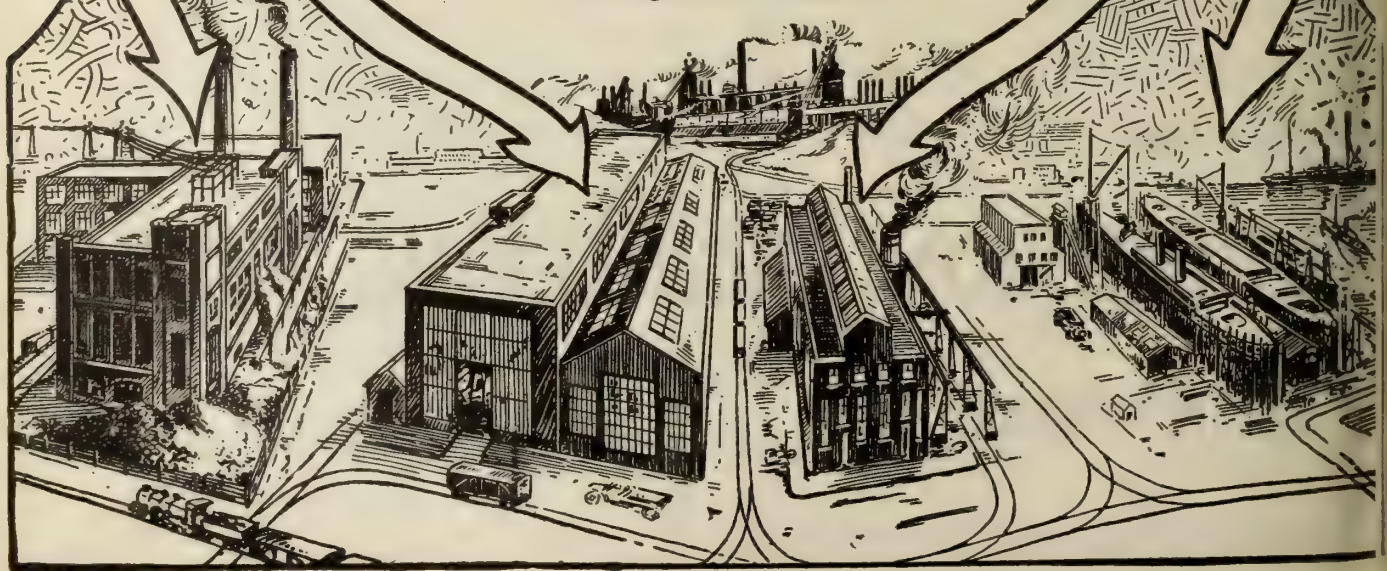
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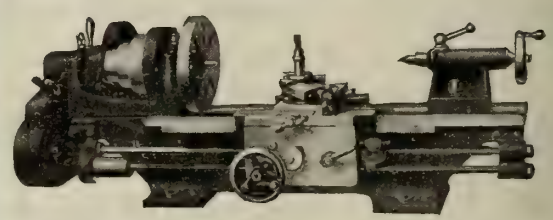
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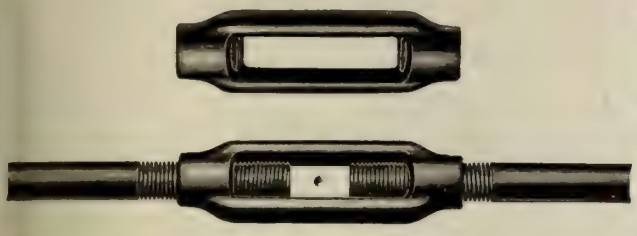
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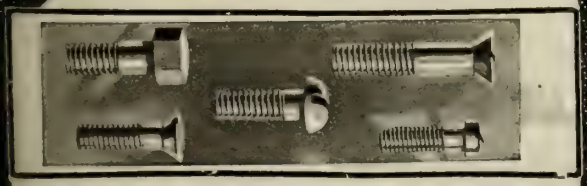
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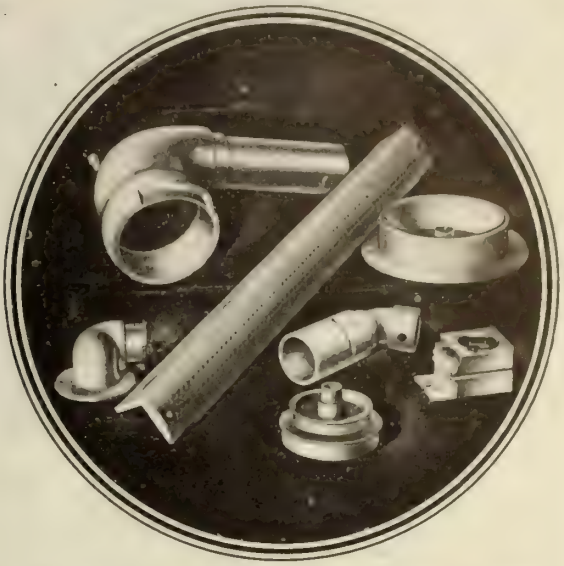


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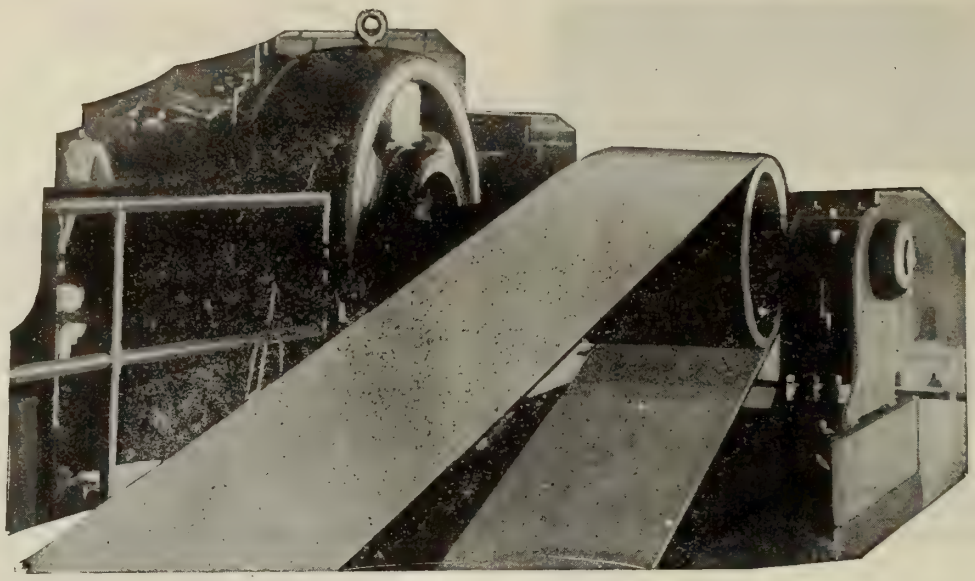
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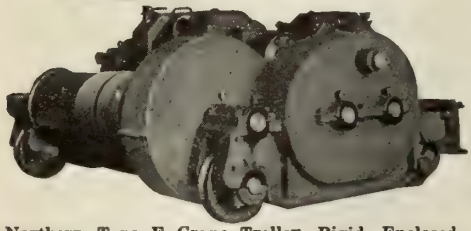
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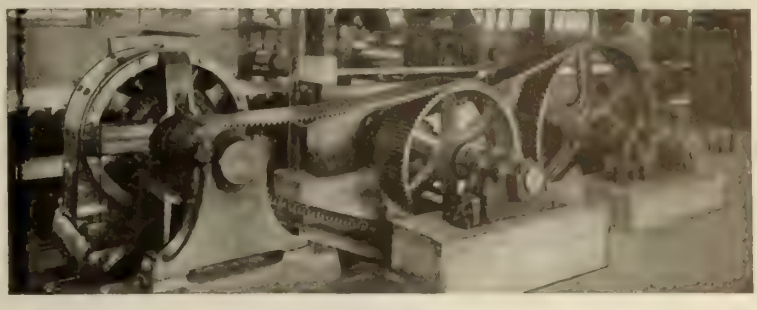
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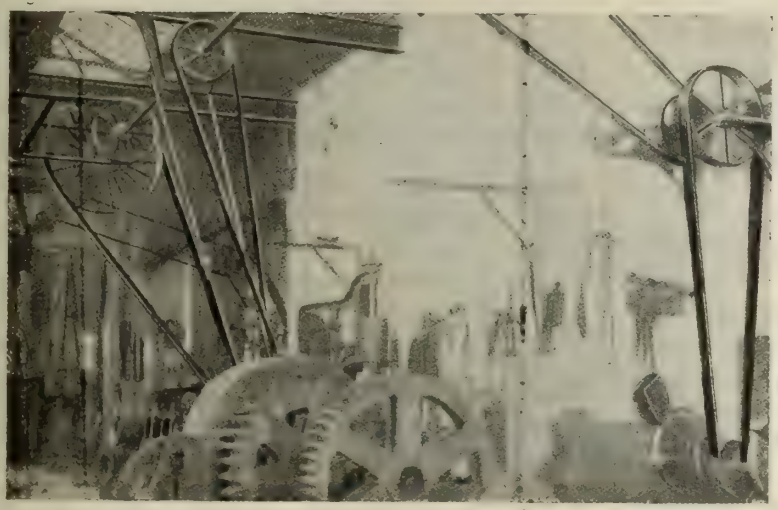
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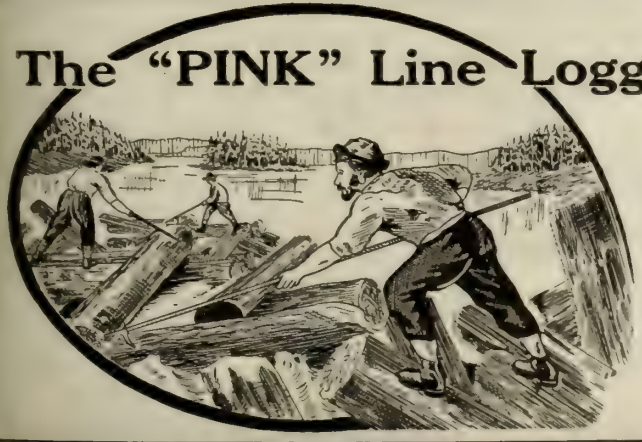
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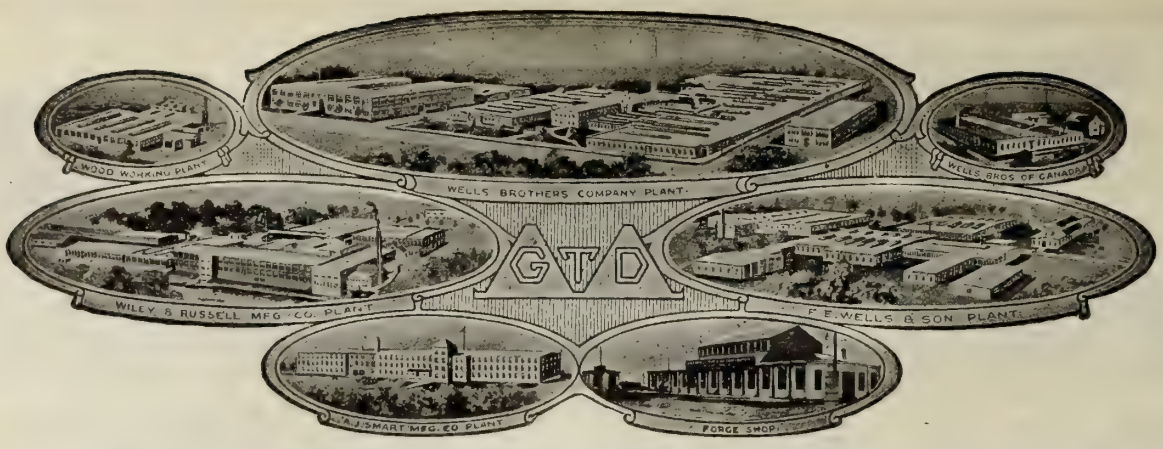
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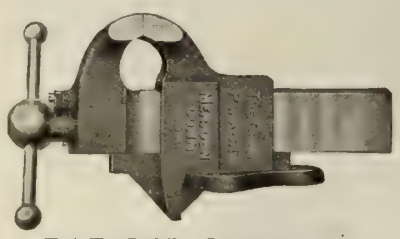
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We specialize in Locker-building.

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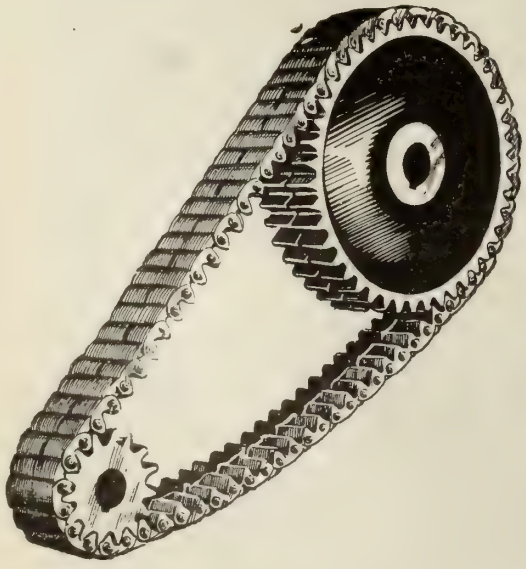
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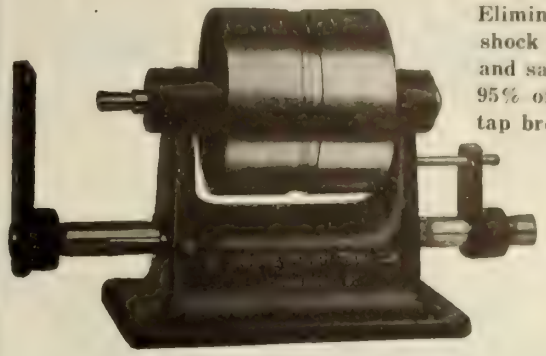


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THE BURKE FRICTION DRIVEN TAPPING MACHINES



Eliminate all shock to the tap and save 95% of your tap breakage.

In addition to this, you are assured of producing the maximum amount of well-tapped holes with inexperienced labor. Machines are also used for lapping, burring, reaming, countersinking, assembling and similar operations. Built in three sizes, 3-16″ at $25; 3-8″ at $45, and 5-8″ at $60, Canadian money.

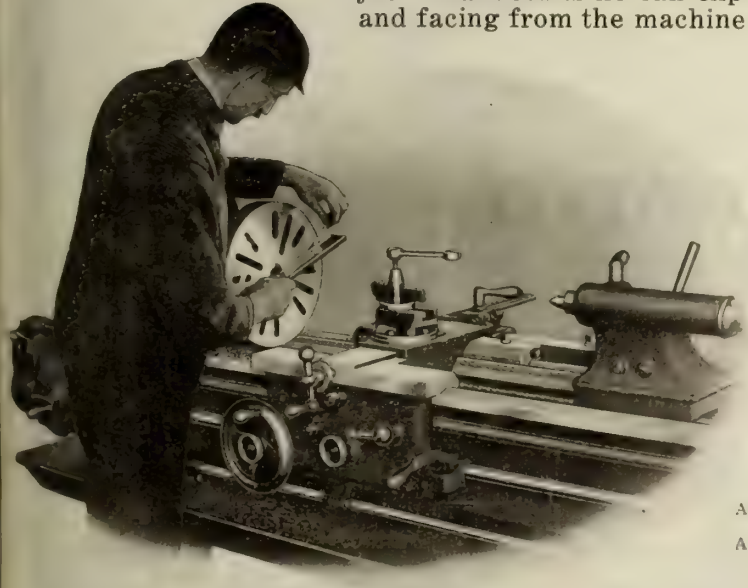
Let us send descriptive circular, or send your samples or blue prints and ask for production estimates.

THE BURKE MACHINE TOOL CO.
520 Sandusky St., Conneaut, Ohio, U. S. A.

Canadian Dealers:—H. W. Petrie Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons, Geo. F. Foss Machinery & Supply Co.

HENDEY

THERE is never any question of a Hendey's ability. Every lathe, shaper, miller and centering machine must pass a series of rigid, well rounded tests before it is passed for shipment. A complete test and inspection record is made for each machine. Thus, a customer knows just what results he can expect in the way of accurate turning, boring and facing from the machine he has purchased.



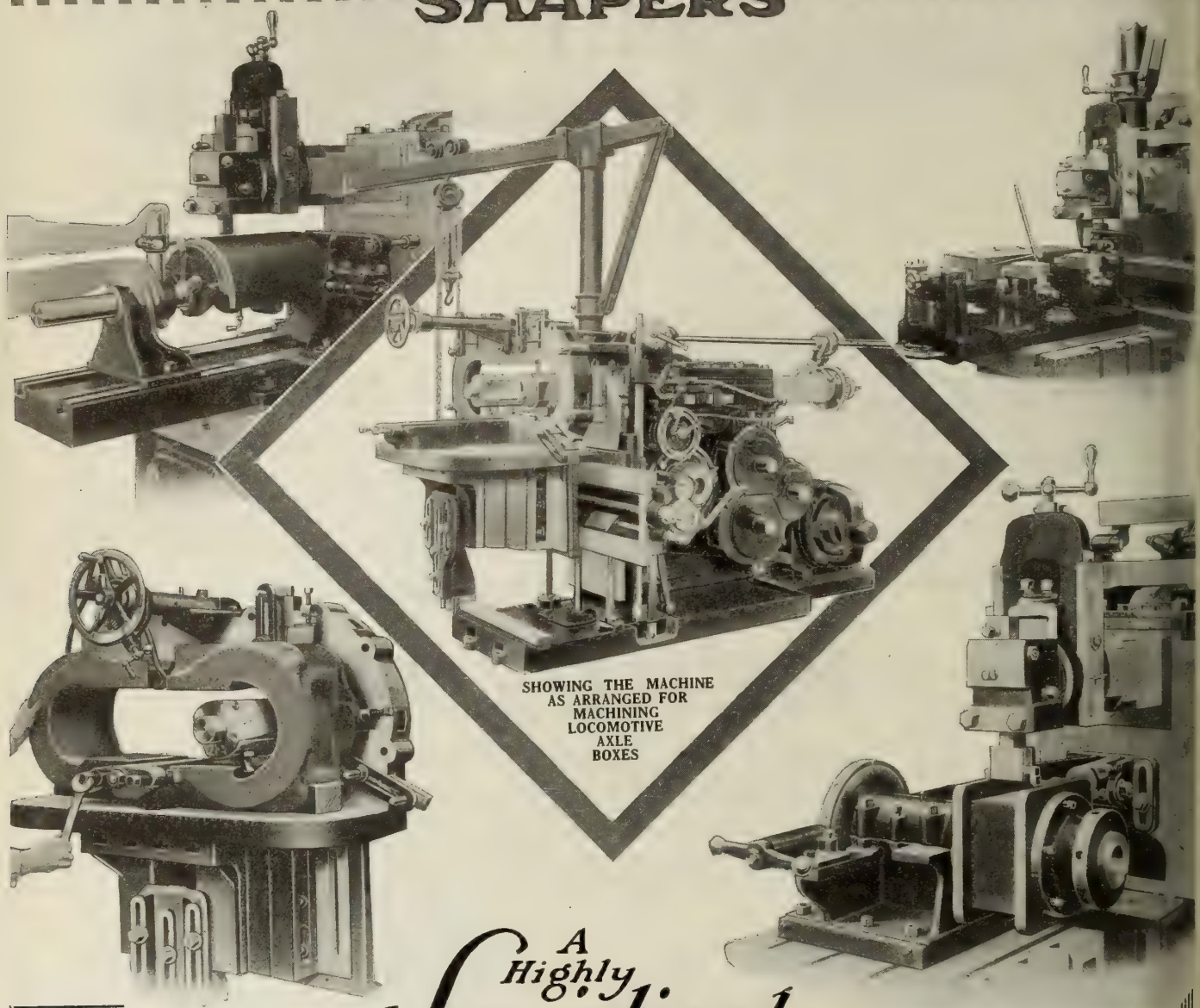
On the left the testing of the alignment of the cross slide travel with the spindle of a Hendey Lathe is shown. The straight-edge-tissue-paper test used shows in the majority of cases a perfectly flat plate after the same has been faced with tool. A slight variation is allowed, however, toward concave on the plate not exceeding .00075″.

THE
Hendey Machine Co.
Torrington, Conn., U.S.A.

Canadian Agents:
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Vancouver
A. R. Williams Machinery Co., Winnipeg.
A. R. Williams Machinery Co., St. John, N.B.
Williams & Wilson, Montreal.

LATHES—MILLERS—SHAPERS AND CENTERING MACHINES

MORTON
HEAVY DUTY RAILROAD SHAPERS



SHOWING THE MACHINE AS ARRANGED FOR MACHINING LOCOMOTIVE AXLE BOXES

A Highly Specialized MULTI-DUTY MACHINE

THIS Morton Heavy-Duty Draw-Cut Railroad Shaper is a specialized tool of exceptional design.

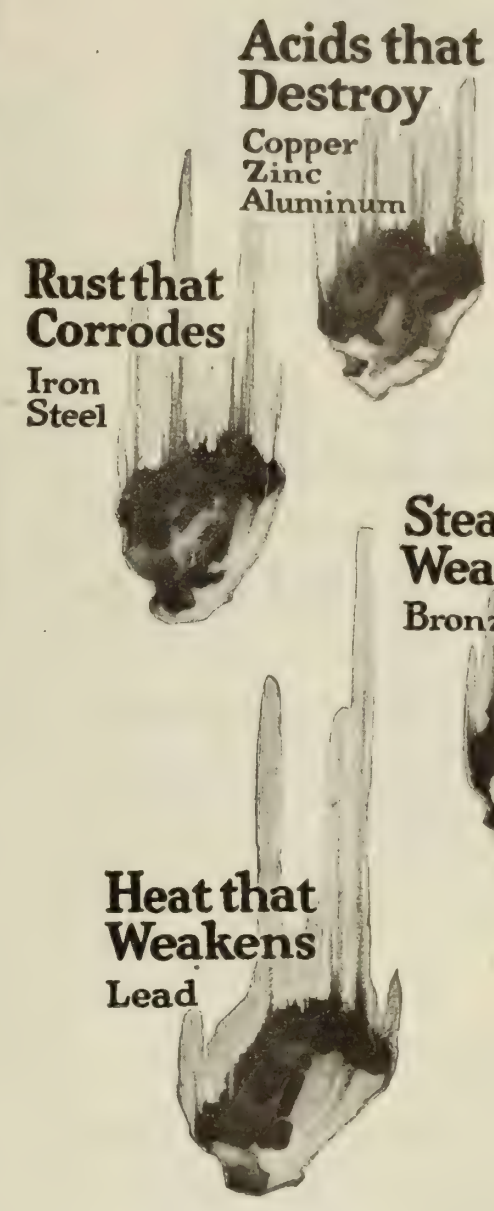
It is a multi-duty machine and the ease and rapidity with which changes are made from one class of work to another are features which make it a highly profitable producer. Fully equipped with the latest time-saving devices! A machine of maximum rigidity! Deep cuts, coarse feeds, and smooth and accurate work make it a tool of outstanding ability.

Send for bulletin 6A—it contains a complete and interesting story of this finely built tool.

MORTON MANUFACTURING CO.
MUSKEGON HEIGHTS, MICHIGAN, U.S.A.

If interested tear out this page and place with letters to be answered.





Why are these metals discarded by many manufacturers?

THEIR life is too short for the service required of them. Manufacturers must use materials that survive. High heats, acid action, steam wear, salt pitting and rust take no toll from **MONEL** Metal. Strong as steel, more wear and corrosion resisting than copper or bronze, **MONEL** combines the best physical properties of other metals without their limitations

Do acids or other chemicals destroy your dairy, mining, refrigerating, bleaching, dyehouse, oil, sugar or like industrial machine parts? Does rust corrode your window screen; kitchen or laundry equipment; automobile or boat trim? Make them of **MONEL.**

These corrosive forces have no effect on **MONEL** Metal. Nor is **MONEL** weakened by heats that break down the structure of other metals. In the country's power plants, **MONEL** valve trim, turbine blading, cylinder liners, etc., are standing up against the continuous cutting wear of superheated steam and hot gases. No other available metal or alloy possesses such a wide range of usefulness.

The name MONEL identifies the natural nickel alloy—67% nickel, 28% copper and 5% other metals—produced by the International Nickel Company.

The International Nickel Company of Canada, Limited

Harbor Commission Building - - TORONTO, ONT.

INCo Monel metal

THE INTERNATIONAL NICKEL COMPANY

INCo MONEL METAL INCo NICKEL



Quantity Production of Shafts in Automatic Heat Treatment Furnace.

PRODUCTION MANAGERS

The following advantages are secured by the Continuous Method of Heat-Treatment :

Increased production per unit of floor space.
Reduction in manual labor per unit of production.
Uniformity of product, resulting in decreased scrap, following less dependence upon the human element.
The fuel economy that naturally follows the direct transfer of heat in spent gases to incoming material.
Improvement in working conditions by cooler shop.

In short, the saving in cost of the finished product due to economy in labor, time, fuel, floor space, decreased rejections, etc.

Do these advantages appeal to YOU?

Write for Bulletin 217-T and learn whether this method is adapted to your product and manufacturing conditions.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 CHURCH ST. (Hudson Terminal Bldg.), NEW YORK
WE MAKE INDUSTRIAL HEATING FURNACES
FOR EVERY REQUIREMENT.
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"FURNACE AND FUEL TO SUIT CONDITIONS."

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FIRE BRICKS

FOR

Quality and Service

Remember—we make several qualities of Fire Bricks, all perfectly adaptable to the purpose for which they are intended. Now, here is where our Service stands you in good stead: we recommend the class of brick particularly suitable for your purpose. In other words, we do not sell you a costly high-class brick when another class of brick suits just as well.

Our Various Brands

"Elkco"
"Elkco" Special
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"Keystone"
"M. D. Elk"
"Rotex"
"St. Marys"
"Elk Dust"
"Keystone Dust"
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When you select Elk Brand Fire Bricks you know you are getting the right quality. Our warehouse is well stocked to supply your immediate needs.

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Sun Life Building, HAMILTON, ONTARIO

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QUICK DELIVERIES

High Carbon Steel
Manganese Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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ESTABLISHED 1860

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Sales Agents :

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Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
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Increased Output
and
Lower Operating Costs
follow the use of
P.H. and IMPERIAL FILES.

P H IMPERIAL

"They Cut Faster and Wear Longer."

Be File-Wise.

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Sole Distributors,
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LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.
The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

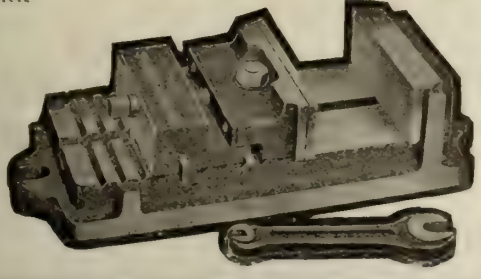
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La Salle, Illinois, U.S.A.

Represented in Canada by
A. R. Williams Machinery Co., Ltd.
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SKINNER DRILL PRESS VISE

TRADE MARK

Truly "The Handy Tool"



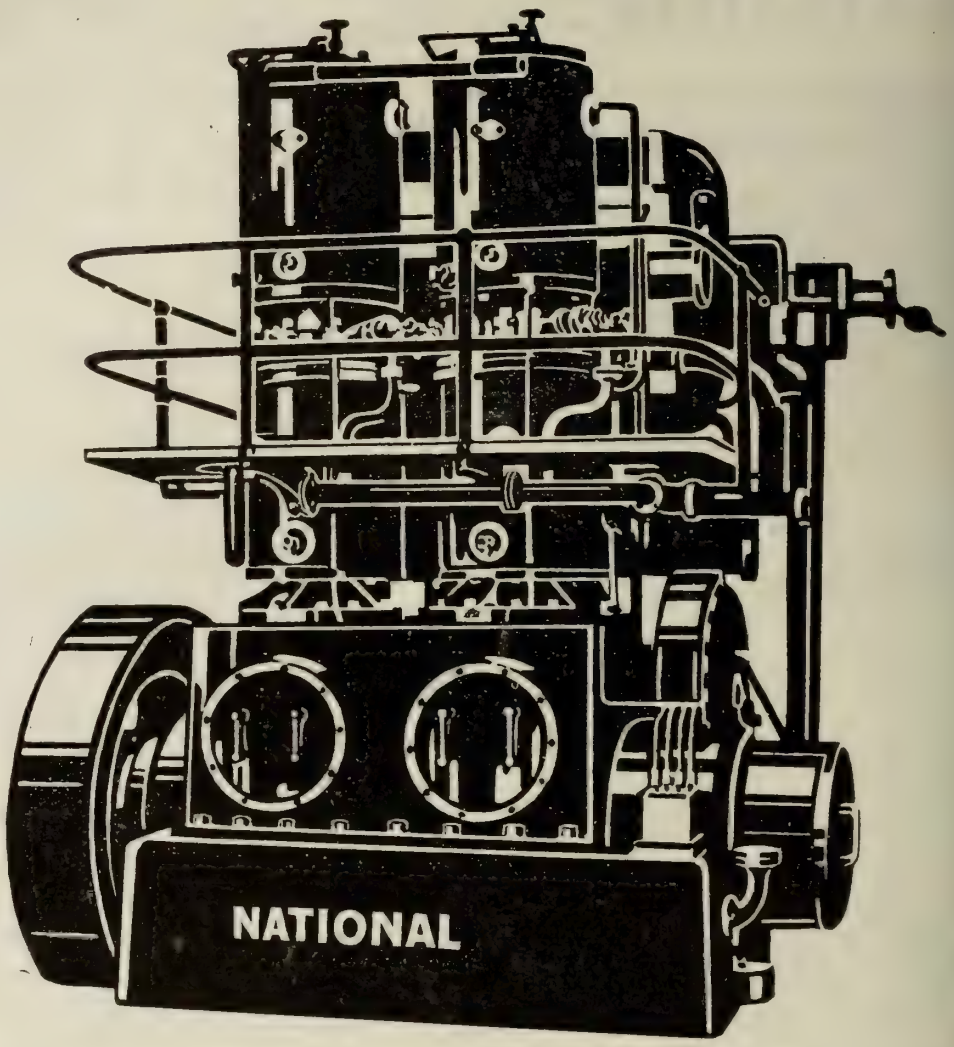
Work can be firmly held in it, one operation completed, the vise turned upon its edge and a second operation completed without reclamping the work in the vise. Send for illustrated circular showing sizes, prices, etc.

THE SKINNER CHUCK COMPANY
New Britain Conn., U.S.A.
Established 1887.

New York Office: 94 Reade Street. San Francisco Office: Rialto Building Chicago Office: 552 W. Washington Blvd.
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First-class Material
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Correct Lighting in your Plant means More Work and Better Work





Let Us Ease the Eye Strain

Good lighting is a factor of first consideration in any effort to improve workmanship, increase production, reduce spoilage and safeguard employees.

A poorly lighted plant breeds weariness and discontent, resulting in uneven production and waste. Ease the strain and get more and better work from a happier staff by installing a correct Industrial Lighting System in your plant.

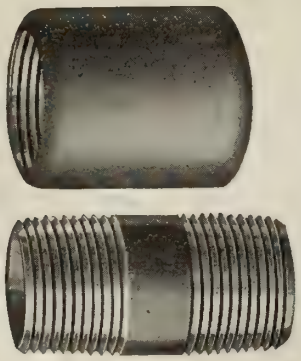
Our Illumination Engineers will gladly help in solving your particular lighting problem by planning the system that will most efficiently and economically meet your need. Such well-known names as Benjamin, Adams & Bagnall and Overbaugh and Ayres are included in our stocks of Illumination Equipment.

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Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black, or galvanized.

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STEEL *for*
Every Commercial Purpose

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We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

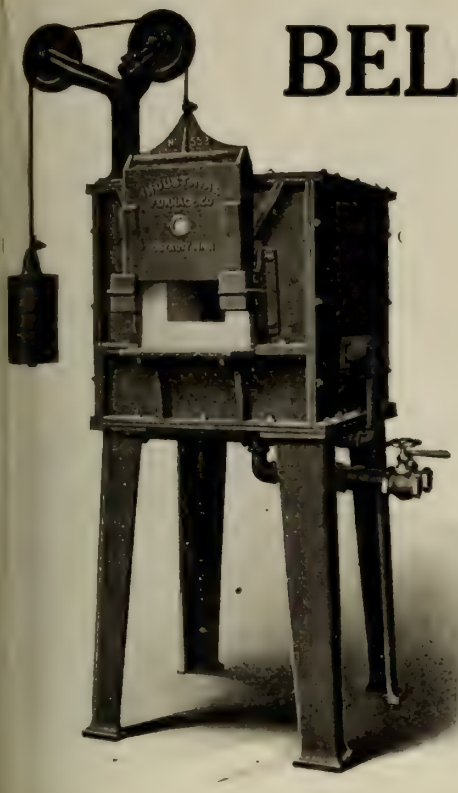
Nova Scotia Steel and Coal Co., Limited

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by the
HARMET
Liquid Process



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Enable the Operator to Speedily Obtain an Intense, Uniform Heat.

A distinctive feature of Bellevue Furnaces is the accurate way they respond to the will of the operator. They speedily develop an intense heat and are always under accurate control. Bellevue Furnaces are simple and economical to operate. Combustion is perfect and no flames come in contact with material. For oil or gas in seventy-nine different styles or to your order.

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JUST TURN ON THE TORCH AND THE IMPERIAL ACETYLENE GENERATOR BEGINS TO WORK



Every shop that has an oxy-acetylene welding outfit needs an Imperial Acetylene Generator. It is a masterpiece of simplicity, constructed without clockwork or any intricate machinery that can get out of order.

Imperial
Automatic
ACETYLENE GENERATOR

Turn on the torch, and carbide begins to drop into the water and generate gas. Extinguish the torch, and generation stops. Automatic, thoroughly protected by safety locks.

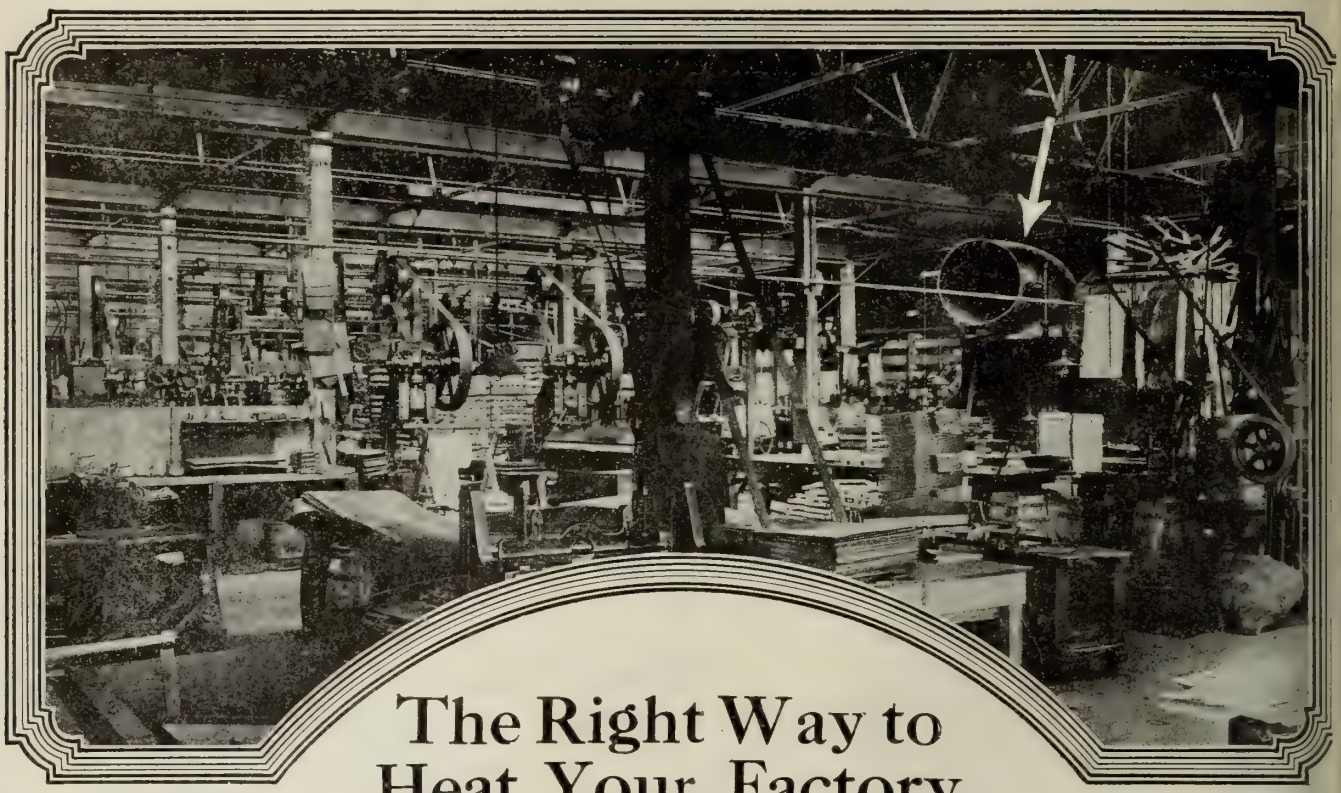
Imperial Welding Equipment will save money in every shop. Makes repairs quickly. Can be used in production. Write and ask for details of what Imperial Oxy-Acetylene Welding Equipment can do. Our Catalog is Free.

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The Right Way to Heat Your Factory

Install a Skinner Bros. (Baetz Patent) Heating System and there will be no more hot or cold spots in your factory—it will be comfortably warm all over all of the time, regardless of weather conditions. This is the right method of factory heating.

Skinner Bros. (Baetz Patent) Heaters do away with complicated pipes or ducts, are portable and require no special foundations. As a result, installation cost is 15 to 50 per cent less than any other system, with equally low operating costs. The mild, gentle circulation of warmed air provided by this heater does not create drafts or establish other conditions injurious to the health and welfare of your employees. Satisfactory performance guaranteed on a money refund basis.



Type SC—Where Steam is Available

Consists of a series of steam coils compactly mounted in an enclosed case, above a powerful fan-wheel. Cold air at the floor level or from outside is drawn into the heater by the fan, heated, and then distributed through outlet hoods to every corner of the open space. Uses live or exhaust steam. Fan operated by any power available.



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Construction is similar to th of Type SC, except that stea coils are replaced by a hea cast iron fire-pot. Burns co coke or wood—no more trou than an ordinary furnace. Co air is forced around the surfa of the heated fire-pot and th gently diffused through outl hoods into the open buildi space.

Get Further Information and List of Users.

Send now for further details on this wonderful heating system and list of users — you can then make your own investigation. Use the coupon, please.

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Baetz Patent HEATING SYSTEM

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We can / cannot use steam.

Do as the Big Shops do.

Many of the large metal-working shops furnish every employee using hack saws with a Starrett Hack Saw Chart. Use of this chart enables the user to instantly select exactly the right saw for each job.

If, for example, a man has to cut heavy angle iron in a power machine, he asks for Starrett Hack Saw Blade No. 255. Or if the job is cutting brass pipe, he calls for No. 252. If light sheet metal, he wants No. 253. If hand-sawing machine steel, he gets No. 112. And so on.

Using the right blade saves time, speeds up production, reduces blade breakage.

Whether you use hack saws in your home, workshop, or on the job—whether you employ a thousand hands, or use your own—if metal cutting is in your line you need STARRETT Hack Saw Blades, and the Starrett Hack Saw CHART.

Copy of this Chart will be sent you free. Write for it, and ask for the Starrett Book—"Hack Saws and Their Use." It's a book of 64 pages of practical hack saw data worth money to men who work in metal. Copy free on request.

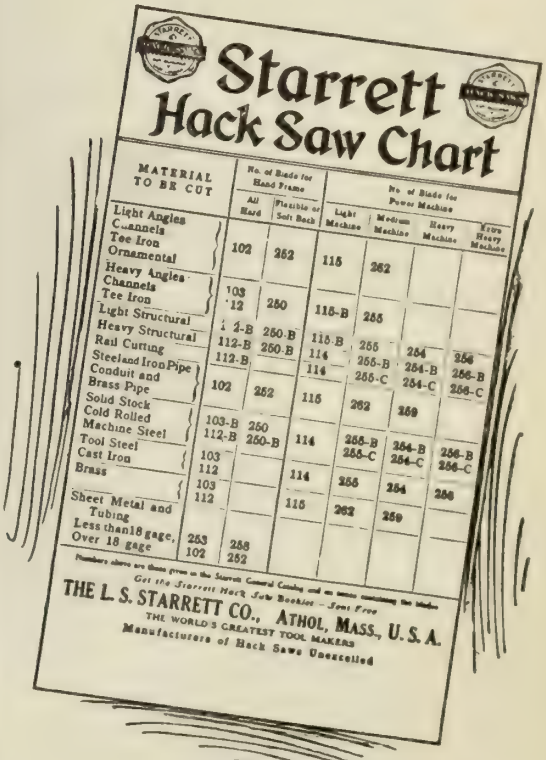
THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers

Manufacturers of Hack Saws Unexcelled

ATHOL, MASS.







Starrett Hack Saws

Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

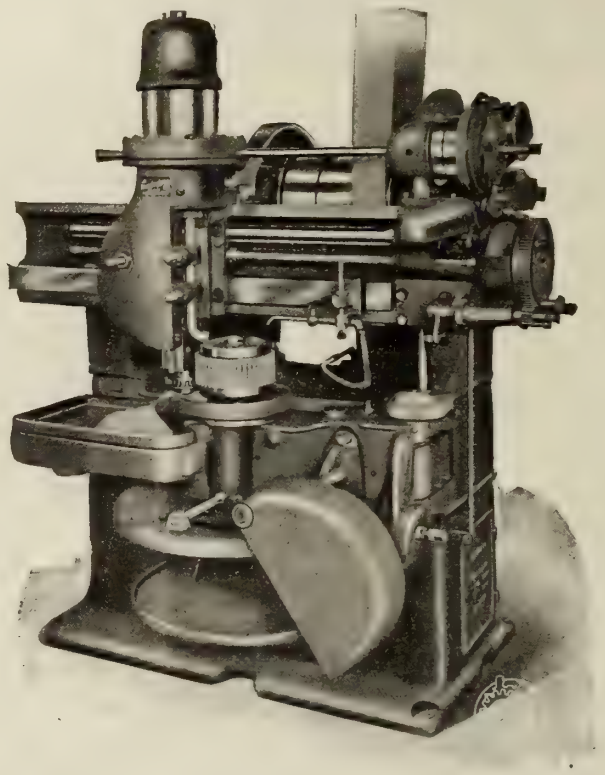
A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this little word "IF."

When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of Gear Cutting with the "IFS" Left Out.

Send for your copy to-day



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana. Alfred Herbert, Milan, Italy; Alfred Herbert Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India), Limited, Calcutta, India.



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It makes photographic facsimiles.

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MAINLY through the portability of Prest-O-Lite it was possible to weld the base of this heavy railroad crane in a few moments less than five hours.

That's the usual quick way in which it is possible to weld with Prest-O-Lite and the oxy-acetylene process.

Through the use of Prest-O-Lite it is possible to weld, build up and cut metals without bringing the work to be done to a workshop.

Thus Prest-O-Lite, the Universal Gas with the Universal Service provides the means for moving an oxy-acetylene welding outfit anywhere and everywhere.

You will be interested in the Nation-wide Service of our conveniently located plants and warehouses.

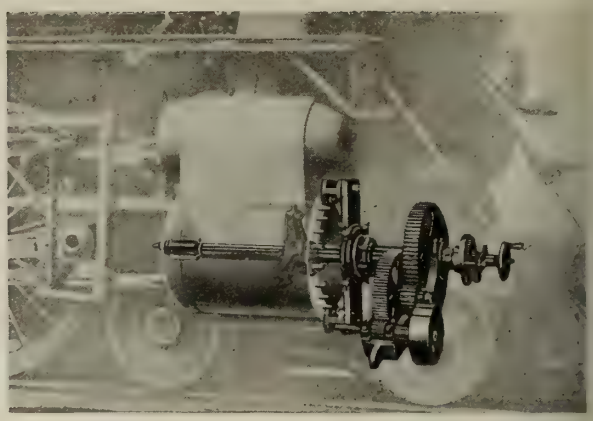
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PWC-525

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Reboring Cylinder of Locomotive on the track with an "Underwood." Quickly set up, accurately done.
Write for catalog.
Tools for Railroad, Marine and Repair Shops.

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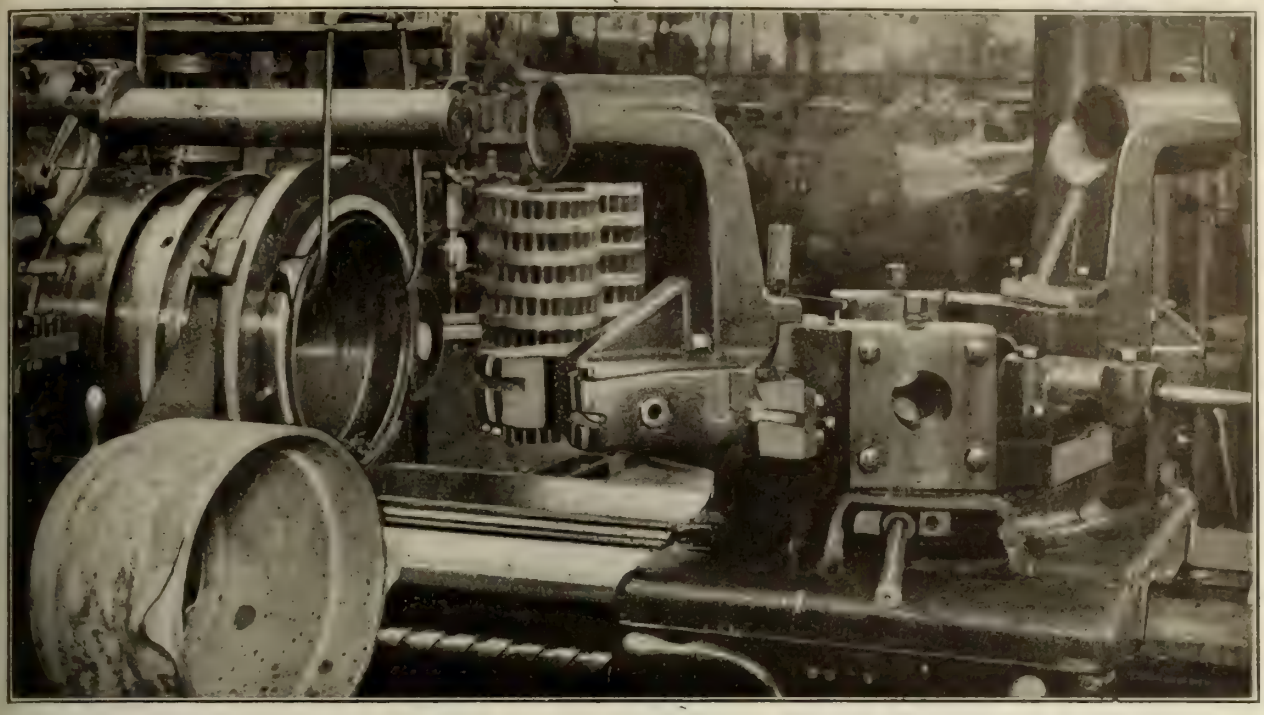
the next time you have some lifting to do.

I can be depended upon.

My pedigree will be cheerfully sent to you.

WRIGHT MANUFACTURING COMPANY
LISBON, O. U.S.A.

Canadian Distribution:
A. R. Williams Machinery Company
St. John, Halifax, Toronto, Winnipeg, Vancouver, Montrea



Machining Delco Generator Frames

The photograph above shows a tool set-up on a Steinle 24-in. Turret Lathe for turning out Delco Generator Frames at the plant of the Delco Light Company of Dayton, Ohio.

The chucking fixture revolves in a steady rest and is equipped with centering and stop pins for centering and locating rear end of frame by pulling sleeve collar forward. Set screws hold the front end in place. The turret fixture is reinforced in the machining operation by the overhead bar support; thus preventing undue chatter or jar under the heavy cuts taken.

This is only one of a number of installations in plants manufacturing electrical equipment where the Steinle is called upon to produce various parts from castings, forgings or bar stock.

In view of present manufacturing conditions it is invarably performance that counts and the Steinle qualities of accuracy, speed, ease of operation, power, reliability and economy of upkeep are guarantees of satisfactory performance on your own work.

Material—Cast Steel
Finish—Bore, Counterbore, Face Bottom, Face Lugs
Time—25 Minutes Each

Why not send us your blueprints if your requirements call for the installation of equipment of this character? We shall be glad to furnish you with production and tooling estimates, or to have a qualified representative call and take up the question of Steinle methods as applied to your production problems.

STEINLE TURRET MACHINE CO.

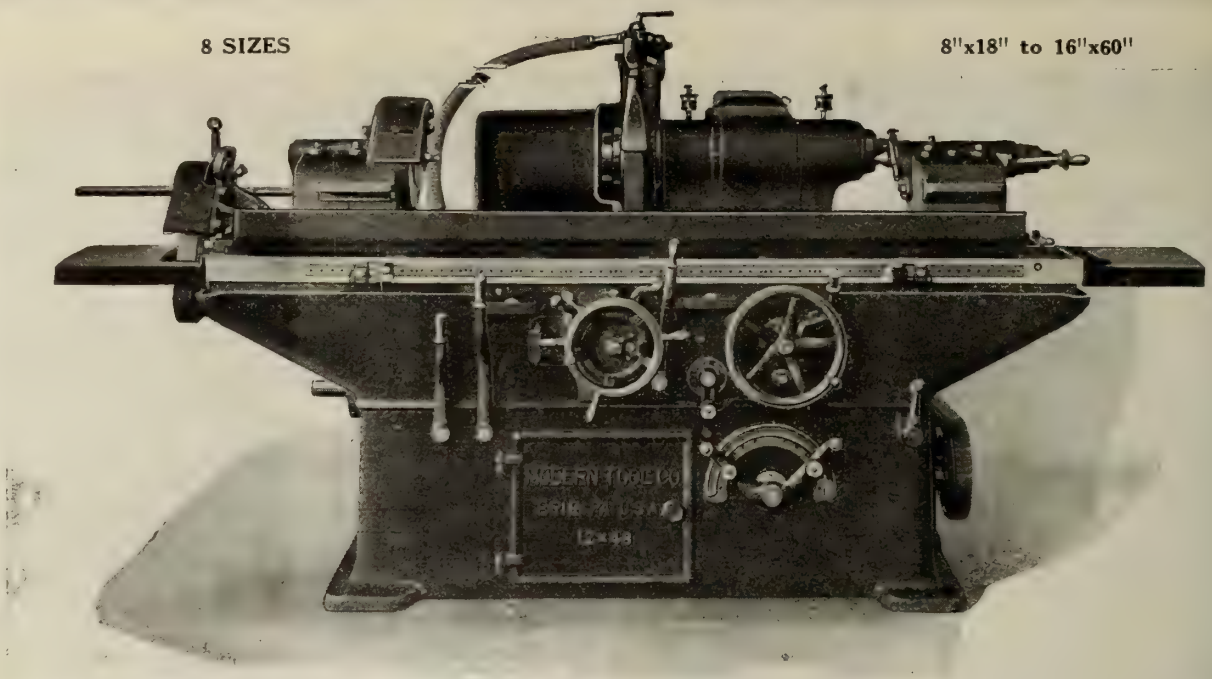
Originators of the full swing side carriage turret lathe

MADISON, WIS., U.S.A.

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California. FOREIGN—Leo. C. Steinle, 53 Victoria Street, London England

8 SIZES

8"x18" to 16"x60"



M O D E R N
PLAIN GRINDING MACHINES

Advantages

Extreme Accuracy ***Positive Work Drive*** ***Unusual Output***
Very Convenient ***Exceptional Durability*** ***Remarkable Rigidity***
Full Self-contained

Modern Grinding Machines are made of finest materials obtainable. They are built by men skilled in this class of work. The utmost is done to insure accuracy and dependability. Modern Grinding Machines enjoy a most enviable reputation for highest quality among manufacturers in America and abroad. All Modern Tools are fully guaranteed throughout.

DRIVE—Constant speed, single pulley or direct connected motor. Controls all centered on front. Work speeds and table feeds entirely independent. Work drive is positive through silent chain. Power transmitted by single belt or by motor direct. Wheel drive by belt from main shaft to wheel spindle. Headstock driven by internal helical gear. Absolutely non-self-centering start and reverse mechanism. Speeds and feeds all regulated from unit gear box. Gears are meshed at all times, engaged by patent drive clutch. Automatic Cross feed at either or both ends of reverse table. Tarry device is regulated at each end of the stroke. Steady rests, universal in movement, capable of delicate adjustment and equipped with positive stops for duplicating parts. Machines equipped with anti-friction bearings. All revolving parts are fully guarded. Send for complete technical bulletin.

MODERN TOOL CO.

Main Office and Works: **State and Peach Sts., ERIE, PA.**

Canadian Agents:

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Foreign Representatives: Yamatake Company, Tokyo, Japan; Leo. C. Steinle, 53 Victoria St., London, S. W., England; Glaenzer & Perreand, 18 and 20 Fauborg du Temple, Paris, France; Rylander & Asplund, Stockholm, Sweden; C. Civita & Co., Milan, Italy; J. Lambercier & Co., Geneva and Zurich, Switzerland.

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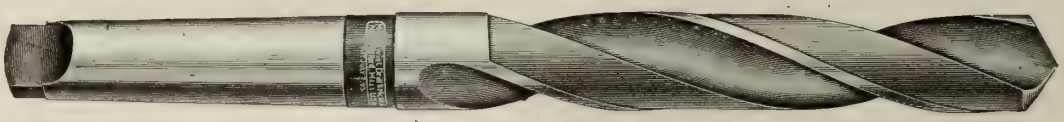
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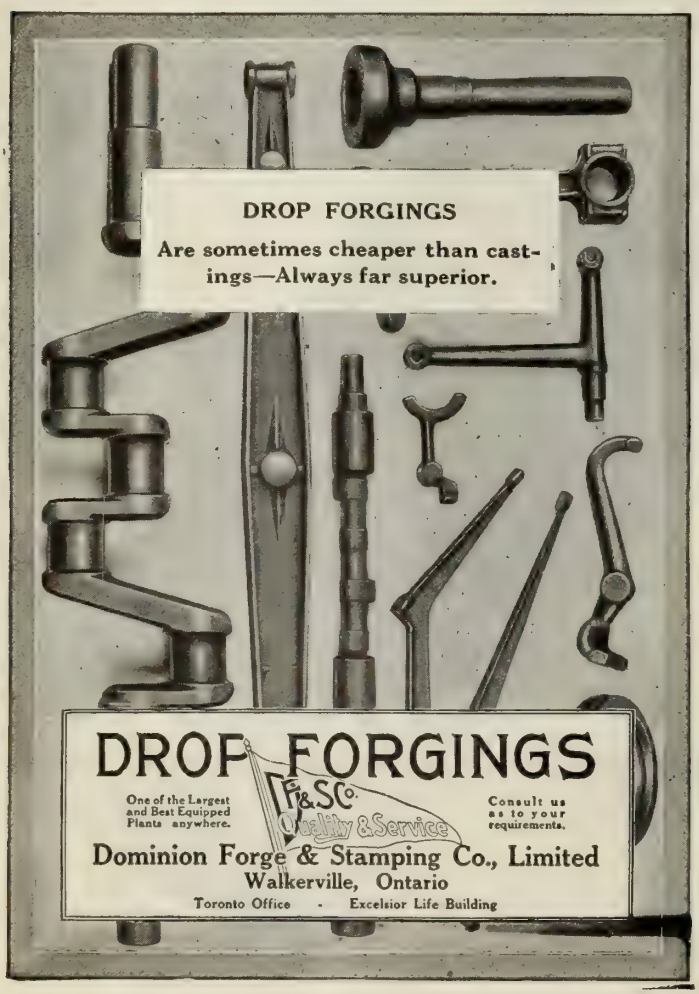


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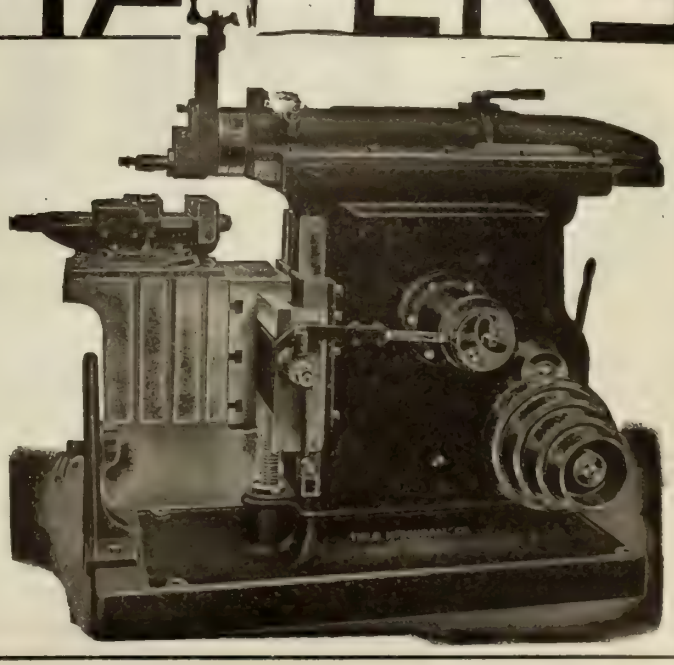
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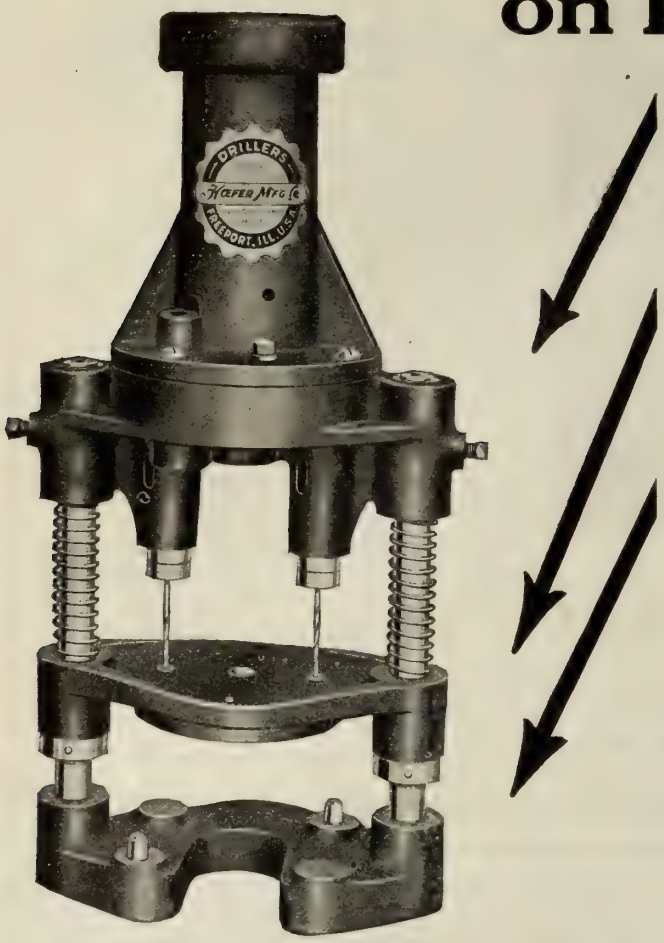


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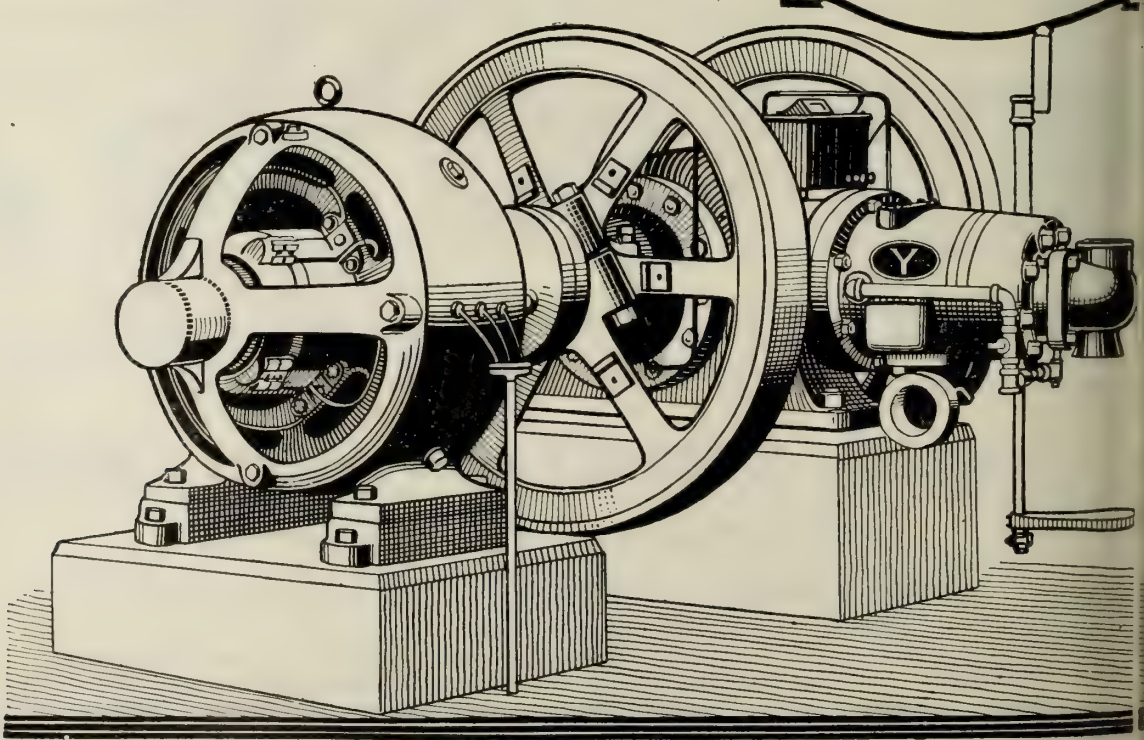
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CANADIAN MACHINERY AND MANUFACTURING NEWS

Fixtures Used With Success In Disc Grinding

Parts to be Machined on the Disc Grinder Should be Designed to Suit—Method of Grinding Hexagon Nuts—Grinding a Number of Rods at One Time—Angle Plate Fixture Also Floating Fixture.

By F. SCRIBER

N the June 2nd issue we published an article on disc grinding. In the present material we shall discuss a few ctures used on such a class of work. ere is no need to dwell on the advanges of disc grinding, for this fact is clearly proven in the previous article that we will content ourselves with a scription of the fixtures, and the work ich they perform.

Question of Design

To make disc grinding a success the rts to be ground must, or at least ould be designed in such a manner at as small a surface area as possible presented to the disc wheel. This n quite easily be accomplished by reising such portions of the surface that e not actually needed. For example g 1 shows various parts in common e throughout many plants. The part own at A typifies a simple steel disc hich has a large grinding area, while to the right of this at B, is shown a die with five holes in it. From a comparison of these two pieces it will be apparent that the piece B, is much easier to grind than the part shown at A. C, shows a cast iron bracket on which the surface D, is to be disc ground. This bracket has been recessed in such a manner as to leave a rib around the outside and through the center, this being all that the bearing requires. It will be obvious from this illustration that about two thirds of the surface to be disc ground is thus removed. At E is shown a shelf support in which the surface F has been recessed to eliminate much of the grinding surface. Almost unlimited applications where the area is to be disc ground could be thus reduced are in evidence, and besides reducing the heat generated by having the work in contact with the wheel, it increases the speed of the grinding operation and prolongs the life of the disc grinding circles; therefore it is advisable to so reduce the grinding area of the work wherever practical.

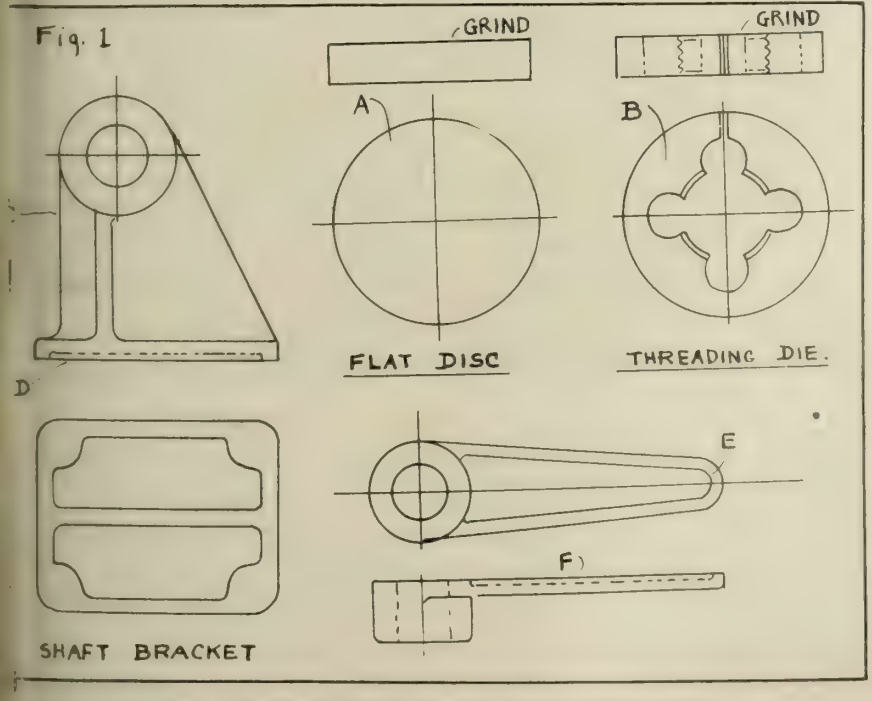


Fig. 1—Showing parts in common use in many plants.

Fig. 2 depicts a holder upon which are mounted six hexagon nuts while the flats on their sides are ground. The nuts are slipped over the hinged rod A, this rod being pivoted at B in a holder C. After all the nuts are placed on the rod it is dropped into position shown; the work guide rest on the disc grinding machine is tilted to an angle of 30 degrees. A holder containing the nuts is then placed in the position shown on the rest D and the sides are ground the flats on the nuts of course accomodating themselves to the flat surface on the disc wheel. After grinding one side they are turned and the next sides are ground. This is continued successively until all six sides are completed.

Figure 3 shows an arrangement which permits of accurately grinding the ends on a number of rods. A vee shaped fixture A is mounted on the supporting table of the disc grinder. A number of rods B are placed in the vee shaped aperture and are clamped therein by means of screw C and strap D. Care is taken to have the ends of the rods practically even and the traverse feed of the machine is used to bring the end of the rods into contact woth the disc grinding wheels.

An application in the use of an angle plate fixture for disc grinding a hal bearing is shown in Fig. 4. The bearing A is held in the fixture B by means of a screw C which forces the bearing back against two screws D and surface E. The bearing in the position noted is then brought into contact with the disc grinding wheels by means of the traversing slide on the machine and is forced against the face of the grinder in the usual manner with a rocking motion. In grinding this half bearing it will be noticed that there are only two narrow surfaces to be ground thus making it an ideal part for disc grinding.

Intelligent Application

The intelligent application of a disc

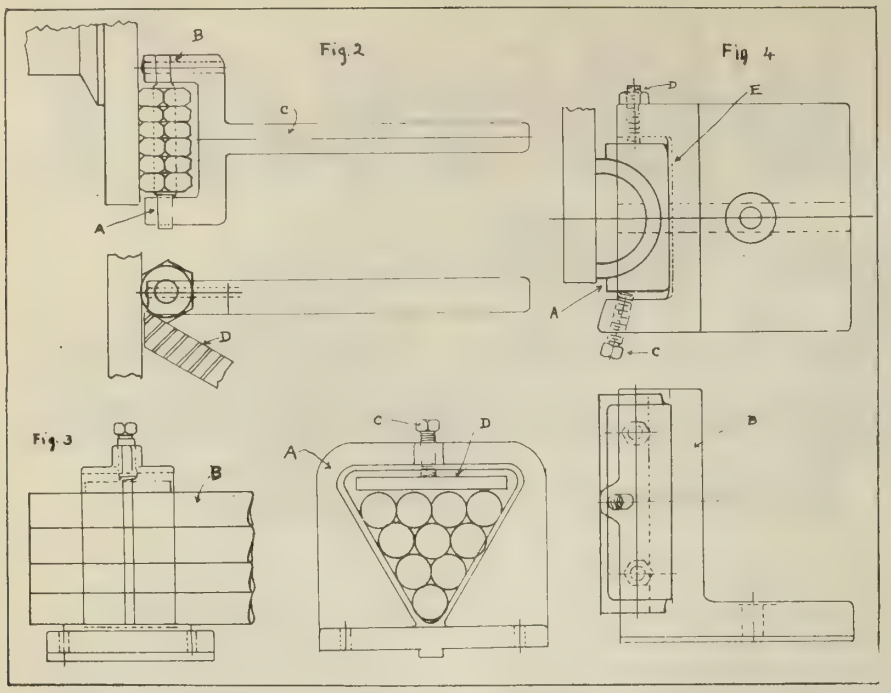


Fig. 2.—Holder for six hexagon nuts. Fig. 3.—Method of grinding the ends of rods.
Fig. 4.—How to use the angle plate with the grinder.

grinder is in a large measure responsible for the success attained. Simple fixtures such as described greatly enhance its value. A disc grinder is not by any means a rough and tumble apparatus but a machine capable of remarkable results on the class of work to which it can be conveniently applied. The amount of material that should be removed varies with the class of work that the machine is applied to. On steel punchings it would probably run from .005, to .015 in., while on cast iron parts it might range from 1-32 to 1-16 in., and often it is necessary to allow for any finish on the pattern.

By referring to Fig. 5, an idea of the utility of the work supports and slides commonly found on disc grinders can be obtained. Figure 5 illustrates a block A being disc ground. This is held in a fixture having a base B clamped to a slide C on the machine by screws (not shown). The work is held by a strap D tightened by a knurled nut E. A lever F brings the work into contact with the wheel and should it be desired to tilt this slide C and work on an angle, it may be readily done by pivoting the bracket G containing the slide C on the center stud H. This bracket is clamped in the desired position by means of the screw and nut J. The work is then caused to traverse across the surface of the wheel, which causes the entire arrangement to pivot on a stud thus imparting a rocking motion to the work diagonally across the disc grinding wheel.

It is generally accepted that disc grinding should be done dry because water will destroy the grinding circles. It is also very desirable that an excessive amount of generated heat be avoided in grinding, as this prevents distortion of the work, also because cool metal grinds easier than warm metal. A metal that is excessively hot tends to destroy the grinding circles. One of the best preventives of heat generation is to keep the cutting circles very sharp and clean, a good stiff wire brush is generally used for cleaning the grit out of the circles.

Fig. 6 shows a method of grinding work on centers on a belt polisher. This consists of two strips of steel A containing centers B. The two strips are riveted together with pins at C, the work D is held between the centers B, it being sprung into the position shown by holding the strips A apart by hand. The work in the holder is then held in contact with the polishing belt and revolves on the centers while being polished.

Floating Fixture

In many cases it is necessary to s hold the work that a floating featur must be incorporated in the design o the fixture. This is made necessary b the fact that a flat surface is to b ground in its natural alignment wit other portions of the part being ground Fig. 7 shows an arrangement embody ing a floating feature. The work i mounted on the face plate A over a pin B or other suitable arrangement The end of A is ball shaped at C, an fits into a similar shaped recess in th angle bracket D. A plate E, made in tw halves, is screwed into the positio shown and holds the work holding plat A in position, while the ball featur allows it to rock. A spring arrange ment F provides sufficient tension s that the face plate A is prevented fro floating too freely. This entire arrange ment with the work is held on the tra verse slide of the disc grinder and whe the work is brought into contact wit the grinding disc, the fixture, throug this floating medium, allows the wor to assume a natural position corres ponding in a general way with the shap of the surface ground on the work.

A work holder for general utilit purposes is shown in Fig. 8. This con

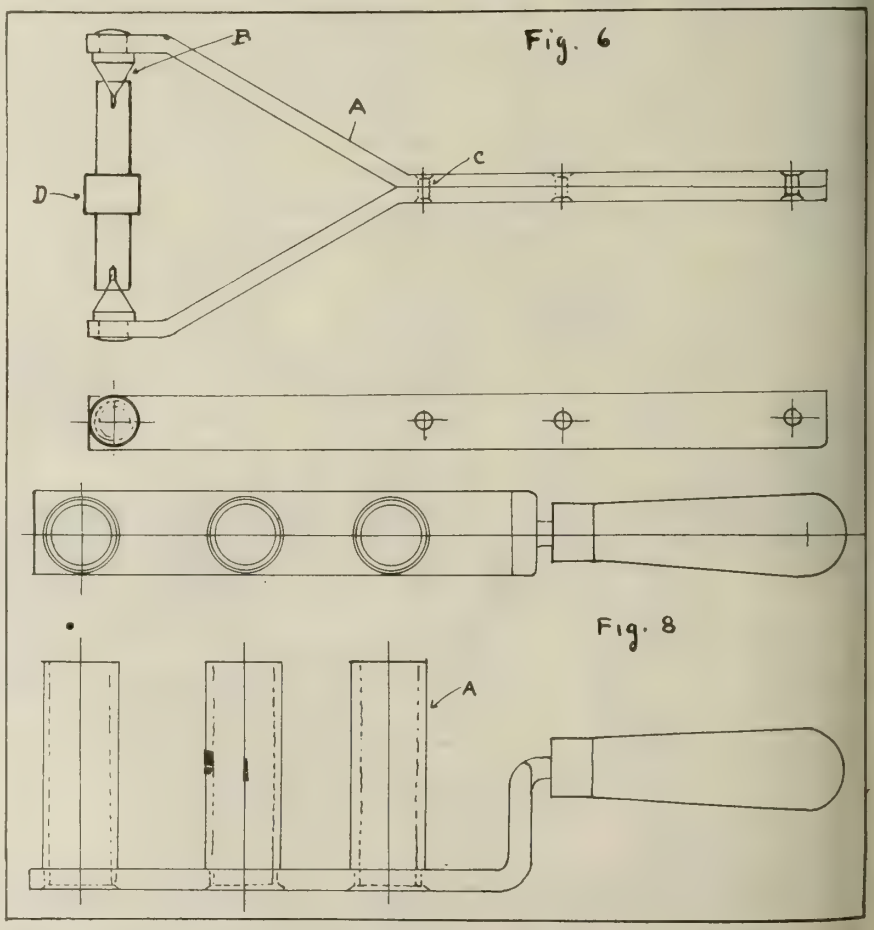
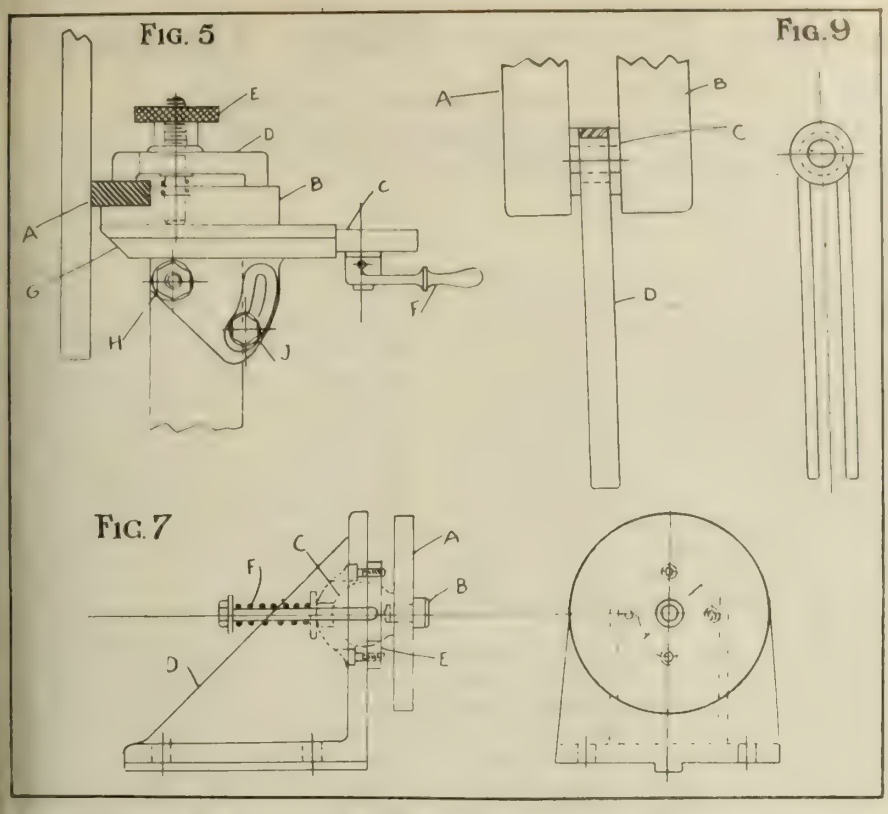


Fig. 6.—Holding the work on centers. Fig. 8.—A work holder for general utility purposes.



g. 5.—Arrangement for grinding edge of block. Fig. 7.—Showing the use of a floating fixture. Fig. 9.—An adaptation of the double wheel disc grinder.

sts of a flat piece of steel having a le handle on its end. Into this piece steel are riveted three pieces of pipe Three parts which have holes in iem are slid over these pieces of pipe id disc ground at the same time, being eld in contact with the disc grinder y hand while this is done. A larger mber of pipes A might be employed epending upon the nature of the work, nd it will be found useful in disc inding to have a variety of simple pliances on hand for general util- y purposes.

Some disc grinders are made with two heels adjustable towards a common nter, These will grind both sides or ds of nuts, collars and other suitable rts at the same time. Figure 9 is example of this class of work where e wheels are shown at A & B; the work ia bushing C which is recessed; a spring lk D grips the work over this recess, d the bushing C is fed by hand be- teen the two discs and both sides e ground in the manner illustrated. It quite general to use suitable hoppers magazine feeds for handling work this type of machine.

LLING-MACHINE FEED SYSTEMS.

By J. AIREY.

n looking into the literature on the ject of milling-machine feed systems ave been much impressed by the lack systematic investigation, and even, quently, of reasonably straight analy- s in connection with the data already and. A case in point, not so much nected with the action of a milling cutter as with the functioning of a milling machine, is the question of the two types of feed systems. This was brought more distinctly to the fore by the definite stand taken in a recent article in favor of a machine driven from the spindle. The best current practice has rejected this feed system. The new system of constant-speed feed shaft lends itself to very rigorous demonstration as being in all ways superior to the system formerly in vogue.

There are two different systems of feed mechanisms used in milling machines, continues the author in a recent issue of "Practical Engineer." The older one has the feed mechanism driven from the spindle of the machine. The modern method uses a separately driven feed shaft running at constant speed.

The following six statements are submitted in logical sequence, some being axiomatic:—

1. In discussing the action of milling, feed per tooth is the fundamental quantity.

2. A large-diameter cutter will have more teeth than a small cutter.

3. One tooth in a large face mill will take a heavier cut than a tooth in a small end mill.

4. Peripheral speed is approximately constant for a given quality of cutter and of material. It follows that the large-diameter mill will be used in conjunction with slow speeds and small-diameter mills in conjunction with high speeds.

5. A large-diameter cutter will call for a larger feed per revolution than a small-diameter cutter does. (See statements 2 and 3.)

COPPER-STEEL.

In a paper read before the American Iron and Steel Institute, E. M. Buck reviews the development of copper-steel, stating that tests made by a committee of the American Society for Testing Materials with the co-operation of the United States Bureau of Standards, together with other data available, prove that by alloying from 0.15 to 0.25% copper with normal open-hearth or Bessemer steel the rate of corrosion of steel is very much reduced, where the products are exposed to alternate attacks of air and moisture. It is also claimed that in the investigations indications pointed to a better adherence of paint coatings on copper-steel, resulting in a more effective and longer-continued protection by the paint film. The manufacture of copper-steel has heretofore been largely confined to sheet metal, but it might be extended to other uses. In particular, steel freight cars are mentioned, especially those of the open kind, which are greatly affected by corrosion.

A large water-power station is at present being built at Ætsä, Finland, about 70 kiloms. east of Bjorneborg. It is said that a transmission line will be laid down the whole of that distance to conduct about 7,000 H.P. to the industrial establishments at Bjorneborg. The power station, which is being built by the Bjorneborg Power Company with a capital of 2,000,000 Finnish marks, is expected to be ready this month.

ELECTRIC HEATER.

An ingenious electric heater for the starting of crude oil engines is a new British invention. The device is said to be extremely simple, and consists essentially of an electric heating element of high resistance wire placed in the line of action of the oil spray. A small amount of current suffices to make this wire white hot, in which condition it brings the spray rapidly to the temperature required for starting. After the engine has gone ahead the element is withdrawn, so that it is not exposed for more than a minute or so to the high temperature of the combustion chamber—an arrangement which gives it long life and great reliability. The electric current required for operating the heater is supplied by a 4-volt or a 6-volt battery charged from a tiny electric generator, driven through a bolt from the engine. By means of this device the engine can be quickly started up from cold without the slightest trouble. Twelve months trial of the apparatus has shown it to be thoroughly satisfactory.

John Conley Tackles Machine Shop Problems

Making a Lathe Fixture For Small Eccentric Shaft—Simple Device Was Sufficient to Produce the Work—Making a Test Tool to be Used For Producing Certain Vee Blocks.

By J. DAVIES

"WELL, John, what do you know this morning?" was the cheery salute of a shopmate one morning as John was sitting on the end of the lathe bed examining very critically a blue print he had in his hand.

"What do I know? I know nothing—and I know it well."

"What seems to be the trouble?"

"You know the small eccentric shaft I made for that flour sifter I had such a time with?"

"Yes, I remember."

"Well, along comes the boss this morning with an order for 100 of them, but he says he is going to turn them over to the production department."

"Well, that lets you out, doesn't it?"

"Not much. He says it is up to me to make a jig, so that any lathe hand can do the job in about one-third the time it took for the first one. Of course I have seen lots of fixtures around the shop, but I have never seen any for lathe work."

"Well, John, I consider the boss has paid you a compliment. I once read that there was nothing new under the sun and that all inventions were new applications of old principles, so you might get an idea from other fixtures already in use."

John was determined to show the foreman that he had more ambition than to be always a lathe operator, so considered this question very carefully and suggested to the foreman a general plan of operation, which after some slight modification was carried out as follows:

The shafts were made from 1 7/16-inch diameter cold rolled steel about three feet long. Two pieces of tool steel were bored a push fit for the ends, one for each end. A piece of cold rolled steel, large enough to allow for turning, was driven into an old flange, after which the flange was faced and bolted to the lathe face plate. The piece driven into the flange was turned to fit the two pieces already bored, they being the exact size of the cold rolled eccentric shafts, for which the jig was being made. Two holes for set screws were drilled and tapped at right angles to each other in the steel pieces A. The screws were sunk below the surface, and the holes countersunk for a box wrench, to avoid accidents through projecting set screw heads.

The jig piece, A, was next fastened to the turned mandril by two set screws. The end was faced true and smooth and a very fine circle was made on the end with a sharp pointed tool equal in radius to the required throw of the eccentric shafts to be turned. A horizontal line was drawn through the centre, right across the face, and where the horizontal line cut the circle was the centre required.

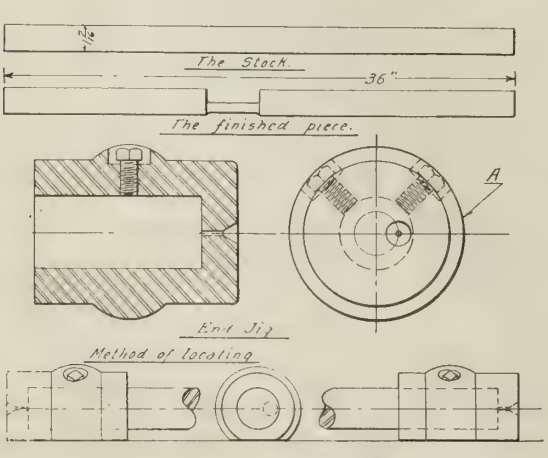
Probably the most accurate method of marking off a horizontal line to cut the centre exactly is to take an old square file and grind it to a sharp point. Place it in the tool post as near the centre as you can guess, then make a horizontal line across the work. Turn the lathe halfway round and test with your pointer, making another line exactly parallel with the first one. If the lines should come exactly on top of each other you have hit the centre first time. If not, and you make two distinct lines, then the exact centre lies midway between the two lines and you adjust your pointer accordingly.

With this point as centre, make a circle with the dividers for setting up by, slacken the bolts and slide the jo to the new centre, setting it very car fully. Now make the centre with a to and put in a very small drill to cle the point, repeating the operation wi piece No. 2 for the other end.

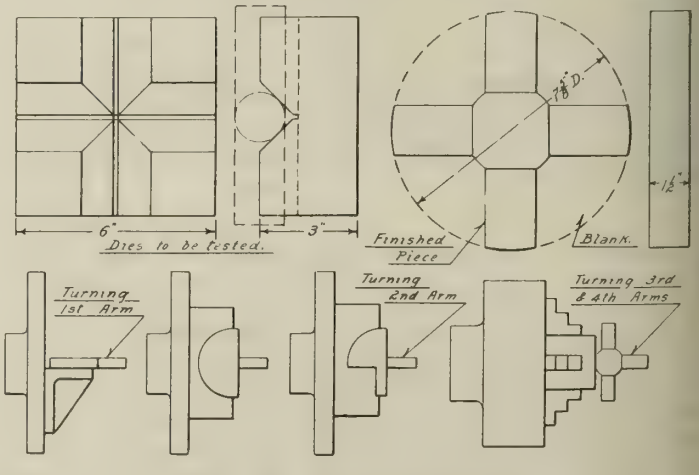
Both pieces are now exactly alike, t only thing that remains being son ready method of locating them on t shafts in proper relation to each othe This is done by placing them on a sho piece of shaft and setting them up t the horizontal lines on the planer shaper, and shaping a flat on one si of each piece. In use the jigs are plac on the shafts and the flat spots plac on the lathe bed, planer or any oth flat surface, and the set screws tigh ened up, when the job is ready to turned. The same jig pieces can be us for several different throws if the ce tres are not too close together.

To John's delight the jig gave eve satisfaction and proved to be a ve quick and accurate method of turni these eccentric shafts. After this su cess John was given another lathe a tachment to make. This time it was bore out a number of cranks, with three-inch hole for the crank shaft, a a two-inch hole for the crank pin, at exact distance of five inches apart fro centre to centre.

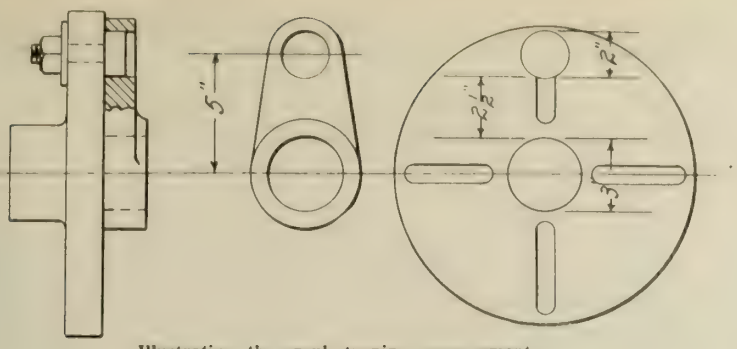
The first thing he did was to turn a pin with a round head, a nice fit f the two-inch gauge ring, leaving a sha threaded at the end for a nut to tight it up in place. He next put the thre inch standard plug in the lathe betwe centres and tested it with the indicat to see that it ran perfectly true. I then placed the pin he had turned wi a two-inch diameter round head in t slot of the face plate, and moved it



The jig used for shaft.



How John made the precision tool.



Illustrating the crank turning arrangement.

a) down until he had it set exactly
s and one-half inches from the three-
in plug between the centres, measur-
in between the two inside edges with
ch inside micrometers. This ensured
hn being exactly five inches apart,
e re to centre. After tightening the
o ting pin in place, he drilled two
rill holes in the head and put in dowel
i to keep it in place.

ow the method of operation was very
ible and extremely accurate. First
placed the three-inch hole over the
o ting pin and set the two-inch hole
proximately true with the casting,
ced the work to the face plate and
hed the two-inch hole to the stand-
r plug. He then reversed the work
placed the finished two-inch hole on
locating pin, which automatically set
xactly five inches centre from the
r hole, then bored out the three-inch
and repeated the operation for
y piece.

he next job John had to tackle was
ecision tool to be used in testing the
racy of some Vee dies being fin-
l on the miller. These dies consist-
f a square block of steel about disc
s square and three inches thick with
w 90-degree Vees cut right through at
angles to each other, perfectly
llel to the base and square to each
r. The test tool was made from one
e of steel and had four arms as
n in sketch, these arms were all
same size and were square and true
each other every way. This tool
simply placed in the die and tested
he surface plate with indicators and
ers. This piece of work was too
u for John's ingenuity, and, as he
essed it, it was a regular Chinese
le and got him all balled up.

ter several trials he found that he
not mark off the four ends exactly
e right relation to each other, and
if he had succeeded in doing so, to
in four centres and maintain that
ion was very unlikely. So he con-
l with the foreman and he in turn
it the drawing office, and the method
achining this piece was decided on
llows:

st, a perfectly flat surface was
on one side, then a true angle
was bolted to the face plate of the
the correct distance below the
c. The piece of work was now
l to the face plate with sufficient
anging to make the length of one of the arms. This arm was then turned to the finished size. Before taking the finished cut the work was checked over with the feelers to see that it was bolted down perfectly flat on the angle plate.

In the second operation the piece was turned round 90 degrees and bolted down on the angle plate exactly the same as for the first operation. The second arm was next turned in the same plane and at right angles to the first arm. The test for right angles was made by putting an indicator in the tool post and slowly pulling the lathe round so that the finished arm, now lying parallel to the face plate, just touched the indicator and registered the same at both ends of the finished arm.

The third and fourth arms were turned by placing a piece of cast iron scrap in the chuck, which was bored out a tight push fit for the finished arms. Before placing this piece of scrap in the lathe, a hole was drilled and tapped for a set screw and partly plugged up with a piece of brass, so that the point of the set screw would not damage the finished work. The first and second arm were pushed into this piece prepared to receive them, and the third and fourth arm finished.

This completed a very accurate test block with the arms all square to each other and lying in the same planes.

A PORTABLE ARC WELDER

The Electric Arc Cutting & Welding Co., Newark, N.J., has developed a welding machine weighing complete 100 pounds, which, with reasonable care, will accomplish any work in or around a garage or garage machine shop, etc. The machine will use electrodes from 1-16-inch to 5-32-inch and will operate continuously with the medium and small sizes, and intermittently on the large sizes. Standard lines of machines are built to operate absolutely continuously, but careful design and development produced this machine, which will fill any and all the requirements for automobile repair work, plumbing shops, sheet metal work, electrical shops, etc.

It is also very handy in a job welding shop where electrical experience is available and discretion is used as to its capacity. Every available care is taken to reduce the weight and maintain its capacity. It probably has not as many limitations as one would be led to believe from the foregoing. The only point is, it cannot be guaranteed on a heavy boiler or engine job for continuous duty, although it will do such work if used with discretion, and with proper discretion, the machine will last a lifetime. Its portability was forcibly brought home to us by a picture of a man holding a complete outfit under his arm.

This machine will operate on either 110 or 220 volts, and any frequency specified in the order, and the machine can be made for other voltages, but the standard worked up design is for both of the voltages mentioned, that is, there are two coils in series on 220 V and in multiple on 110 f. The power supply must be of at least 5 KVA in order to use this machine, and be within the underwriters' regulations. While it will operate from a lamp socket with the smaller electrode, it is not allowable or good engineering to do so. If 5 KVA is available, however, it will operate connected to the panel board from which the lights are distributed. It will operate for less than 1 KWH per hour or in general less than 3c an hour.

The connections are very simple. Two wires are hooked from the machine to power supply and two other wires which are furnished with the machine are attached to a plugging in board unit mounted on the machine for regulation. In order to make the machine standard there is included in each machine provision for operating on the following volts.

The uses to which this machine may be put cover every field of arc welding that could be encountered except perhaps doing very heavy work rapidly, as above voltages—90 to 130 volts and 180 to 260 stated; however, it will do the heavy work but at a reduced rate, i.e., not economical for production, but at a rate perfectly economical for emergency repairs.

Around a garage or automobile repair or machine shop, the uses to which this machine can be put are as follows: Repairing of scored cylinders by spotting and peening with a nickel electrode, and straight repair welding of cracked and broken blocks, and mudguards, mudguard brackets, cracked water jackets on cylinders, broken frames and other chassis parts such as lamp brackets, bumper brackets, tire holders, step brackets and any part around the chassis which has become loosened due to wrenching or wear, may be tightened up forever with this machine. Squeaks and rattles otherwise impossible to get rid of, can be cured forever with this machine. In the automobile machine shop, parts that would have to be bushed or replaced can be built up to beyond their original dimensions and machined down to their correct size. Other broken parts such as crank shafts, connecting rods, universals, worn teeth either gears or connection dogs, or anything worn in or about the car, can be built up and machined back to its original dimensions.

Governing Production of Heated Products

Certain Factors Are Involved—Equipment and Fuel Should Be Selected To Suit Individual Plant Conditions—Principal Factors Are Grouped Under Three Heads—Chart of Value is Given.

By J. A. BROWN

IN the production of a heated product, particularly that in which heat treatment is a part, it is necessary to select that form of equipment and fuel adapted to the individual plant conditions, which when properly combined and operated will produce the result sought. In general terms this may be summed up as producing a finished product of given quality at minimum cost.

To produce this result the principal factors to be considered may be grouped under three principal heads; the first is the quality of finished product; the second the facilities available or required to produce this product, these in turn determining the cost of the finished product.

The quality of the product depends upon the raw material and upon the heat treatment it receives. The term raw material is here used in its economic sense in that the finished product of one group of producers becomes the raw material of the following group. Each step requires a definite combination of material, process and skilled effort for its transformation. Raw material, before heat treatment, includes material more or less fabricated, having been cast, rolled, or forged at working temperatures considered suitable for these operations but with, perhaps, indifferent or little attention given to the resulting structure or condition. The chemical analysis probably checks within the limits required by the specifications, but the physical properties and structure may indicate considerable lack of uniformity in the material submitted to heat treatment. This condition merits far more attention that it has received, as every heat treater is familiar with many instances in which the after treatment is expected to restore those properties that have been sacrificed in working the raw material.

Heat treatment is commonly understood to consist of a definite succession of heating and cooling operations and the heat treatment as a process is good or bad to the extent that these operations are made definite and that the variables involved may be controlled. Control requires the duplication of condition and results and demands a high degree of standardization. Thermally, heat treatment simply covers an interchange of heat, and the thermal action is between two substances, one giving up heat and the other receiving it. A hotter fluid, flame or substance surrounds or plays on a cooler substance or object and, due to the difference in temperature, the cooler object becomes heated and the surrounding substance loses heat. The manner in which the heat is applied determines the uniformity with which the heat is absorbed.

In order that the change in the structural composition of the metal may be unobstructed, it is a fundamental requirement that the heating and the cooling should be uniform. Uniformity in heating produces the required structure in the least time with the least expenditure of heat energy, while uniformity in cooling fixes the final structure composition.

POINTS OF IMPORTANCE

Three factors must be considered, viz., the quality of finished product; facilities available or required to produce the product, these in turn determining the cost of the finished product.

The temperature variation in and around the piece being heated and the degree of accuracy with which this temperature variation may be controlled determines the uniformity of heating. Equally important is the time in which the material is heated or held at temperature before cooling.

Plant conditions not only affect the quality of the output, but may materially affect the cost of a finished product. This condition should therefore be considered in detail as part of the production facilities.

Temperature Required.

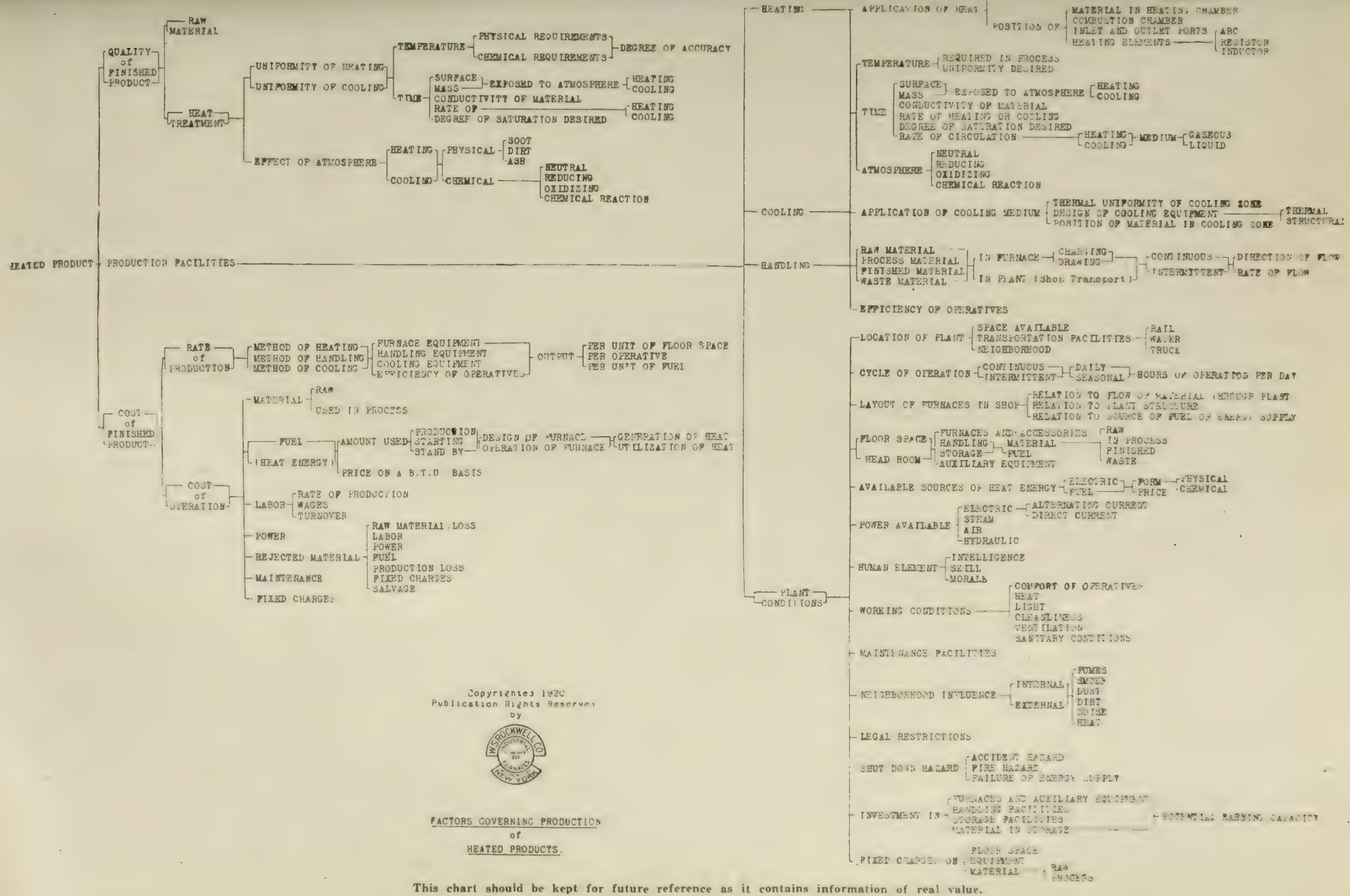
For every piece subjected to heat treatment this question must be answered: "What temperature is required?" and a workable answer depends upon data of various natures resulting from actual investigation. Fundamentally, it is a question for the metallurgist to answer correctly and fix the degree of heat required in a given operation. In a physical sense, the temperature variation in and around the piece being heated and the degree of accuracy with which this temperature variation may be controlled determines the uniformity of heating.

Equally important is the time in which the material is heated or held at temperature before cooling. Time depends not only on the mass of the material but on the surface exposed. [illegible] relation of mass and surface is a fu[illegible] tion of the shape and it is readily [illegible] preciated that an irregular shape w[illegible] unequal metal thickness, offers m[illegible] difficulties than a simple shape of [illegible] form thickness. Heat transfer can [illegible] take place where a temperature dif[illegible] ence exists. The greater the temp[illegible] ture difference, the more rapid the fl[illegible] As the difference becomes less the [illegible] decreases until equilibrium or sat[illegible] tion is reached. Obviously the temp[illegible] ture in the heating zone should not [illegible] higher than the temperature requ[illegible] for the operation or process, thoug[illegible] is evident that a longer time will be [illegible] quired to heat. In forge shop prac[illegible] high temperature and incomplete [illegible] uration are responsible for the so-ca[illegible] wash heats, where the surface of [illegible] metal may be dripping and yet a h[illegible] core will be found in working un[illegible] hammer or press.

The atmosphere in the furnace ha[illegible] very direct effect on the quality of [illegible] ished product. This atmosphere or c[illegible] dition in the furnace may result fr[illegible] the fuel used or from the conditi[illegible] under which the fuel is burned. S[illegible] and ash result from the physical co[illegible] tion under which a fuel is used, a[illegible] indicating unconsumed fuel. Ash is [illegible] quently a troublesome feature, w[illegible] coal is used in powdered form. So[illegible] operations require a clean fuel and [illegible] find anthracite in use in the soft c[illegible] districts and natural gas in the cera[illegible] and glass industries of the Middle W[illegible]

At times it may be necessary to p[illegible] tect the work from contact with the f[illegible] nace gases and in this case muffles [illegible] refractory materials are employed. T[illegible] atmosphere within the muffle may [illegible] oxidizing or reducing, though usu[illegible] oxidizing. Enameling, glazing and si[illegible] lar operations are conducted in [illegible] way. Vitreous enamels may be made [illegible] the electric resistance furnace but [illegible] the arc furnace, the gases from the e[illegible] trodes are very liable to have a reduc[illegible] effect upon the oxides in the enam[illegible] Special atmospheres to control a ch[illegible] ical reaction are obtained by the use [illegible] muffles filled with gas or superhea[illegible] steam. Atmosphere is not due to a[illegible] particular fuel or type of furnace, [illegible] depends entirely upon the air supply [illegible] a given fuel. Where the air supply [illegible] less than that theoretically required [illegible] combustion, so that the gases in [illegible] heating chamber carry no free air [illegible] contain a small percentage of fuel ga[illegible] reducing atmosphere is maintained.

*Presented at American Society for Steel Treating by the author who is connected with the W. S. Rockwell Co., New York.



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FACTORS GOVERNING PRODUCTION
of
HEATED PRODUCTS.

This chart should be kept for future reference as it contains information of real value.

Production facilities must be provided with regard to the manufacturing requirements and in harmony with the plant conditions. For a given quality of output, the heating, cooling and handling methods must meet the requirements of the process.

The application of heat is not an abstract question or one to be determined from a discussion of fuel values or combustion, nor is the heat balance a real test of the equipment. The application of heat is essentially one of dynamics for heat flow and the thermal condition around a mass to be heated is not determined by the temperature indication at one or more points in the furnace. The stress that has been laid on uniformity of temperature in the chamber leads to false conclusions inasmuch as the temperature at any particular point represents what might be termed a static condition, while fundamentally we are concerned with the transfer of energy and not the indication of temperature. The real condition governing the design of the heating chamber is that the heat be uniformly applied to and absorbed by the work.

Absorption of Heat.

Absorption of heat varies with the position of the material in the heating chamber, the location of the combustion chamber in relation to the heating chamber, or, in electric furnaces, to the position of the heating element in relation to the charge. Many electrically-heated furnaces, particularly those of the semi-arc or resistance type, function in the same way as a fuel-fired furnace. The product or material in the furnace is heated by conduction and radiation. The electric energy is used to heat the resistor, which in turn transmits the heat to the product by the atmosphere or by radiation. The laws governing the movement of the gases in the heating chamber are the same with either form of energy. With electricity as with fuels, the uniformity of heat throughout the chamber and uniform heating in the chamber do not necessarily go together, as the result is a function of design and operation and not something inherent in the energy itself. It may be said, however, that electric energy in some form of special equipment can accomplish results not possible with any form of fuel-fired furnace.

In one sense there is no absolute uniformity in the temperature of the gases in the heating chamber. From the time combustion is completed and until the gases leave the heating chamber, they are giving up heat, and at the same time, decreasing in temperature. This condition determines the position and design of inlet and outlet ports. Hot gases rise and must therefore be pulled down; cold gases fall and must therefore be pushed up. The high velocity of gases, due to a temperature difference, is not generally appreciated. It is evident that the heating conditions, when the chamber is empty, are very different from those existing when the chamber is full. In many cases the chamber is so overloaded that the flow of heat becomes essentially that through a series of flues, and consequently the placing of the charge should follow the fundamental requirement that a hot gas when cooling should go down; a cold gas when heating should go up, and this condition of flow be fixed by the location of the ports.

How to Reduce Rejections.

Most malleable iron annealing furnaces are packed too solidly and often times the rejections would be materially reduced by the use of a smaller charge placed with more open space between the saggers. In some periodic kiln operations, a virtue is made of necessity, due to improper application of heat, for instance, abrasive wheels are graded by their degree of burn due to their position in the kiln. The same defect in placing the charge is often observed in carbonizing furnaces and is aggravated by the relatively short time required for the carbonizing operation. There is no excuse for this practice in open chamber heating and from a pile of pieces in one charge, it is often possible to pick out two or three distinct degrees of heat.

The same considerations that govern absorption of heat by the work apply with equal force to the cooling or quenching of the work. Where the work is cooled by quenching the action may be much more drastic in its effect on the steel and therefore requires more refinement in the details of handling. Heat gives the structure, cooling fixes it. Heating should be slow and may be prolonged with less injury than where the heating is too fast. There is not the same flexibility in the cooling operation which must be performed with more precision in point of time. Heating and cooling may be more or less automatic through the mechanical handling of the work, and the same consideration of the effect of surface and mass upon the time and temperature should be given to the cooling or quenching process that is given to the heating.

As the size of the work increases, the difficulties of heat treating largely are those of handling the material. The mechanical handling of hot material gives rise to quite a different set of conditions to those met in handling cold material. Each definite range of temperature requires the development of a satisfactory method of handling. The methods of handling molten steel have been practically standardized for each particular process. The making of brass castings follows a common procedure. There are no standard methods in handling a heat treated product as each instance must be dealt with on the ba of fuel and furnace adapted to the wor In many ways, the difficulties of han ling the work are lessened when t transfer is made on a horizontal pla with little or no change in the worki level during the operation. Furnac used in connection with sheet rolli mills often have the hearth line at t same height as the roll. Forge furna have their hearth line at the level of t hammer or press dies.

Plant conditions not only affect t quality of the output but may mate ally affect the cost of a finished prod and should be considered in detail part of the production facilities.

In the location of a plant the cost land is seldom a determining fact Contour may be taken advantage of certain operations. Level ground hillside may have particular featu desired for certain processes. A diff ence in elevation may permit the co veying of material by gravity or aid t disposal of waste. Low undrained sp may be used as a dump for waste m terial.

The space available fixes the type construction and may lead to a one-st building or to a concentration in a hi story building. In a high story buildi the flow of product may be vertical, fr top down, instead of horizontal. In t manufacture of many lines of small me parts material received at the grou floor is raised to the upper floor a then progressively descends while bei processed until it is finally packed shipment at the same level on which was received.

Transportation Important.

Transportation is of importance a vitally so at the present time. Wh freight rates on different classes of co modities have a marked influence, th must be a general balance between r material and the market for the finish product, with power, fuel and oth items shifting the fulcrum of this b ance. Nearness to source of raw m terial and nearness to final mark should be considered. Nearness to s cial labor markets have settled spec trades in certain localities, for instan the brass industry in the Naugatu Valley. Fuel or power may be det mining factors as the cheap power velopment at Niagara, cheap fuel Pittsburgh, and water power in N England. In general, rail transpor tion is preferred to water for nearly purposes, as the latter is often inope tive for part of the year.

The general tendency is for a sm plant to locate in a city of suburbs. a large city, while the labor supply m be plentiful, it is apt to be inferior quality and unsteady. At the same ti such location usually offers the adv tages of fire and police protection, wa supply and sewarage. A location

tween two near cities is affected by the high labor turnover due to the general floating or drifting of labor from one city to the other. In general the tendency as the size of the plant increases is away from the city leading, in some cases, to an isolated industrial community.

The cycle of manufacturing operations may require that two or more departments be adjacent or in definite relation to each other, or it may require one or more passages of the work through one of the departments, as an annealing operation following successive machine operations. Layout requirements should, as far as possible, be in harmony with those conditions tending to reduce fire and accident hazard. Where possible operation should be continuous rather than intermittent and this is determined by the size of the furnace as well as by the process and the temperature required. The operation may be continuous, as that of a blast furnace, or an intermittent operation may be carried on continuously as in the open-hearth furnace or an intermittent operation as malleable iron annealing or burning ceramic ware where the charging, heating and cooling cycle may extend over a period of several days. One of these operations would be practicable on an eight-hour basis with a shutdown at night.

Since the furnace operation is but one of the sequence of the manufacturing operations, it follows that the furnace should be located in its proper point in the order of operations, although in general this sequence is due to the economics of handling rather than the particular geographical position, and the internal transportation system of a plant determines the relative position. The question of location is usually one of compromise or a balancing of alternates. Work is brought to and taken from the furnace. Its form may be the same or different as in a melting furnace or a cupola where solid raw material is charged and the charge in a liquid or molten state is transferred to another point.

Fuel is brought to the furnace and, in the case of solid fuel, ash or refuse is removed. Just how far it is desirable to locate the fuel supply in relation to the furnace, depends on the character of the fuel. Fuel oil, from its nature, is readily and cheaply distributed through a plant at small cost for pumps and pipe lines. Gas has similar advantages in distribution. Cold washed producer gas may be piped through a plant as required. Hot producer gas must be used comparatively near the generator. Energy in the form of electric current is very flexibly distributed. With solid fuel the cost of handling is large compared with the cost of the fuel. This tends to place the furnace in close proximity to the fuel supply.

In the grouping of furnaces, a single process leads to the simplest and most compact grouping. With several processes underway at the same time, an entirely different arrangement of floor space, different methods of handling and even different fuels may be required. The facilities for handling the fuel may require as much space as the furnace and the auxiliary equipment becomes a large item in the required floor space. An electric heating furnace may require a transformer that takes up more space than the furnace.

In general the sources of heat energy available for industrial purposes are those fuels provided by nature; coal, wood, oil and natural gas, or electric energy from the above fuels or from water power. Coal may be used in its raw state; it may be powdered, which changes its physical form but not its chemical form, or it may be gasified, changing its physical as well as its chemical form. Depending upon the method of gasification, coal is the basis of gases having widely different qualities ranging from producer gas with a low B.t.u. content per cubic foot through various mixtures of coal gas, producer gas or water gas under the general name of fuel gas. Coal gas in general has the highest B.t.u. value per cubic foot while blue water gas, intermediate in value between producer gas and coal gas, gives a higher temperature.

A fuel to be commercially available must have a form, value and price that will permit its use in the particular form most suitable for the purposes desired. The unit cost of gaseous fuel is much greater than that of the solid fuel from which it is obtained but due to its form value, the gaseous form permits a reduction in the net fuel cost per unit of product. Fuel is here considered simply a source of latent heat energy without taking account of its commodity value. The principles governing the application of heat and the factors entering into the result are the same in electric heating as with other fuel, and while the flow of electric energy is readily controlled it must be realized that this does not imply the same degree of control in the application of the heat produced.

Power Available.

The power available may influence the type of furnace and the method of handling the work through the furnace but in general the question of power concerns principally the operation of auxiliaries and continuous or intermittent demands for power will influence the choice. Electric and steam power are well adapted to continuous operation. Steam power, due to condensation, is not well adapted to an intermittent demand. Electric, air and hydraulic power are adapted to intermittent operation where the energy may be stored during certain parts of an operating cycle. Electric power is gradually superseding air and hydraulic power in steel mill practice.

In considering the human element, intelligence may be purchased but without skill has potential value only, skill may be required but without intelligence will accomplish indifferent results. Morale must be developed; labor has in a large measure lost that sense of fidelity and loyalty to the ideals of a trade that forms a basic morale. This question must be solved in each plant depending upon the type of organization, the distribution of responsibility and the sequence of authority are large factors in determining the most effective form of co-operation.

Recent and to some extent present conditions show that while the working conditions within the plant may be of the best, if the workman has no suitable place to live, his value as a producer is greatly diminished and the type of workman is directly reflected by his home surroundings. The cheap lodging house or bunk house under unsanitary conditions reduces the type of labor to that of the floater, unskilled, of low intelligence and often a menace morally as well as physically to the community. Sanitary conditions mean health, self-respect and increase in the morale. These conditions have been studied in connection with the "safety first" movement leading to a more technical study of occupational disability.

The following conditions are quite common in connection with furnace installations; high temperatures, humidity, noise, vibration, insufficient illumination, excessively bright or harmful industrial lights, vitiated fume or dust laden air. While heat is fundamentally apart of the subject considered, every effort should be made to lessen its ill effects and to prevent its radiation. To some extent this may be attained by the use of heavy, well insulated furnace construction, water-cooled or insulated doors, protective shields or screens and a natural circulation of air due to locating the furnaces away from walls and by placing them in the center of the building. Ventilation may be improved by a forced air blast directed from the walls and windows to the center of the building.

In connection with the application of heat in industrial furnaces, maintenance of structure and production requires considerable study. In order to reduce the shutdown or time that an appliance is out of service, it is desirable to use standardized units as far as possible, to keep sufficient spare parts on hand and to use standard material in construction. Simplicity of construction is the first requisite and in furnace work the use of standard brick shapes and the avoidance of special tile should be considered. The value of standardization

is not fully appreciated. For instance, a consulting engineer bought for export one each of three different makes of melting furnace.

Watch the Operator.

Fume, smoke, dust, dirt, etc., have a direct injurious effect in causing discomfort to the operator, decreasing the productive ability, and resulting in the general lowering of the resistance to disease. When these elements are ejected outside the plant, the surrounding neighborhood suffers injury. Fume and dust from certain chemical and metallurgical operations, smoke from furnaces or boiler plants, noise from hammer shop, have an injurious effect on the neighborhool and eventually affect its character, sometimes leading to a warfare in which the neighborhood or industry is a victim, the neighborhood is lowered in character or the plant moves.

Some of the conditions outlined above are controlled by restrictions. These restrictions may be legal as by municipal ordinance, state or federal enactment; or the result of a mutual contractual relationship as that with insurance companies; or the restrictions may be moral as imposed by the general civic sense or industrial conscience. Legal restrictions are most direct in their deterrent effect providing, as they do, a penalty for non-observance, at the same time they are very apt to be below the actual needs as indicated by public policy.

Accident and fire hazards may be minimized by the observance of accepted principles of safety engineering and may be covered in part by insurance governing the hazard peculiar to the use of certain forms of heat energy, such as the method of storage, the quantity stored, method of handling, and the way in which it is used. One of the older principles of fire protection was that fires cannot be prevented but they can be controlled and stopped; the newer idea is not only fire protection but more insistently fire prevention.

Failure of energy supply apart from accident, is due largely to transportation troubles and to labor troubles which may interrupt either production or transportation. Such interruption may be reasonably guarded against by providing proper storage. In some cases the user must provide for these contingencies while in others the producer does so by providing local storage. The exhaustion of one source of fuel may require a change to another fuel, or conservation may demand a seasonal distribution or restriction in favor of certain classes of users, as with the natural gas supply in Pittsburgh.

As furnace operations differ widely in the fuel and in the method of utilizing it, the capital cost or investment in any proposed combination of furnace and fuel should be carefully estimated as it may be found that the cost of furnaces with their auxiliary equipment and handling devices and the cost of fuel storage for any particular fuel does not give the return in earning capacity that another combination of equipment and fuel would give, or when the same floor space is devoted to productive use and the heat energy purchased. The amount of capital which may be tied up in this manner and the real estate occupied as well as the cost of operating a fuel storage plant, not only affects the cost of the fuel used but must be balanced against the potential possibility of utilizing the land and capital as well as a corresponding amount of expense in productive operations. In the same way the fixed charges on floor space, equipment and material must be considered in connection with the investment required and balanced against the potential earning capacity of a different combination of these items.

With a given quality of product and given production facilities, the cost of the finished product will result from the rate of production and the cost of operation. The rate of production will depend upon the output and the hours of operation per day or other unit of time. Output and rate of production will govern the selection of a furnace equipment, the method of heating, the method of handling and the method of cooling. These in turn are influenced by the efficiency of the operatives. There are no fixed standards to determine definitely the form of equipment or fuel to use. Both must be selected with regard to the manufacturing requirement and the plant conditions. Fuel and equipment should be selected for what it can do under specific conditions.

Definite Checks.

Output per unit of floor space per operative or per unit of fuel are definite checks on the manufacturing conditions. Cost per unit of fuel or per unit of output is not determinative, and the real question is: What does it cost to do things? which in this case is to produce a quality product at minimum cost. The cost of operation will depend not only on the cost of the raw material but should include that incidental to the process. The manufacturer does not control the price of fuel but he can to a great extent control the quantity used by the selection of a furnace and fuel adapted to his individual plant conditions. The amount of fuel used will depend on the design of furnace, nature of the operation, and the operation of the furnace. The design of the furnace has its greatest influence on the amount of fuel used in production while the nature of the operation largely influences the amount of fuel used in starting and stand-by operation.

In considering the fuel cost too much emphasis has been laid on the heat value of the fuel, its combustion and the generation of heat, and too little attention has been given to its proper utilization. Many absurd comparisons are made between different fuels, based merely on their heat content, but it should be noted that while a change in the form of energy increases the unit cost of the energy it does not necessarily increase the cost of the ultimate result sought. The ultimate cost is largely influenced by the method of utilizing the energy in its new form.

To reduce labor costs means necessarily increasing the productiveness of the worker. High wages may or may not tend to reduce labor cost; reduction of working hours may or may not reduce labor cost. Labor turnover is influenced largely by the location of the plant.

The use of power is usually considered as an expense. The power required in industrial heating operations is for the most part used in driving the auxiliaries and in handling the work to and from the furnace. Where furnaces are operated with the air for combustion applied by a power-driven unit, the cost of the power is often regarded as a unnecessary expense when compared with stack or natural draft. It will usually be found, however, that the better control of the heating operation both in time and uniform heating condition more than justifies the cost of the power used.

This same idea would hold in providing for the generous use of power in the operation of auxiliaries, in the reduction of manual labor and more particularly in handling the quenching medium. In many cases atmospheric cooling the quenching medium is sufficient to maintain the temperature within the required limits, while in other cases the volume of the output and rate of production requires the installation of a more effective cooling system, which in turn may mean a refrigerating plant. Charging and discharging machines, conveyors and quenching devices represent justified outlay for power.

Rejected Material.

Rejected material is not only a direct loss, represented by the raw material, labor, power and fuel costs, but reduces the productive capacity of a plant. Rejected material may be due to defective raw material; sometimes to poor design where the piece is ill-adapted to the treatment proposed, that is while the piece may be treated individually with fair success, by its shape or form it does not lend itself to mass production.

Imperfect heating, due to an overloaded furnace or to improper preliminary or previous treatment, is a common cause for rejected material. The barbarities of the forge shop sometimes

(Continued on page 81)

A Multiple Gear Shaper of Interesting Design

The Stevenson Gear Company, of Indianapolis, Indiana, have recently developed a new and improved type of gear cutting machine known as the Stevenson Multiple Shaper. This machine differs from the usual type of gear cutting machines in that it cuts all or a multiple number of teeth in a gear or similar product at one operation

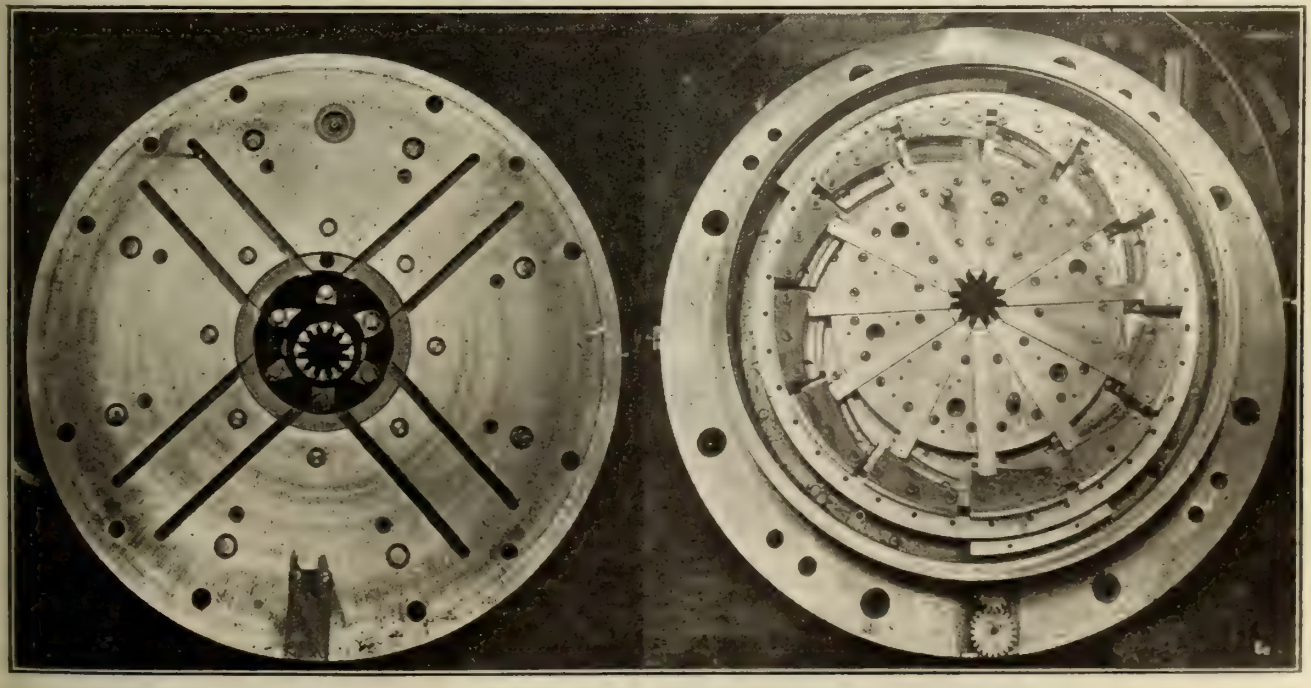
The essential member of the machine is a special tool head which consists primarily of a series of radially disposed tools spaced about the circumference of the blank to be cut. The machine operates in the same manner as an ordinary vertical shaper, except that the tools are held stationary and the gear blank is reciprocated past the tools. The mechanism consists essentially of a ram carrying a blank supporting arbor and the multiple tooled head for operating upon the blank. The frame of the machine is a casting of rectangular box section with a vertical cylindrical portion at one end. The ram is mounted in the center of the cylindrical part of the frame, and the tool head is mounted above the ram at the top of this portion. The crank shaft which drives the ram is journaled near the top of the rectangular section and is provided with an adjustable crank head at the end next to the ram and is driven through rack gears by an individual electric motor. The arbor which carries the gear blanks is not made solid with the ram but fits in a socket in a spindle which is journaled inside the ram and is free to rotate independently of the reciprocating motion imparted to it by the ram. An intermittent indexing movement is imparted to the spindle after each cutting stroke by an intermittent gear train. The machine is seven feet high, weighs 17,000 pounds and when operating to full capacity is driven by a 100 H.P. motor. Its capacity is for gears 12 inches in diameter, 6 inch face, 4 diametral pitch.

Tool Head.

The tool head consists of a flat, steel disc 3 feet in diameter, provided with a hole at the center and a number of radial grooves cut in its face in which the tool bits are arranged like the spokes of a wheel about the circumference of the gear. Successive feeding movements are imparted to the tools by an annular sectional cam ring. As the gear blank is reciprocated past the cutting tools, the tools are gradually fed in by successive cuts to the full depth of the tooth. At the completion of each stroke of the ram and before the next cut begins, the gear blank is indexed a space equal to one tooth, thereby presenting a different tool to each tooth from the one which made the previous cut. After the tools have been fed in to full depth, they are held stationary in that position while the cutting process continues until the gear has indexed one complete revolution, thereby giving each tool an opportunity to take one last cut on each tooth. This final complete index insures a uniformity of spacing of the teeth in the gear equal to that of the indexing mechanism. Uniformity of the tooth form is secured even though the tools themselves may be far from uniform for it is at once apparent that if any tool is longer or wider than any other tool, even though it be only a thousandth of an inch, that portion of it which is longer or wider will take one last cut on the corresponding portion of each tooth in the gear, thereby eliminating any variation which may have been caused by previous cuts. By this process of finishing all the teeth of a gear with a single finishing tool, the machine is said to attain great accuracy and the speed is multiplied by the number of tools operating on the gear blank at one time.

To technical men the most interesting individual mechanism on this machine is the tool head, as it involves the solution of the most interesting and important problems, both in design and construction. In the three illustrations of the tool head, Fig. 1 is a top view of the tool head as it would appear when in operation on the machine. Fig. 2 shows the tool head partly disassembled and shows the principal details of the mechanism. When it is mounted on the machine, the only working parts to be seen are the points of the tool bits

(Continued on page 81)



Two views showing details of tool head of gear shaper



WHAT OUR READERS THINK AND DO



HARDENING DROP FORGING DIES.

By P. W. PEEL.

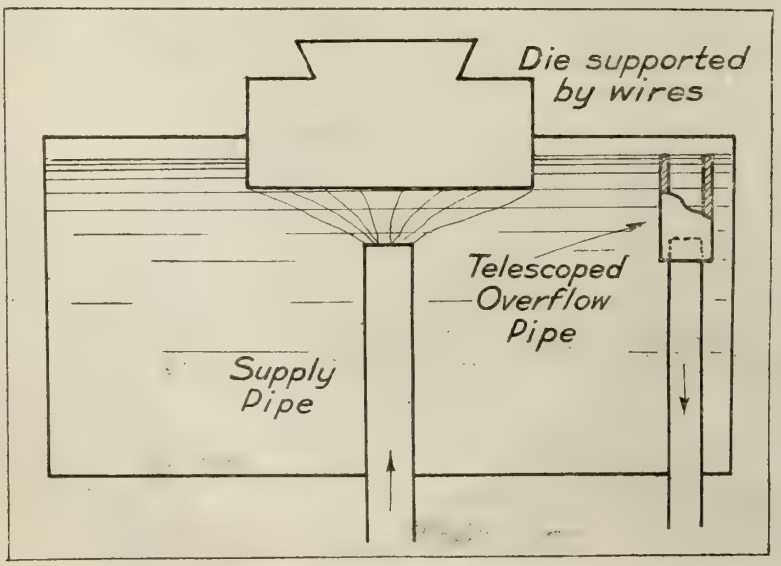
When hardening drop forging dies, it is very essential that some type of furnace which heats evenly be used. Do not heat too fast or the corners and light sections will be overheated and weakened.

If large pieces of steel are placed in a furnace and allowed to remain exposed to the direct heat and to the air therein, their surfaces are likely to become oxidised. Since the faces and walls of the impressions must be hardened, it is desirable to afford protection to them. This is sometimes done by placing a quantity of granulated charcoal in the furnace on the hearth and laying the die face downward. A more satisfactory method however, consists in placing one or two inches of granulated, charred leather in the bottom of a shallow hardening box and laying the face of the die on the leather, the box being packed with leather. The die may then remain in the furnace until it is uniformly heated throughout; the corners at the base of the tang of die being filled with fine clay to prevent unequal heating. In this connection I cannot too strongly emphasize the necessity for making accurate pyrometric observations, not to ascertain furnace temperature, but to check the material under treatment.

The form of bath depends on the character of the pieces to be hardened, one satisfactory form being shown in the accompanying sketch, having the die resting upon supporting wires. The overflow pipe should be telescoped, thus enabling the operator to regulate the depth of water in the tank. To obviate tang distortion it is advisable to quench this portion first; the same being accomplished by fixing the die on the wires, tang down, and allowing the water supply to play thereon. The die should be left in this position until the tang is cooled below a red heat, then being turned and the supply stream played against the face until cooled.

To prevent the tang from softening before the face becomes hard, turn water by means of a dipper, on to the tang until red has disappeared from the face then cease pouring on to the tang and allow heat to work from the centre of the block up through the tang, which will in all probability be reheated to low red. After the block has cooled should be placed over a fire and re-heated to remove hardening strains.

At times it is necessary to harden die having slender projections or some weak portion which is likely to crack during the process, cracking resulting from unequal contraction which can be avoided by rubbing soap on the projection, more especially at the junction the die.



Showing method of hardening the dies.

IDEAS WANTED.

We are particularly desirous of obtaining for this section of our journal, short instructive ideas. These can cover any phase of machine shop practice and should be illustrated if possible by a sketch of the idea being described.

If you are unable to make a neat sketch, do not let that stop you. Draw the idea as best you can, send it in to us and we will finish it up for you. For all accepted material we pay a good rate, so that not only do you help some one else by passing along the idea, but you benefit yourself as well.

This section should be a regular exchange of ideas. Surely Canadian mechanics have many schemes that have saved them both time and money. Send them to the Editor of Canadian Machinery, 143 University Ave., Toronto, Canada. Don't be a once in a while contributor. Become a regular. You'll find it pays.

SPEEDING UP SHOP TRUCKS.

To reach certain overhead stora racks at the plant of the Richards W cox Manufacturing Company, it w necessary to employ a short ladd which, if left where it was used—a this often happened—blocked an ais

This difficulty, continues "Factor was met by hinging the top of the l der to the framework of the overhe rack and attaching the bottom of t ladder to a weighted rope passi through an overhead pulley. If a tr is brought past while the ladder is use, it is a simple matter for the tr operator to release the counterwei so the ladder will rise up out of the w The worker using the ladder revol it to position when he is ready. Wh not in use the ladder is always held out of the way.

3225. **Corrugated Iron Sheets.** Liverpool firm desire catalogues, prices of corrugated iron sheets, gauges from 24 to 32, size 6 feet b feet by 8/3 inches, for export to Gold Coast, West Africa.



DEVELOPMENTS IN SHOP EQUIPMENT



MARKING MACHINE.

Noble & Westbrooke Mfg. Co., Hartford, Conn., have recently placed a machine on the market which is said to perform graduating operations with speed and accuracy. Hand and power feed machines are both made and on the power-driven machine; the loading and removing of pieces of work on the machine are the only duties required by the operator. With the hand machine, one turn of the handle completes the work. Provision is made for holding the work in the proper relation to the graduating die, and the depth of the marking is governed by means of a foot-lever cam, and weight, which are governed by a positive stop that is adjustable to provide for making any desired depth of lines. This insures making even and accurate impressions.

The machine is equipped with steel spindles, adjustable bearings, and is fully automatic in operation, being stopped by means of a clutch on the spindle which drives the marking die. Practically all types of modern machine tools are equipped with micrometer adjustments, and this machine is well adapted for the graduation of the dials used on micrometer adjusting screws; it is also adapted for graduating and numbering cross-slides and compound rests for lathes.The graduating and numbering are completed in one operation. This company also furnishes the full equipment for these machines, including the engraved steel marking dies.

ADJUSTABLE SHELL REAMER

The Cleveland Cutter and Reamer Company, of Cleveland, Ohio, has placed on the market a new type of inserted-tooth adjustable shell reamer, where the backs of the blades are provided with serrugations placed at an angle and fitting corresponding grooves in the slots in the body. The construction permits of a double adjustment, the lock nuts providing an adjustment of 0.083 inch, while moving from one corrugation to the other provides a similar adjustment, and this action of sizing can be continued until the blades are worn out. The reamers can be furnished either with straight or helical placed blades. The standard sizes range from one to six inches in diameter, but any size may be made for special requirements.

SURFACING MACHINE

The Peerless Surfacing Machine Company, of Troy, New York, has developed what will be known as the "Junior" surfacing machine, which will be used for the surfacing of small work. The abrasive belt is carried on two small pulleys located in a swinging bracket at one side of the machine. This arm can be clamped in any desired position, and likewise the rest for carrying the work. The machine is of the bench type and may be transported to any part of the shop and mounted in different ways. It may be driven direct by motor or by using a countershaft. The opposite end of the machine spindle may be utilized for a small grinding wheel or disc plate. The machine is adaptable to a large variety of work.

MILLING AND GRINDING ATTACHMENT

A combination milling and grinding attachment has recently been placed on the market by the A. F. Robbins Company, of Waltham, Mass. It is especially adapted for use on small lathes for milling or grinding operations without removing the work from the machine. The base attaches to the tool rest of the lathe and the head can be swung to any angle by means of a swivel bolt in the centre and secured by means of a quick acting clamp. A graduated circle facilitates locating. The spindle bracket may be adjusted horizontally on a vertical slide and may be set very accurately to thousandths of an inch. By the use of different spindles the range of operations is very large. Provision is also made for supporting the outer end of the arbor when desired.

3226. Saws.—A Liverpool firm desire catalogues and prices of pit saws complete with fittings 6 feet, 7 feet, and 8 feet. and cross-cut saws of the same size, for export to the Gold Coast, West Africa.

LEADING ARTICLES IN THIS ISSUE

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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J. H. MOORE, Technical Editor
T. H. FENNER, Associate Editor
J. H. RODGERS, Montreal Editor



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Investigating Heating Furnaces

THE University of Illinois, which has done some valuable work through the medium of its Engineering Experiment Station, is now engaged on an investigation of the hot air furnace and system of heating. This is being carried out in co-operation with the National Warm Air Heating and Ventilating Association, and should be productive of good results. In order that the results obtained from the experiments should be of use in practical problems, a plant has been built which operates under the exact conditions found in the ordinary hot air heating installation. The objects of the experiments are to determine a proper method of rating hot air furnaces, so that the proper size of furnace can be definitely selected for the service required, to determine methods of increasing the efficiency and capacity of furnace heating equipment, and generally to determine all unknown factors in connection with this type of heating plant.

There is no country in the world where more interest should be taken in domestic heating plants than in Canada, where they are very much in evidence for the greater part of the year, and where the house holder has to go deep into his bank account every year, to purchase indifferent coal which he feeds to an inefficient furnace. Then if the weather gets really cold with a high wind he shivers anyway. We have never been in a house in this country in the middle of winter yet that was comfortable, and whether this was due to the bad building or the poor heating system, or both, the effect was the same.

Most hot air furnaces are put into houses in a happy-go-lucky spirit, and very often they are cut down by the contractor as small as he possibly can, in order to save a bit more money. The actual requirements from a scientific point of view we do not believe are ever considered. The result is a gross waste of fuel, without any degree of comfort, and if the experiments now going on can determine an absolutely correct way of determining the capacity of furnace required, and also a method of rating which will ensure the purchaser getting that capacity, the benefit to the people in general will be enormous. If in addition to this, the most efficient way of carrying piping from basement to rooms, the correct position of register, and the right type of insulation are determined, there will be a large saving in fuel consumption, and the money thus saved to the country will be available for investment in Canada, instead of being eaten up by U. S. exchange and freight charges.

The house heating plant in its individual capacity may not look much, but multiplied by the hundreds of thousands of families that use them, it is an exceedingly large factor in the country's expenditure. When we consider that of the money spent thus for fuel, the householder gets probably 20 per cent. of its value in heat, he should be interested in anything that tends to improve matters along these lines.

A Vision Worth While

THE WORLD is used to turning to the United States for stupendous undertakings, and not in vain, for while they do not always get the best, yet they usually have the biggest of everything. In another part of this issue will be found an account of the mammoth bridge which is being erected across the River Hudson, to form a great artery of commerce between the states of New York and New Jersey. The bridge like other bridges over the Hudson and East Rivers will be of the suspended type. It would no doubt interest greatly some of the ancient bridge builders of the far east, who in the dawn of the world swung their gossamer like structures on fibre cables over the gorges of the Himalayas, for they would see a structure, surpassing in dimensions anything that their wildest vision could have conjured up, and yet based on the principle that they themselves had used.

We say surpassing anything their vision could conjure, but it is by virtue of that very vision that all these modern wonders have been made a possibility. The bridge builder challenged by the necessity of the times, and aided by the scientist who with infinite patience pursued the jealously guarded secrets of nature, saw in his mind's eye something larger than had ever been attempted, and with confidence in his ability and the material he had to work with, proceeded to make his vision a material fact. So from the crazy fibre bridge swinging above the abyss, and capable of supporting but one person at a time, we have come to the bridge that can carry foot passengers, wheeled vehicles, street cars, and railway trains with perfect safety. Each great bridge as it has been projected, has been a source of wonder to its generation. The Tay Bridge, the Forth Bridge, the first Brooklyn Bridge and latterly the Quebec Bridge with its tragic history, have all caused those of little faith and less vision to remark "it can't be done."

Science , the handmaiden of industry, goes quietly on with her appointed task, and makes available better and better materials, which give added strength with less weight, and make it possible for the builder to plan bigger and bigger things . It is all a matter of vision. The scientist, who projects his mind into the abstract; the engineer who takes the result of the scientist's researches and applies them to practical use, and the capitalist, who from his faith in the engineer and scientist, gathers together the gold to make these visions possible, knowing well that though he stands for great reward he may well stand to lose all. So science, industry, and capital go forward hand in hand, linking up town and country state and nation till the day will come when all the world will be joined up with such arteries that the farthest points apart will be reckoned not in weeks, or days, but in hours.



MARKET DEVELOPMENTS



Buyers Keep Up Bombardment for Lower Prices

Machine Tool Business is Dull—Several Reductions Are Made in Price of Small Tools—Dealers Are Sometimes Selling Below What It Costs to Stock Material in First Place.

MARKET conditions are not undergoing any marked changes. Business in machine tools is dull and dealers are not afraid to admit it—but then it's summer, and business was never any too good at this season. Nearly all dealers are receiving notices from their principals that there are reductions being made in the prices, and some makers of foundry equipment are out with new prices.

There have been several reductions in the prices of small tools recently. High speed reamers are down about 20 per cent, while milling cutters have suffered a reduction of 10 per cent. High speed drills are also down, the decrease being all the way from 10 per cent on the smaller sizes up to 30 per cent. on the larger drills. Carbon drills are now selling at 50 per cent. off list.

Pittsburgh reports that the increase in demand upon the steel mills has spread during the past week. The improvement started with sheets and has spread to other lines. Further improvement is looked for, but nothing of a sensational character.

The wages of common labor among the independents has come down to the 30 per cent. rate. In fact in the east it is down in some cases to 25 and 27 cents. The steel corporation is still paying the 37 cent rate.

The scrap market situation is about as bad as it ever will be. In some districts low stocks point toward an early improvement but the old policy of buying for immediate requirements continues.

Several independents are openly quoting 1.75c on bars and 1.85c on shapes, and plates instead of quoting such prices as representing a special concession to a particular buyer. Wire products and standard steel pipe are quite well held at prices which developed early in July.

STEEL INDUSTRY IS NOW RECOVERING FROM SEVEREST PART OF DEPRESSION

Special to CANADIAN MACHINERY.

PITTSBURGH, August 4—The increase in demand upon the steel mills, noted first in the report of two weeks ago, has spread in the past week. The improvement began with sheets, which have shown the most marked increase in mill demand, and has clearly extended to merchant bars and tubular products, while there is some increase in other lines. In no steel mill product has there been any decrease in demand in the past fortnight.

It would be quite unsafe to base any high hopes on the improvement that has begun, even though the improvement is practically certain to proceed farther in the next few weeks. The point is that this is not a broadening in the ultimate consumption of steel, but is in the direction of demand upon the steel mills returning towards a normal relation with the actual ultimate consumption. Of late the demand on the mills has been subnormal, by reason of the existence of stocks which the holders desired to liquidate. These stocks were of steel in the hands of jobbers and manufacturing consumers and manufactured wares of various sorts in the hands of manufacturing consumers, hardware, machinery, cutlery, tools, agricultural implements, etc. Demand upon the mills was at one time less than 20 per cent of capacity, perhaps only about 15 per cent, and it is obvious that even in times of lowest industrial activity the requirements in steel could not run at so low a rate. To illustrate the point, freight ton-mileage movement on the railroads, which is certainly an index of general industrial activity, has been running only a few per cent below the rate in the best year before the war, whereas if steel demand were 20 per cent of the present capacity, and it has been less than that, it would represent less than one-third of the steel output in the period from which freight movement shows only a few per cent falling off.

Again, debits to depositors' accounts at banks, volume of business in the country, have been running only about 20 to 30 per cent below the amounts a year ago, while steel production lately has shrunk by about three-fourths, being only about one-fourth as great.

The Process of Liquidation

What is occurring now in demand upon the steel mills is a recovery from the extreme stagnation caused by the necessity of buyers reducing their stocks. They are not reducing to normal, and indeed they are probably below their normal average already. They are trying to reduce to nothing, to get to a position where they will distribute or fabricate steel as fast as they receive it from mills.

Steel mill operations are now about 20 per cent of capacity. When the demand on the mills catches up with the flow of steel and manufactures of steel into consumption the rate will be, perhaps, 40 or 50 per cent. This would occur without there being any improvement in business generally, without the volume of construction work increasing, and without railroad buying increasing. Those things represent favorable developments that will come some time, perhaps soon. Possibly there will not be much improvement in those respects before next spring. The majority of men seem to think next spring is about the best time to predict. But the steel industry is now recovering from the severest part of its depression.

The character of the business being placed, when scrutinized in detail, bears out the above analysis, and indicates that it is entirely reasonable to expect continued improvement, though at a very moderate pace. Practically all the business received, in the form of strictly new orders and in specifications against contracts, the latter being the form in which the Steel Corporation now gets most of its shipping orders, is for the quickest shipment possible, and the mills are showing a remarkable showing in this respect, often shipping an order a day or two after its receipt. The specifications are quite miscellaneous in

many cases, indicating that buyers wish to piece out with remaining stocks they have.

Steel Prices

The buying does not represent "confidence" in the steel market on the part of buyers. It represents confidence that they can distribute the steel ordered, or manufacture it and distribute the wares made from it, and get their money before anything serious happens in the matter of prices. Men are not buying ahead, but are buying against the business they know they can put through and complete. Confidence in the future of prices is not needed. The buyers may expect lower prices in future, and in fact most of them do, and if prices decline some more then the next order or the order after the next will be at the lower prices.

However, if steel prices are going to decline in future, they will not decline as rapidly in the next few weeks as they have in the past few weeks. The pace of decline will be reduced. Very roughly speaking, it may be said that steel prices on a general average have been going down at the rate of less than a dollar a ton a week, and that is nothing for buyers to be afraid of when they are simply doing prompt business. There will be no "breaks" in steel prices. The market is too soft to break, and there is not enough room left.

Several independents are openly quoting 1.75c on bars and 1.85c on shapes and plates instead of quoting such prices as representing a special concession to a particular buyer. The decline from prices announced a month ago is $3 per ton. Black sheets are down $5 a ton in the month to 3.25c, and galvanized the same amount to 4.25c. In all these products a particularly attractive order would probably draw a special concession but only a small one compared with the way mills have shaded the nominal prices in the past few months. Wire products and standard steel pipe are quite well held at prices developed early in July.

Wages

Practically the last of the independent steel mills have now come down to the 30-cent rate for common labor, a rate that appeared at some mills weeks ago, while in the east lower rates, down to 27, and even 25 cents or even less, are being paid, the east having been in the habit of paying somewhat lower rates than the central west in times of stress. The Steel Corporation is now alone in paying the 37-cent rate. The top rate was 46 cents, and that was with time and a half for hours over eight, the overtime payments having at one time or another been discontinued by all mills. The Steel Corporation may reduce in the near future. Effective at the beginning of this week, the Corporation has made its second wage reduction in the Connellsville coke region, the first having been May 16. The new rates are above the independent scale as further reduced July 1.

The valley pig iron market has made a record in the past week, by showing no decline, but possibly that was due to no business being offered. The valley market is quotable at $20.50 for Bessemer, $19 for basic and $19.50 for foundry, f. o.b. valley furnaces. The transportation cost of assembling the raw materials to make a ton of pig, which is coke, ore and limestone, is more than $10, when it was a trifle under $5 before the war. Hence the furnaces insist that freight rates must come down.

POINTS IN WEEK'S MARKETING NOTES

In the iron and steel trades there still exists the hope that things will improve shortly. This in spite of the fact that the last week witnessed a further drop in prices. Many say that the bottom has been reached, and that although no immediate change can be looked for, the market is sure to improve rather than decline further.

Foundry activities are increasing the enquiries for coke. Prices in this commodity have not changed much, and the volume of actual business is not sufficiently large to speak of. Many foundries are inclined to buy on a spot basis rather than on a contract, this holding especially true on the Buffalo market.

Prices on bolts and nuts are very unsettled. The desire to sell is greater than the desire to buy, this causing frequent shading of prices in order to land business. In spite of the recent reduction on steel bars, makers do not seem inclined to make a further formal price reduction, saying that the present steel bar prices were fully anticipated in the reductions that had been made on bolts and nuts.

The demand upon the steel mills has spread within the past week at Pittsburgh. This improvement began with sheets, and has spread to merchant bars and tubular products, although there is a slight increase in other lines. It is expected that this movement will become better as time goes on.

Several independents are openly quoting 1.75c on bars and 1.85c on shapes and plates, instead of quoting such prices as representing a special concession to a particular buyer. The decline from prices announced a month ago is $3 per ton. Black sheets are down $5 a ton in the month to $3.25, and galvanized the same amount to $4.25. Even at these prices, a particularly attractive order would probably draw out a special concession.

Practically all the independents are now paying the 30 cent rate for common labor. In the east as low as 27 and 25 cents is being paid. The steel corporation is now alone in the 37 cent rate.

Pig Iron Market

Some sellers report a slight improvement in the pig iron market in Chicago. Such business however is mostly confined to carload lots.

The hand to mouth policy of buying is beginning to make itself felt in the New York Market. Foundrymen are experiencing some difficulty in obtaining material as promptly as they require it, owing to reduced production and depleted stocks. Dealers expect a buying movement in the near future, although heavy buying is not looked for. Inquiries are more numerous at present, and it looks as if the turn has been reached.

There is a feeling of optimism in the Buffalo market. Again it is a depletion of stocks, that causes the change, and in this case it is expected that one combination will blow in a furnace shortly. If they don't they will have to buy iron elsewhere, and such a step is not looked for yet. The present prices are by no means attractive, and this fact alone makes the above step seem sure. The necessity of filling orders on old contracts has practically forced one producer out of the market so far as new business is concerned. Taken in all there is cause for the belief that things will be better in the district.

Cleveland thinks that prices, as they exist at present, cannot possibly go lower. Some of the furnaces in the district state that $20 for foundry iron is as low as it will go at present. The volume of business being done is very light and whenever orders do come in they are for immediate needs only.

Scrap Metal Market

In Pittsburgh no material change can be reported. If anything, the market is somewhat firmer, and this is said to be due to the tendency of railroads and other producers to hold rather than sell at the present low prices.

A few deals of decent proportions are recorded in Chicago, and the various railroads are offering a fair amount of material for sale, although the market as a whole cannot be said to be brisk. The prices still remain low and lack of confidence in the present quotations seems to be holding buyers out of the market.

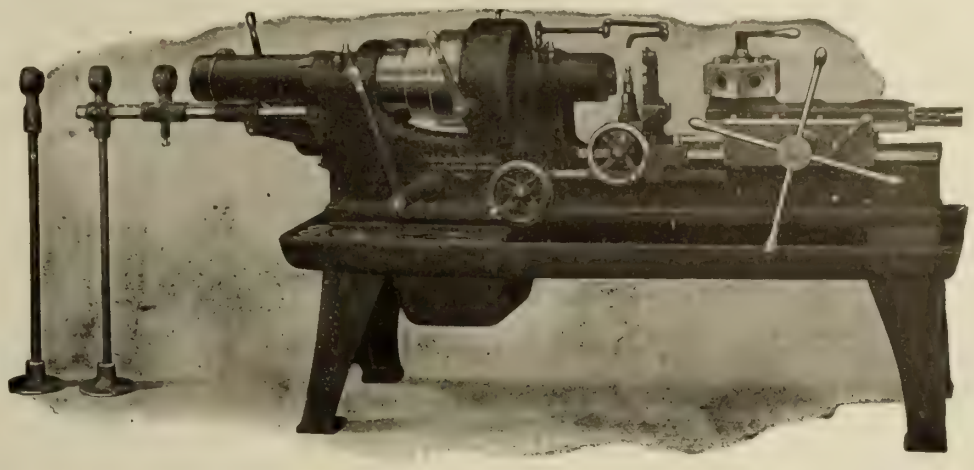
In New York, the dealers believe that prices have reached the low mark, and will stay there for some little time. No further drop is expected, and apart from one or two half decent orders the market moves along in the slow fashion it has been accustomed to for some time past.

It is not expected that the demand for scrap will improve in Buffalo for some time as a large majority of foundries have sufficient material on hand to supply their requirements for at least a month or two. Prices are being shaded somewhat by yard interests in the hopes of stimulating interest.

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For large output and close limits—If you are figuring on screw machine work you can depend on W. & S. machines being right for the job.

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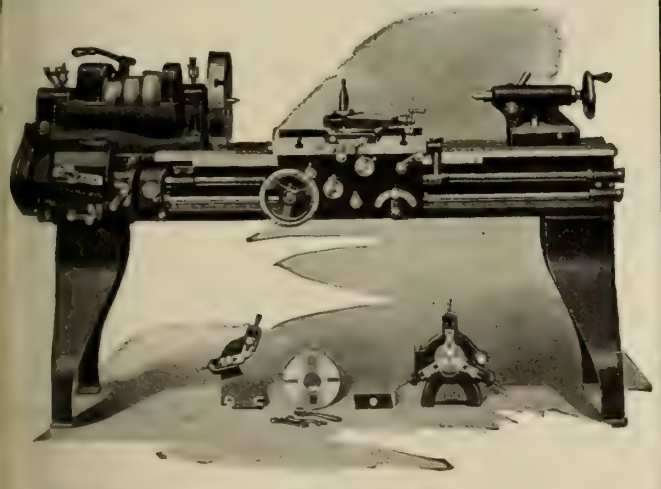


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Buying a Pig in a Poke

The buying of advertising space used to be buying "a pig in a poke." The quantity and quality of circulation was shrouded in mystery and often the bag was tied against investigation.

That day has passed. The advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has untied the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

In buying advertising space in the Canadian Machinery you are not buying "a pig in a poke." Our A. B. C. statements will stand the analysis of the most exacting investigator.

BUYERS ARE VERY MUCH IN CONTROL OF MARKET IN TORONTO STEEL TRADE

Special to CANADIAN MACHINERY.

TORONTO—The summer season was never famous as a time to sell machine tools, nor is this summer any exception to the rule. Dealers admit that business is dull, but at the same time they admit they are selling a few tools here and there.

But there are none of the large sales being made that the dealers like to get hold of. Existing plants are not making extensions to their plants or equipment, nor are there any new firms that are outfitting plants with a view to going into the manufacture of some new article.

It might be thought that under such circumstances there would be a number of failures, and that a number of plants would be thrown on the market for disposal. Such is not the case, however, and when Canadian Machinery inquired regarding this, the manager of one of the largest firms handling used and rebuilt equipment answered that his firm had taken in only one plant during recent months. "One might imagine that in such a season there would be quite a lot of material offering in the way of used equipment, but it speaks pretty well for the standing of these places that there should be practically nothing to indicate that there are shops at the point where they have to shut the doors and dispose of any portion of their equipment."

Most of the dealers are getting notices from their principals that there are reductions being made in the prices of machine tools of various sorts. Some makers of foundry equipment are out at present with new prices, and one maker of drills also sent notice this week of a reduction. Makers are apparently convinced that reductions will not bring them any business, and these new prices are put out as feelers. Of course many of the makers state that their manufacturing costs are less now, and they are able to offer a better price, but lower costs must be more than offset by the fact that there are very few machines being made, and the overhead assessed to each one must necessarily be high as a result.

The Small Tool Market

One of the dealers spoke a very trite thing in regard to prices this week when he admitted "if there were only more business being done there might be more cutting of prices."

There have been several reductions in the prices of small tools in recent weeks. High speed reamers, for instance, have come down about twenty per cent, while milling cutters suffered a reduction of ten per cent. High speed drills are also down, the decrease being all the way from 10 per cent on the smaller sizes up to 30 per cent on the higher sizes, which sell the least.

Carbon drills are now selling at fifty per cent off the list. The firms making drills are anxious to secure orders, and are making concessions to induce the should-be large user to come in now and place business during the slack weeks.

One firm that we heard of got very fair treatment in an unusual case. The company sent out inquiries for several special sizes in fairly large lots, and the prices they received were quite favorable owing to the quantities named in the first place. When it came to actually placing the business the buyer specified against only about one-third the quantity on which the price had been named. He explained that his appropriation had been cut and that he had acted fairly all the way through. The price was allowed to stand on the smaller amounts.

The average order that comes to the dealer in small tools today is a small affair, and the man who is buying is very much in need before he places his orders and so wants to get delivery quickly. It means that the dealer must keep up a very well assorted stock in order to get his share of the small volume of business that is moving.

The Steel Market Slow

Dealers would like to know when the end of the period of liquidation is going to come in their line of business. The United States market is very much disturbed at the moment, and no price schedule seems to posses sufficient stability to withstand the onslaughts of the competitors, or of those who are out to get rid of a lot of material for which they have no further use.

One dealer, who buys a lot in the U. S. market explained that there were such a large number of building programmes being abandoned that stores were being put on the market in order that realization might be made at some price. In this way there are always bargains to be had, and no steel company could hope to meet these prices and stay in business for any length of time.

Selling Very Low Yet

One hears of cases where Toronto dealers are still selling well below what it cost them to stock the material in the first place. As far as we can learn, stocks in local warehouses are being brought down very satisfactorily, and merchants have so far been able to accept their losses safely. Even at best, it is a poor way of doing business, and dealers here realize that the liquidation price, if it continues long enough, is sure to have an effect on the permanent price whenever the market gets in a mood to have such a standard.

Then the purchaser is keeping up a constant bombardment of the market in a quest for lower and still lower prices. Some of the items on which quotations are asked are rather amusing. Apparently there is no limit to the size of an order that is sent the rounds of the dealers in order to secure a figure. Items that in ordinary times would never be subject to quotations are now marched along to the market and loaded up with prices and terms.

All this tends to make it harder for steel merchants to get going along sound business lines.

Then the actual orders that are placed are very small. Boiler tubes are sold in very small lots, plate is not much in demand, while sheets are not moving much better even at the new prices. Some of the dealers profess to have very little confidence in the present sheet market. "There has been too much of a spread between bars and sheets in the past," stated one Toronto dealer, "and I believe that there will be a narrowing down of this gap. There was a great deal of sheet capacity brought into existence in United States during the last two years, and a lot of that must go down. These people are after business, and the thing they are doing is to cut, and they are cutting away the margin between sheets and bars."

Some Orders Coming

Some of the mill representatives are not at all disappointed over the business they are doing. A fair tonnage is going through, and it is pretty well assorted, although the automobile industries are still buying pretty close to their actual needs, and very often in much smaller quantities than usual.

There is a tendency in the steel market to express regret at the attitude of the building trades to take any less pay than they received before. The trade seemed to be of the belief that even yet there might be time to get structural work under way for winter finishing if there were some concessions made.

In the Scrap Market

"All the worst things you have ever said about the scrap market are still true," was the statement of the leading scrap metal yard this week. "There is hardly any business at all, and any concern that is staying in during this period must be pretty well backed. I believe that fully 75 per cent of the dealers are out of business. Many of the smaller ones believe that it is better for them to get out entirely until things take a turn for the better, and no doubt a good many of them will come back when the turn comes. So far, we can see nothing in sight to indicate that there is anything better in store."

Trade Gossip

The John Bertram & Sons Co. Limited, and Pratt & Whitney Co. of Canada Limited, are closing their plants for two weeks vacation from the 30th of July. Correspondence will be given attention, and orders for goods in stock will be shipped during the vacation period.

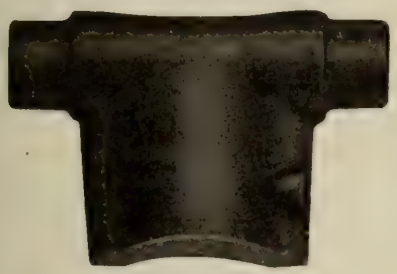
The policy of closing plants for summer vacation has been tried out in some large plants in the United States, and some Canadian Companies are making the experiment this summer, and if it proves satisfactory, it will, no doubt, be acted upon annually hereafter.

GEO MET RIC

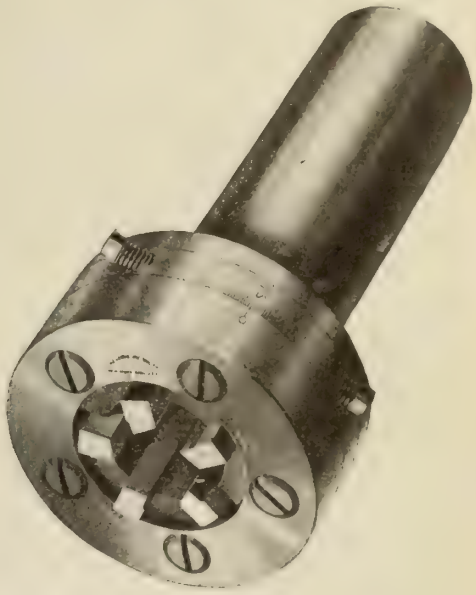
Right on the Lead

2,000 A DAY

$\frac{1}{16}$" TURNED DOWN ON 2,000 DROP FORGINGS WITH A GEOMETRIC ADJUSTABLE HOLLOW MILLING TOOL







There is an extensive quantity of milling that is done with great economy by the use of GEOMETRIC ADJUSTABLE HOLLOW MILLING TOOLS.

Like all other Geometric Tools, the Hollow Mill is regarded as superior at home and abroad. A Sydney (New South Wales) man volunteers the good information that he has used different styles of GEOMETRIC DIE HEADS and GEOMETRIC HOLLOW MILLS quite a lot, and after cutting threads under all sorts of conditions with all sorts of methods on his side of the world and in England, he has arrived at the conclusion that the GEOMETRIC WAY CANNOT BE EQUALLED.

The Geometric Hollow Mills provide an efficient and economical method of reducing duplicate parts to an exact diameter prior to threading and for brass finishing.

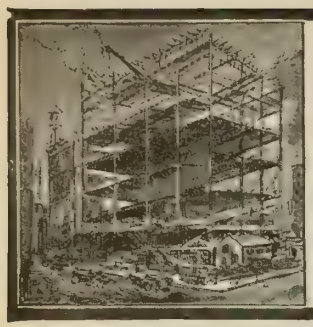
Send for the Geometric Adjustable Hollow Milling Tool Booklet if you are interested, for it tells what these tools are doing.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto; St. John, N.B.; Halifax, N.S.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



HUDSON RIVER BRIDGE WILL BE LARGEST STRUCTURE IN THE WORLD

WHEN completed, the Hudson River Bridge will be the wonder of America, as far as bridges are concerned. Here are some of the more important features and figures in connection with it.

The main outlines of the bridge, as at present determined, call for a total length from anchorage to anchorage of 6,660 ft, this to be divided into two shore spans each 1,710 ft. long, with a central span across the river of 3,240 ft. Including the anchorages the length is 7,460 ft.

A roadway 220 ft wide, will be suspended from four steel cables, each consisting of 80 lines of eyebass arranged in three banks and enclosed in a watertight tubular casing of bronze plating; the diameter of this being 15 ft. The upper deck of the bridge will have a roadway for automobiles and motor trucks, this to be 155 ft. wide in the clear. There will also be a two trolley line track and two 17 ft. walks for passengers. On the lower deck will be ten trunk railway tracks.

If the Olympic; Leviathan; and Aquitania were placed in the center span, there would still be four hundred feet to spare, and although the combined weight of these three vessels is 160,000 tons this would not equal the weight of the main span.The two main towers of the bridge will each be 840 ft. high, this meaning that even the Woolworth building will be overshadowed as the latter is only 792 ft in height.

Naturally the anchorages on such a bridge will be of huge proportions. The engineers at present call for a mass of masonry measuring on its base 400 ft. by 375 ft. wide The top of the anchorage will be 220 ft. above the ground level. On top of each base it is proposed to erect two large office buildings 70 ft. wide, 250 ft. long, and 280 ft. high; thus on the two anchorages there will be four modern office buildings, which will of course contribute considerably to the annual receipts of the bridge.

The structural part of the towers, which carries the load of the cables will not be visible, for externally the the towers will look like solid granite. This stonework will act merely as a covering, but inside this facing will be massive, strongly braced steel towers. The protection to the steel work throughout the construction of the bridge has been planned to such an extent that it is expected that one painting of the towers will be good for at least a decade. The total weight of steel in each tower will be 35,000 tons.

A big feature in the construction is that practically the whole of the bridge will be weatherproof. In other words the steel work will be so completely enclosed with rain and moisture excluding material that the cost of repainting will be reduced to a minimum. It is stated that only 15 per cent of the steel work will be exposed. This feature alone should save at least $500,000 annually, for it would at least cost that amount to repaint the bridge annually.

It is impossible in this space to more than barely touch on some of the figures of construction, but even from the foregoing one can grasp an idea of the magnitude of the task. The cost will be about 110 million dollars, but it is expected that the one bridge will be equal in capacity to twenty tunnels, so that the cost is a secondary consideration.

NEW AUTOMOBILE FACTORY STARTS WORK

Present Plant Is Temporary. Plans Are Made And Site Purchased For Permanent Buildings

The Canadian Automobile Corporation have started factory operations at Lachine, Que., where they have taken over the plant of the Rapid Tool and Machine Co. Ltd. This movement is only temporary as they intend erecting a permanent works at Longueil parish. The car to be produced will be named the Mercury Six.

Some weeks ago the actual assembly of parts was commenced, and those in charge of the factory are G. E. Brennan, and M. H. Potter, formerly engineer and production expert to Stevens-Duryea, the well known United States company.

All the engineers in charge of the factory, which is expected to give employment to about 150 men, have been connected with motor construction for long periods. The directors of the company are F. W. Stewart, vice-president Cluett, Peabody, Co., of Canada, Limited, and an ex-chairman of Montreal section of the Canadian Manufacturers Association, chairman of the board, H. W. Austin, managing director of Perrin Kayser, Ltd., vice-president; J. D. Henderson; D. L. Harrington, president and general manager Rapid Tool and Machine Co., Ltd. M. H. Potter, John MacNaughton, and R. J. M. Cantell, all of Montreal.

The site purchased at Longueuil comprises 163,000 square feet, and the company is contemplating erection in the near future. Arrangements have been made with the Grand Trunk for the building of a siding.

Trade Gossip

Efforts are being made to arrange for a permanent building at the Toronto exhibition to demonstrate and display French products only. The French Government is said to be interested in the proposition and it is expected that the eight exhibition cars which will tour the Dominion, showing French goods, will be stationed at the exhibition this year for the complete period.

Three vessels will be added shortly to the Canadian Government Merchant Marine. The Canadian Pathfinder, recently completed at the former Dominion Shipbuilding plant in Toronto, has taken a trial trip and will be delivered at Montreal. The Canadian Cruiser, a 10,500-ton vessel, was launched last week at the Halifax Shipyards plant by the wife of Premier Murray of Nova Scotia The Canadian Challenger was launched recently at Levis, with Mrs. R. B. Teakle, wife of the General Manager of the Government Merchant Marine, officiating. The Challenger is an oil-burner with 8,350 tons deadweight and a speed of 11 3-4 knots.

ERRATA

In the May 19 issue of Canadian Machinery, we published on Page 58 a notice on the Internal threading tool made by the Jones and Shipman Ltd. Leicester, England. Unfortunately the Canadian office address was left out and it might be well to mention that the tools we spoke of are procurable at the Toronto office 163 King St. E.

ATKINS

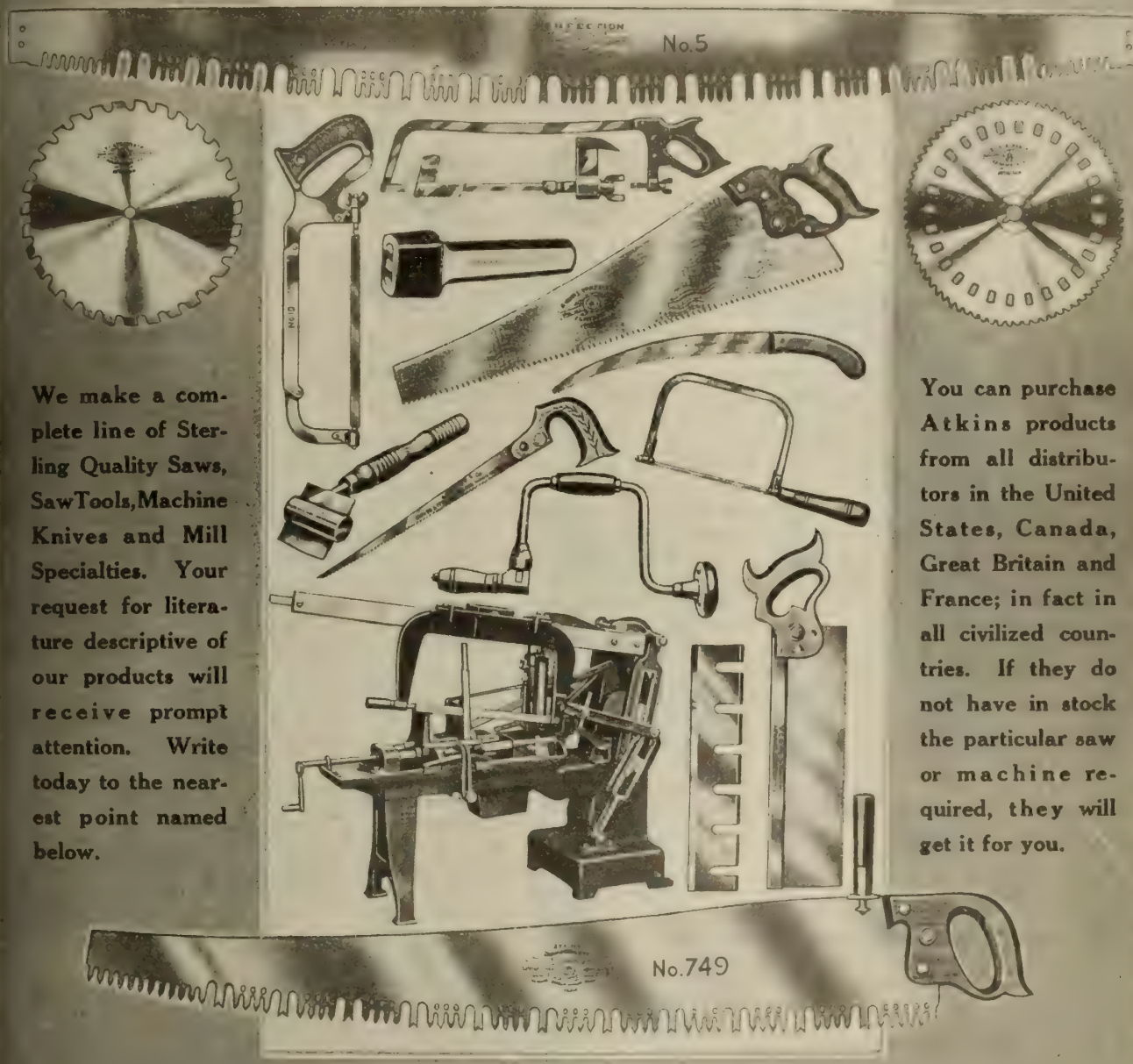
STERLING QUALITY

SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO

Branch: VANCOUVER, B. C.

Upon the Health of your employees depend your profit and production



Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)



Allows just the proper amount of cool, clean, fresh water to come through the bubbler. No spurting, overflowing, no loss "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments, and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:

McKENZIE BROS.

888 F. St. Andre St., Montreal, P. Q., Canada

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

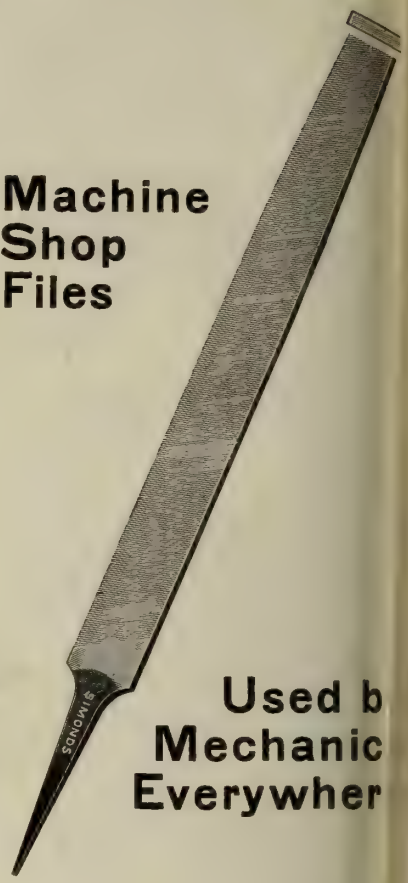
Canadian Machinery

EXHIBITION TO BE HELD AT OLYMPIA

The Shipping Engineering and Machinery Exhibition to be held at Olympia from the 7 to the 28 of September is almost entirely British. Unlike the exhibition of 1919, there will not be a central position taken up by the foreigner, as was the case when the Dutch section filled a very prominent part of the hall. The vast expanse of Olympia will this year be given up to a remarkable representation display of what British shiping, shipbuilding and engineering can do. A notable feature will be the exhibits dealing with oil fuel and oil engines for shipping. The only foreign element will be exhibits by one or two American and Scandinavian firms. Already over 270 well-known firms have taken stands, and apart from the purely practical side of the display several striking novelties in shipping auxiliaries will be shown and demonstrated. The strongest section of all will be marine engineering, but special sub-committees, composed of leading men in the industry, will see that representative displays are forthcoming to show what is being done in naval architecture and shipping; marine propulsion (steam, gas, oil, hydraulic, electric), engine and boiler appliances, fittings, fuel; auxiliary machinery and refrigeration; heating and sanitation; passenger accommodation, engine-room stores, packings and jointings; discharge and loading arrangements, cargo gear (steam, hydraulic and electrical); iron and steel; non-ferrous metals; acetylene cutting and welding; transporting machinery, and railway engineering. A special section will be devoted to illustrated lectures on problems of the day that bear on the industries dealt with by the exhibition. The following prominent shipping men are taking an active interest in the preparations at Olympia as honorary vice-presidents: Lord Weir of Eastwood, Sir Archibald Denny, Sir Eustace H. Tennyson d'Eyncourt, M. Inst. C. E., K. C. B. (Director of Naval Construction, the Admiralty; vice-president of the Institute of Naval Architects, and Commander of the French Legion of Honor), Sir Alexander B. W. Kennedy, L. L. D., D. Eng. (past-president of the Inst. C. E., and past-president Inst. M. E.), and Colonel R. Saxton White.

The production of the Nova Scotia Steel Co. has been as follows. In the first half of 1921 the steel plant at Sydney has not operated. Coal totalling 280,825 tons was produced during the six months ending June 30, and 99,121 tons of iron-ore, of which a proportion was sold for overseas delivery. At the Trenton plant during June, 884 tons of bars of various sizes and 124 tons of rivets, pit-spikes, and bolts and nuts were made. During June 61,300 tons of coal and 23,050 tons of iron ore were mined.

SIMONDS



Machine Shop Files

Used b Mechanic Everywher

A machinist is delighted whe he takes up a new tool and fin it more than meets expectation Too often he develops a grou when he gets a file that "fal down" on the job. If he is su plied with one of the Simon famous brands his disposition sure to improve with its use, a a contented workman is usually good one.

In selecting your files first co sider Simonds because they made of high grade steel, prope heat treated and cut to stand ha work. They have a cutting ed backed by Simonds quality.

Simonds Canada Saw Co. Lt

MONTREAL, QUE.

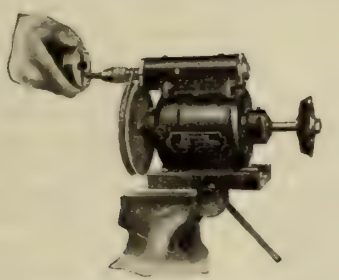
St. John, N.B. Vancouver, B

Aikenhead's

Everything in Tools

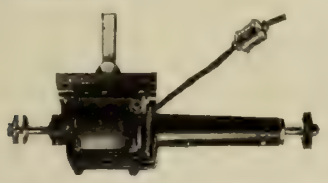
DUMORE

High Speed Electric Grinders



No. 2CG Dumore Grinder

Button Die Grinder .....1/6 H.P. Motor
Speeds .....10,000 and 50,000 R.P.M.
Net weight .....15 1/2 lbs.
Shipping weight ..... 28 lbs.



No. 3 Multi-Speed Dumore Grinder
Seven Grinding Speeds, 3,600 to 50,000 R.P.M.
(1/4 H.P. Universal Motor)

Equipment

12 Emery Wheels 3/16″ to 5″ in diameter; 2 3/8″ Emery Pencils; 5 spindles, 2 wheel arbors and chuck. Reach of largest spindle, 6″. SEVEN QUICK change pulleys give any speed desired.

Canada's Leading Tool Supply House

The Wahlstrom Chuck



Never Slips

With this Wahlstrom Self-Centering, Automatic Drill Chuck two seconds is all you need to change the operation from drilling to reaming, counterboring, or tapping—and you don't stop the spindle; simply grasp the chuck with one hand and replace the loosened tool with another.

The instant-acting jaws of the Wahlstrom close on the entire shank with a grip that becomes firmer and firmer as the resistance to the tool increases.

Made in two styles. One holds Nos. 1, 2 or 3 Morse Taper Shank Tools—with or without tang. The other is made in three sizes, 15-64 to 1-2 in.; 3-8 to 3-4, and 17-32 to 1 in., thus holding all sizes of straight shank tools from 15-64 to 1 in.

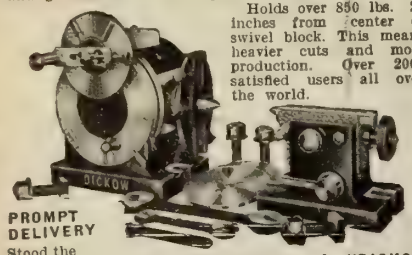
Get them at Aikenhead's!

Aikenhead Hardware, Limited

17 Temperance Street, Toronto. Ont.

Why Reduce Your Production

and waste money by using cheap, inaccurate Index Centers, when a few dollars more will buy a DICKOW INDEX CENTER, which is absolutely dependable, and guaranteed for its high degree of accuracy.



Holds over 850 lbs. 22 inches from center of swivel block. This means heavier cuts and more production. Over 2000 satisfied users all over the world.

PROMPT DELIVERY

Stood the test for 14 years.

Also Manufacturers of "DICKOW SUPERIOR EIGHT" Precision Lathes

Dependable and Accurate.

Write us to-day for complete description.

FRED. C. DICKOW MACHINERY CO., Not Inc., 3504 W. Lake St., CHICAGO, ILL.

HAMILTON ENGINEERING SERVICE
LIMITED

Consulting and Designing Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.

195 KING WILLIAM ST. HAMILTON

OVENS

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd
Brantford, Canada



No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger Co., Windsor, Ont.

Trade Gossip

According to a statement made by Works Commissioner Harris, of Toronto,the resurfacing of Gerrard St., from Carlaw Ave. to Leslie St. will be undertaken this year.

In the opinion of the British Trade Commissioner in New Zealand, the demand for electrical machinery will soon become very great. To his mind, such machinery will include tramway and lighting plant, agricultural, dairying and household appliances.

A Canadian Steel concern secured $10,000 worth of the $100,000 business, which the Toronto transportation commission placed recently. The balance of the order went to the United States. The material ordered was special track intersections, and the contract calls for delivery prior to September 1.

The Board of Railway Commissioners, Ottawa, have granted the application of the City of Galt for an order directing the Lake Erie and Northern Railway Co. and the Grand River Railway Co. to construct and operate a branch line railway in the southerly limit of the city.

— Norman W. Warren, who for the last six years has occupied the position of western manager of the Dominion Bridge Co., Ltd. in Winnipeg, has been appointed general manager for the whole Dominion, with headquarters in Montreal.

Works and plant that cost over £250,000 have just been established at Newcastle, N. S. W.,by John Lysaght (Australia), Limited, for the manufacture of galvanized iron—the only one of its kind in the state. The site occupies 28 acres; production is 600 tons of galvanized iron per month, and provision has been made for an increase in monthly output to 2,400 tons.

The Algoma Steel Corporation, are rolling a new type of rail as far as Canada is concerned. This style rail has never been produced here before and is known as the 100 pound R. E. Section rail. It was developed some years ago by the rail committee of the American Railway Engineering Association, which is composed primarily of the chief engineers of the various railroads in the United States and Canada. The rail has been manufactured and used in the United States for a few years back, but it was not adopted in Canada until a few months ago, when the C. P. R. decided to take it as their standard. Previously an 85-pound rail had been the C. P. R.'s standard-rail. The C. P. R. placed its first order for these rails with the Algoma Steel Corporation so that this plant is the first Canadian plant to manufacture them.

The American authorities have refused to put an import tax on boots and shoes and other leather products entering the states.

The Ontario Government is planning to build a permanent roadway on Yonge St. between North Toronto and Bond Lake, according to Hon. F. C. Biggs.

Power may be sold by the Sarnia Hydro-electric commission to the St. Clair Tunnel Co. Nothing has been settled as yet, but it looks as if the proposition would go through.

Hon. A. McNab, Minister of Public Works for the province of Saskatchewan, has announced that 7,200 miles of new trunk roads will be built by the Saskatchewan government within the next three years $2,000,500 will be spent this year on such work.

It is expected that the two proposed bridges which will connect the Island of Montreal with St. Anne de Bellevue, and Vandreuil on the mainland will cost a round $1,000,000. At present it is the intention to start this work sometime in the fall.

Australia is a large consumer of galvanized iron, and it is believed that a extensive market for the company's products is assured. Many of the skilled operatives from abroad had necessarily to be imported, and an extensive housing scheme has been inaugurated in connection with the works.

Damage to the extent of several thousand dollars was done at the St. Thomas, Ont., pumping station last week as a result of an unusual heavy rain. Kettle Creek overflowed its banks and flooded the pumping station and adjoining property. The attendants worked in water waist-deep in order to keep the plant in operation. It was impossible to operate either the steam or the electrically-driven pumps, but the gasoline engine-driven pumps were kept running for the 13 hours during which the boiler house was flooded.

The shingle mill of A. J. Waskett Arrowhead B. C. was destroyed by fire recently, the loss being $32,000.

The flood destroyed the stock chlorine of lime, and the officials once issued a warning to citizens to boil all water before drinking. The alum supply was also destroyed although the filtration plant continued to operate with reduced efficiency. Notices to boil the water were placed on bulletin boards throughout the city and in the street-cars and announcements were made from the pulpits. The water undermined the roadway alongside the pumping plant chimney to a depth of 5 ft., and prompt steps had to be taken by the city engineer to save the chimney. Rowboats had to be used in this work.

Catalogues

The Geometric Tool Co. New Haven Conn., have issued a small booklet on their "Jarvis" high speed tapping device, and quick changed chucks and collets, also another showing the different style die heads and two illustrations of their machine. The information is condensed form and should be of interest to mechanics generally.

George Ellison, mechanical and electrical engineers at Birmingham, England have forwarded us two catalogues dealing with circuit breakers, and trailing cable sockets and plugs. Both the booklets should interest electrical men especially.

Edwards and Co. Inc New York have issued a new catalogue covering their varied line of electrical signaling apparatus. There is much of interest contained in this book, and it will appeal to purchasing agents especially.

The Westinghouse Electric and Manufacturing Company has just printed Folder 4456 entitled "The Center of Power." This folder illustrates the many uses of the small motor, and encourages the use of labor saving machines in the home, office, shop and farm.

A New Book on Belt Conveyors has just been published by the Canadian Link-Belt Company of Toronto and Montreal. It is known as No. 215, and describes the Uniroll and Multiroll Idlers made by this company. Among the interesting features of the book are:— 1. The correct methods of figuring belt conveyors and the details entering into this. 2. Numerous examples suggesting the correct types of belt conveyors for the handling of bituminous coal, by-product coke, sand and gravel, bagged sugar and similar material, crushed rock, etc.

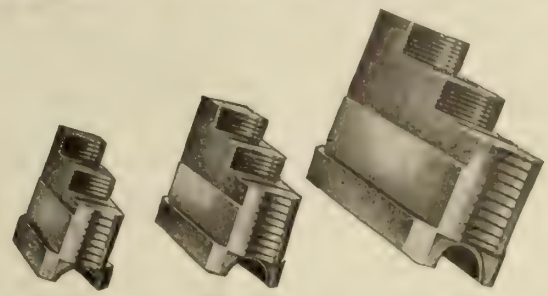
The Electro Alloys Co. Elyra, Ohio, have issued a booklet on what Thermaloy is, how it is made, and its uses. This material is said to be suitable for galvanizing containers. Annealing boxes, lead, cyanide and salt pots. Retorts, pots and muffles. Pyrometer protection tubes. Furnace grates, rails doors and pneumatic stoker parts. Rolls, chains, link bars, tubes, etc., for continuous operation furnaces, and molds for die casting metals.

Other uses are :—Piercing tips, extrusion and drawing dies for metal tubing manufactures, bars, points, supports, etc., for enameling furnaces. Dies, mold and piercing tips for glass-making machinery. Stirring arms for gas producers and metallurgical roasting furnaces. Retorts for cracking and distillation of oil, and containers for baking carbon products. Communication should be sent to 1692 Glenmont Rd. Cleveland Ohio



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1—24" Rockford Shapes, back-geared
1—26" Back-geared Drill, lever feed only.
1—No. 54 Perkins Sprue Cutter.
1—No. 320 Brown-Boggs Press.
1—10"x24" Plain Landis Grinder, self-contained.
1—Union Triplex Hydraulic Pump, 1¼"x 4"
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1—24" x 12' New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24" x 12' Can. Mach. Lathe, S.B.G., C.R., P.C.F.
2—22" x 10' Davis Lathes, D.B.G., Q.C.G., C.R.
1—21" x 10' London Lathe, S.B.G., C.R., P.C.F.
4—20" x 8' C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
3—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1 29" x 10' Butler Lathe, D.B.G., Q.C.G., C.R.
1—16" x 6' McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18" x 8' Mueller Lathe, D.B.G., Q.C.G. Turret on cross slide.

Shapers

1—24" Rockford Shaper.
1—12" Port Hope Shaper.

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2—No 24 H.D. Foote Burt Drills.
1—28" Barnes Drill, B.G., P.F.
1—22" Barnes Drill, B.G., P.F.
—20" McDougall Drills, W. & L.F.

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1—18" x 24" x 10' Rahn Meyer (used).

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1—Briggs High Duty Type "B" 42" Traverse (new).
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1—Ford-Smith, No. 3 Universal (used).
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1—16" No. 2B Edlund H. S. Sensitive (new).
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1—No. 7 Watkins, 9" Cap. (used).
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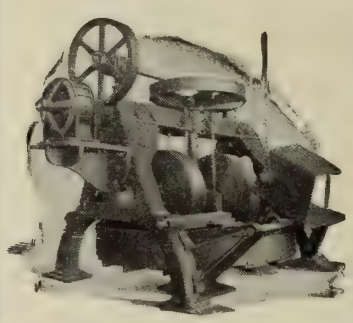
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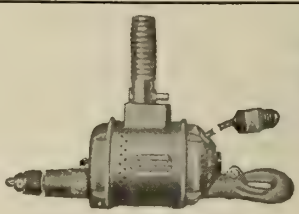
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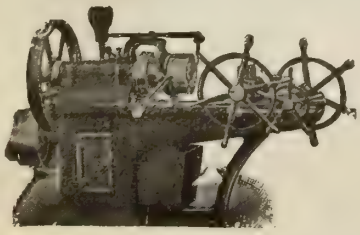


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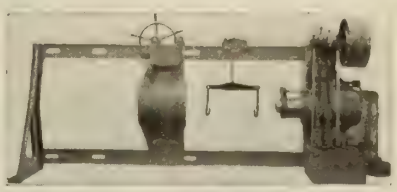
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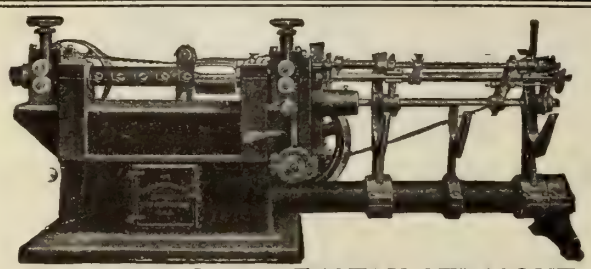
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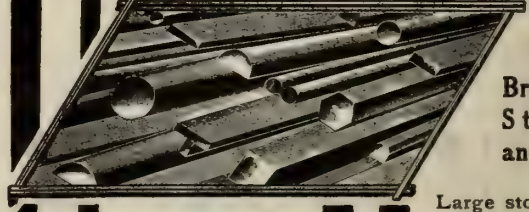
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We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

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Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd , Mimico, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Independent Pneumatic Tool, Chicago, Ill.

Analyses, Chemical
Toronto Testing Laboratory, Toronto, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Columbia Hdwe. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

For list of Dealers see the last page of This Buyers' Directory

Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The J... Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto,
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling M... ines, Horizontal
Armstrong-Whitworth of Canada, ... Montreal, Canada.
Bertram & Son Co., Ltd., The J... Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Mont...
Garlock-Walker Mchy. Co., Toronto,
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling M... Vertical
Armstrong-Whitworth of Canada, ... Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Mon...
Garlock-Walker Mchy. Co., Toronto,
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, ...
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, ...

Boring Tools
Armstrong-Whitworth of Canada, ... Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, ...
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling ... Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., ... onto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain ... Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain ... Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., H... ton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., ... ilton, Ont.
MacKinnon Steel Co., Sherbrooke, ...

Broaching Machines
Bilton Machine Co., Bridgeport, Con...
Garlock-Walker Mchy. Co., Toronto, ...

Bronze
Brown's Copper & Brass Rolling ... Ltd., Toronto, Ont.
Walker & Sons Metal Products, ... Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., ... onto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., ... Montreal, Que.
Canada Metal Co., Ltd., Toronto, O...
Ontario Metal Products Co., Ltd., ... onto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont

Buffing or Polishing Machines (See Polishing and Buffing Mach...
Blount Co., J. G., Everett, Mass.
Can. Hanson & Van Winkle Co., ... Toronto, Ont.
Ford-Smith Machine Co., Hamilton, ...
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinna...

Bulldozers
Bertram & Son Co., Ltd., The ... Dundas, Ont.
Canada Machinery Corp., Galt, On...
Garlock-Walker Mchy. Co., Toronto ...

Burners, Oil and Gas
General Combustion Co. of Can., ... Montreal, Que.
Rockwell Co., W. S., New York Cit...

Bushings
Fisher Motor Co., Ltd., Orillia, On...
Morrow Screw & Nut Co., Ltd., ... Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto ...

Calipers
Brown & Sharpe Mfg. Co., Providenc...
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., ... land, Ont.

Can-Making Machinery (See Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton ...
MacKinnon Steel Co., Sherbrooke, ...

BUYERS' DIRECTORY

(s, Ore
acKinnon Steel Co., Sherbrooke, Que.

(tings, Aluminum
nada Electric Castings Co., Ltd., Orillia.
an. Hanson & Van Winkle Co., Toronto, Ont.
nada Metal Co., Ltd., Toronto, Ont.

tings, Brass and Bronze
goma Steel Corp., Ltd., Sault Ste. Marie, Ont.
nada Electric Castings Co., Ltd., Orillia.
n Hanson & Van Winkle Co., Toronto, Ont.
nada Metal Co., Ltd., Toronto, Ont.
n. Driver-Harris Co., Walkerville, Ont.

C ings, Copper
nada Metal Co., Ltd., Toronto, Ont.
s Hansen & Van Winkle Co., Toronto, Ont.

C ings, Marine
n. Steel Foundries, Montreal, Que
minion Foundries & Steel, Ltd., Hamilton, Ont.

C ings, Die Molded
her Mo'or Co., Ltd., Orillia, Ont.
nklin Die-Casting Corp., Syracuse, N.Y.
le Foundry Co., Galt, Ont.
llman Brass & Metal, Ltd., Hamilton, Ont.

Cings, Ferro-Alloy
Steel Foundries, Montreal, Que.

Cings, Iron
oma Steel Corp., Ltd., Sault Ste. Marie, Ont.
nard Industrial Co., A., Fortierville, ue.
ton Machine Co., Bridgeport, Conn.
wn, Boggs & Co., Ltd., Hamilton, Ont.
n Hanson & Van Winkle Co., Toronto, Ont
nada Electric Castings Co., Ltd., Orillia.
lna & Co., M. A., Cleveland, Ohio.
burn Ltd., John T., Toronto, Ont.
le Foundry Co., Galt, Ont.
nedy & Sons, Wm., Owen Sound, Ont.
Dougall Co., Ltd., R., Galt, Ont.
oris Foundry Co., Ltd., Ottawa, Ont.
ker & Sons Metal Products, Ltd., tram, Walkerville, Ont.
minion Engineering Works, Limited, ontreal, Que.

Cings, Hyd. Press
Steel Foundries, Montreal, Que.

Cings, Malleable Iron
ational Malleable Iron Co., elph, Ont.
nedy & Sons, Ltd., Wm., Owen und, Ont.
th's Falls Malleable Castings Co., ith's Falls, Ont.

Cings, Monel Metal
Driver-Harris Co., Ltd., Walkerle, Ont.

Cings, Naval Bronze
lman Brass & Metal, Ltd., Hamilton, t.

Cings, Nichrome
Driver-Harris Co., Walkerville, Ont.

Cings, Nickel
Hanson & Van Winkle Co., Toronto, Ont.

Cings, Semi-Steel
dson Mfg. Co., Thos., Montreal, Que.
Iron & Steel Foundries, Hull, Que.
e Foundry Co., Galt, Ont.
nitoba Steel Foundries, Ltd., Winnipeg, Man
minion Engineering Works, Limited, ontreal, Que.

Cings, Steel
minion Foundries & Steel, Ltd., Hamton, Ont.
a Steel Foundries, Montreal, Que.
nedy & Sons, Wm., Owen Sound, Ont.
ttish Crucible Steel Co. of Can., Ltd., ndsor, Ont.

Conc te, Iron
ith Mfg. Co., Jersey City, N.J.

Cooling Machines
ham & Son Co., Ltd., The John, ndas, Ont.
rk-Walker Mchy. Co., Toronto, Ont.

Cha . (See Sprockets and Chains)
re Crane & Hoist Co., Ltd., Niagara lls, Ont.
n Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, a
el (Hans) of Canada, Ltd., Montr Que.
Wri Mfg. Co., Lisbon, Ohio.

Chai. Driving
Cal Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jon & Glassco, Montreal, Que.
Ma Chain Co., Ithaca, N.Y.
Rem (Hans) of Canada, Ltd., Montr Que.
Wri Mfg. Co., Lisbon, Ohio.

Chan
Bert m & Son Co., Ltd., The John, ndas, Ont.
Jon & Lamson Machine Co., Springfi Vt.
Lan Machine Co., Inc., Waynesboro, Pa.
Pra & Whitney Co., of Canada, Ltd., ndas, Ont.

Chemists
Tow o Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg Co., Providence, R I
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hender Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis Mo.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Fine
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont
Kearney & Trecker Co., Milwaukee, Wis
Madison Mfg Co., Muskegon, Mich
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Ot Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto,

Flux, Galvanizing
British Smelting & Refining Co., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ob
Bertram & Son Co., Ltd., The Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton
Canada Machinery Corp., Galt, On
Can. Fairbanks-Morse Co., Ltd., Mo
Garlock-Walker Mchy. Co., Toronto
National Machinery Co., Tiffin, Ohi
Stewart & Co., Duncan, Glasgow,
Steel Co. of Canada, Ltd., Hamilton,

Forgings, Drop
Canada Foundries & Forgings Co., land, Ont.
Dominion Forge & Stamping Co., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Montreal, Canada.
Canada Foundries & Forgings Co., land, Ont.
Can. Atlas Crucible Steel Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine
Dom. Foundries & Steel, Hamilton
Hepburn Ltd., John T., Toronto,
N. S. Steel Co., Ltd., New Glasgow
Steel Co. of Canada, Ltd., Hamilton

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sher Que.
Can. Ingersoll-Rand Co., Ltd., Sher Que.
Ford-Smith Machine Co., Hamilton
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, On
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto,

Foundry Supplies
Atkins & Co., Inc., E. C., Indianap
Rice Lewis & Son, Ltd., Toronto,
Sturtevant Co., B. F., Boston, M

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Q

Fuel Oil Burning System
General Combustion Co. of Can., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., delphia, Pa.
General Combustion Co. of Can., Montreal, Que.
Rockwell Co., W. S., New York

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Montreal, Que.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York C

Furnaces, Heat Treating Oil an
Armstrong-Whitworth of Canada, Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., She Que.
Can. Fairbanks-Morse Co., Ltd., M
General Combustion Co. of Can. Montreal, Que.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York C
Walker & Sons Metal Products Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., delphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products Hiram, Walkerville, Ont.

Furnaces, Tempering and An
Brown & Sharpe Mfg. Co., Provider
Electric Furnace Construction Co., delphia, Pa.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York C
Walker & Sons Metal Products Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toron

Gages, Comparator
Jones & Lamson Machine Co., field, Vt.
Herbert Ltd., Alfred, Toronto, On
Johansson Inc., C. E., Windsor,
Perdue, W. B., San Francisco,
Starrett Co., L. S., Athol, Mas

Gages, Measuring (See Tool W
Chesterman & Co., Ltd., J., Sheffie
Crescent Machine Co., Ltd., Mont
Greenfield Tap & Die Corp., Galt,
Johansson Inc., C. E., Windsor,
Starrett Co., L. S., Athol, Mas

Gages, Recording
Bristol Co., Waterbury, Conn.
Johanson Inc., C. E., Windsor.
Taylor Instrument Co., Toronto.

BUYERS' DIRECTORY

ckworthie, Ltd., John, Birmingham, Eng.
ws & Sharpe Mfg. Co., Providence, R.I.
. Fairbanks-Morse Co., Ltd., Montreal.
enfield Tap & Die Corp., Galt, Ont.
ansson Inc., C. E., Windsor, Ont.
tt & Whitney Co., of Canada, Ltd.,
undas, Ont.

Gage, Special Measuring (See Tool Work)
enfield Tap & Die Corp., Galt, Ont.
tt & Whitney Co., of Canada, Ltd.,
undas, Ont.

Gage, Standard
rmstrong Whitworth Co. of Can., Lt
ontreal, Que.
ne & Co., Inc., E. C., Indianapolis,
ansson Inc., C. E., Windsor, Ont.

Gage, Thread
worthie, Ltd., John, Birmingham, Eng
enfield Tap & Die Corp., Galt, Ont.
ansson Inc., C. E., Windsor, Ont.
rett Co., L. S., Athol, Mass.

Gas Coal Compressed
ir Liquide Society, Toronto, Ont.

Gas Compressed
et-O-Lite Co. of Can., Toronto Ont.

Gaskets
mond State Fibre Co. of Can., Ltd.,
oronto, Ont.
lop Tire & Rubber Goods Co., Ltd.,
oronto, Ont.
dyear Tire & Rubber Co. of Can.,
d., Toronto, Ont.
len Co., Ltd., Montreal, Que.
oth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
or Instrument Co., Toronto, Ont.

Gear Blanks
ada Foundries & Forgings Co., Wel-
d, Ont.
Steel Foundries, Montreal, Que.
ond State Fibre Co. of Can., Ltd.,
oronto, Ont.
Foundries & Steel, Hamilton, Ont.
ilton Gear & Machine Co., Toronto,
tario.
adelphia Gear Works, Philadelphia,

minion Engineering Works, Limited,
ontreal, Que.

Gear Counters
H Mfg. Co., R. A., Battle Creek,
ch.

Gear Cutting Machines
am & Son Co., Ltd, The John,
ndas, Ont.
in Machine Co., Bridgeport, Conn.
n & Sharpe Mfg. Co., Providence, R.I.
Fairbanks-Morse Co., Ltd., Montreal.
ws Gear Shaper Co., Springfield, Vt.
s. Ltd., H. W., Toronto, Ont.
on Machine Co., D. E., New London,
n.

Gear Testing Machines
n & Sharpe Mfg. Co., Providence, R.I.
Smith Machine Co., Hamilton, Ont.

Gear Cast
Link-Belt Co., Toronto, Ont.
Steel Foundries, Montreal, Que.
Foundries & Steel, Hamilton, Ont.
r Motor Co., Ltd., Orillia, Ont.
Iron & Steel Foundries, Hull, Que.
minion Engineering Works, Limited,
ontreal, Que.

Gear Cut
n & Sharpe Mfg. Co., Providence, R.I.
adian SKF Co., Toronto, Ont.
ront Machine Co., Ltd., Montreal, Q.
mond State Fibre Co. of Can., Ltd.,
onto, Ont
minion Bridge Co., Ltd., Lachine, Que.
Steel Products Co., Brantford, Ont.
Smith Machine Co., Hamilton, Ont.
ber & Son, Robt., Montreal, Que.
milton Gear & Machine Co., Toronto,
tario.
rm Ltd., John T., Toronto, Ont.
ne & Co., A. B., Hespeler, Ont.
er & Glassco, Montreal, Que.
n Tube & Supply Co., Montreal, Que.
Neall Co., Ltd., R., Galt, Ont.
adelphia Gear Works, Philadelphia,

Gear Dressed
ndy & Sons, Wm., Owen Sound, Ont.

Gear Forged
da Foundries & Forgings Co., Wel-
d, Ont.
n Tube & Supply Co., Montreal, Que.

Gear Herringbone
Steel Products Co., Brantford, Ont.
milton Gear & Machine Co., Toronto,
C
adelphia Gear Works, Philadelphia,
P

Gear Machine Moulded
Steel Foundries, Montreal, Que.

Gear Rawhide (See Gears, Cut)
milton Gear & Machine Co., Toronto,
Ontario.
adelphia Gear Works, Philadelphia,
P

Gear, Silent Chain
ber & Son, Robt., Montreal, Que.
ler Chain Co., Ithaca, N.Y.
Link-Belt Co., Ltd., Toronto, Can.
Renold of Canada, Ltd., Montreal,
Que.

Gear Worm
Steel Products Co., Brantford, Ont.
milton Gear & Machine Co., Toronto,
Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont
Canadian SKF Co., Toronto, Ont
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton, Ont.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que
Crescent Machine Co., Ltd., Montreal, Q.

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blaskill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd. Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Stratford, Que.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Ont.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Ont.

Oils
Canadian Oil Companies, Ltd., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd. Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Ltd. Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

BUYERS' DIRECTORY

Bosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R I

Pig Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa
Williams Machinery Co., A. R., Toronto, Ont.

Pipe Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Machine Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Holden & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Pratchey Machine & Tool Co., Detroit, Mich
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Greenhead Hardware Ltd., Toronto, Ont.
Machine Ltd., Montreal, Que.
Geo Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Turnle Turret Machine Co., Madison, Wis.

Pliers, Parallels
Peck & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt-Walker Mchy. Co., Toronto, Ont.
Holburn Ltd., John T., Toronto, Ont.
Robert Ltd., Alfred, Toronto, Ont.
Peck & P. Mfg. Co., Niagara Falls, Ont.
Sutton Mfg. Co., Muskegon, Mich.
Ward Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Pile Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Elkay Sanitary Drinking Fountain Co., Asheville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Gisholt-Walker Mchy. Co., Toronto, Ont.
Holburn Ltd., John T., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Bent Co., J. G., Everett, Mass.
Bertram & Sharpe Mfg. Co., Providence, R.I.
C. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt-Walker Mchy. Co., Toronto, Ont.
Tyler & Co., John C., Birmingham, Eng.

Pot Steel
British Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Baker Motor Co., Ltd., Orillia, Ont.

Press, Arbor
Arbor Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lake P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stringer Co. of Can., Ltd., Chas. A., Windsor, Ont.

Press, Drop and Forging
Bertram Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Press, Foot and Hand
Bertram, Boggs & Co., Ltd., Hamilton, Ont.
Tyler & Co., John C., Birmingham, Eng.

Press, Forcing
Arbor Press Co., Kalamazoo, Mich.
Stuart & Co., Duncan, Glasgow, Scot.

Press, Hydraulic
Alva Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Lake Mfg. Co., Springfield, Ill.
Petrie Ltd., W. R., Toronto, Ont.
Stuart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Bernard Industrial Co., A., Fortierville, Que.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal. Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn
National Acme Co., Cleveland, Ohio
Tallman Brass & Metal Co., Hamilton, Ont.

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Alkenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng. Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrew Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Alkenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montr
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, On
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National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
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Armstrong Bros. Tool Co., Chica
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Chesterman & Co., Ltd., J., Sh Eng.
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Greenfield T & Die Corp., Galt,
Hamilton neering Service, L Hamilton, Ont.
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Rapid Tool & Machine Co., Lachi
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Rockford Milling Machine Co., Ill.
Starrett Co., L. S., Athol, Mass
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Wheel Trueing Tool Co., Detroit,
Williams Machinery Co., A. R., Ont.
Williams Machinery & Supply Co., Montreal, Que.

Tool Work
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Crescent Machine Co., Ltd., Mont
Ford-Smith Machine Co., Hamilt

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Vises, Metal Workers'
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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont.

Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

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Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

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Columbia Hdwe. Division, Cleveland, O.
Torrington Company, Ltd., Upper Bedford, Que.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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L'Air Liquide Society, Toronto, Ont.

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All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

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Holden Co., Ltd., Montreal, Que
L'Air Liquide Society, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont

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Union Carbide Co. of Can., Welland, Ont.

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Union Carbide Co. of Can., Welland, Ont.

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Hull Iron & Steel Foundries, Hull, Que.
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Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

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Greening Wire Co., B., Hamilton, Ont.
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Wire Rope
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Sleeper & Hartley, Inc., Worcester, Mass.

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National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

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Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

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Williams Machinery Co., A. R., Toronto, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
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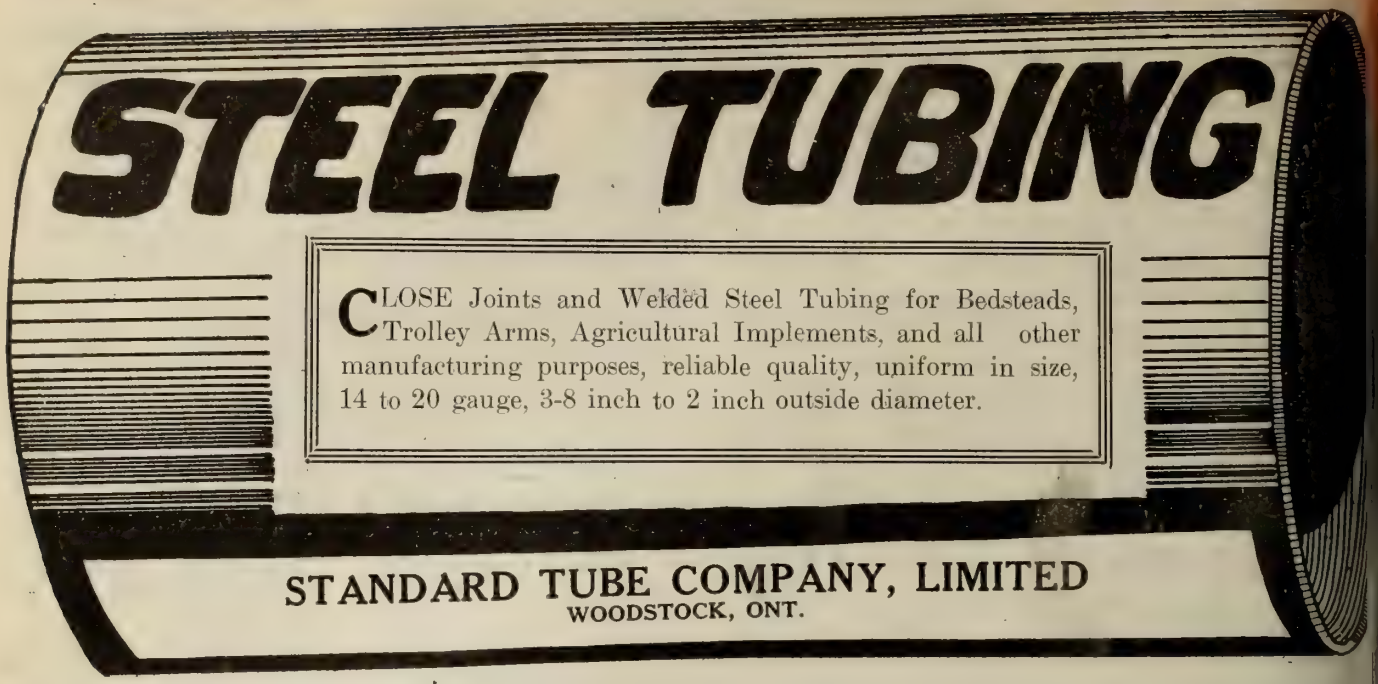
Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrenches, Tap
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

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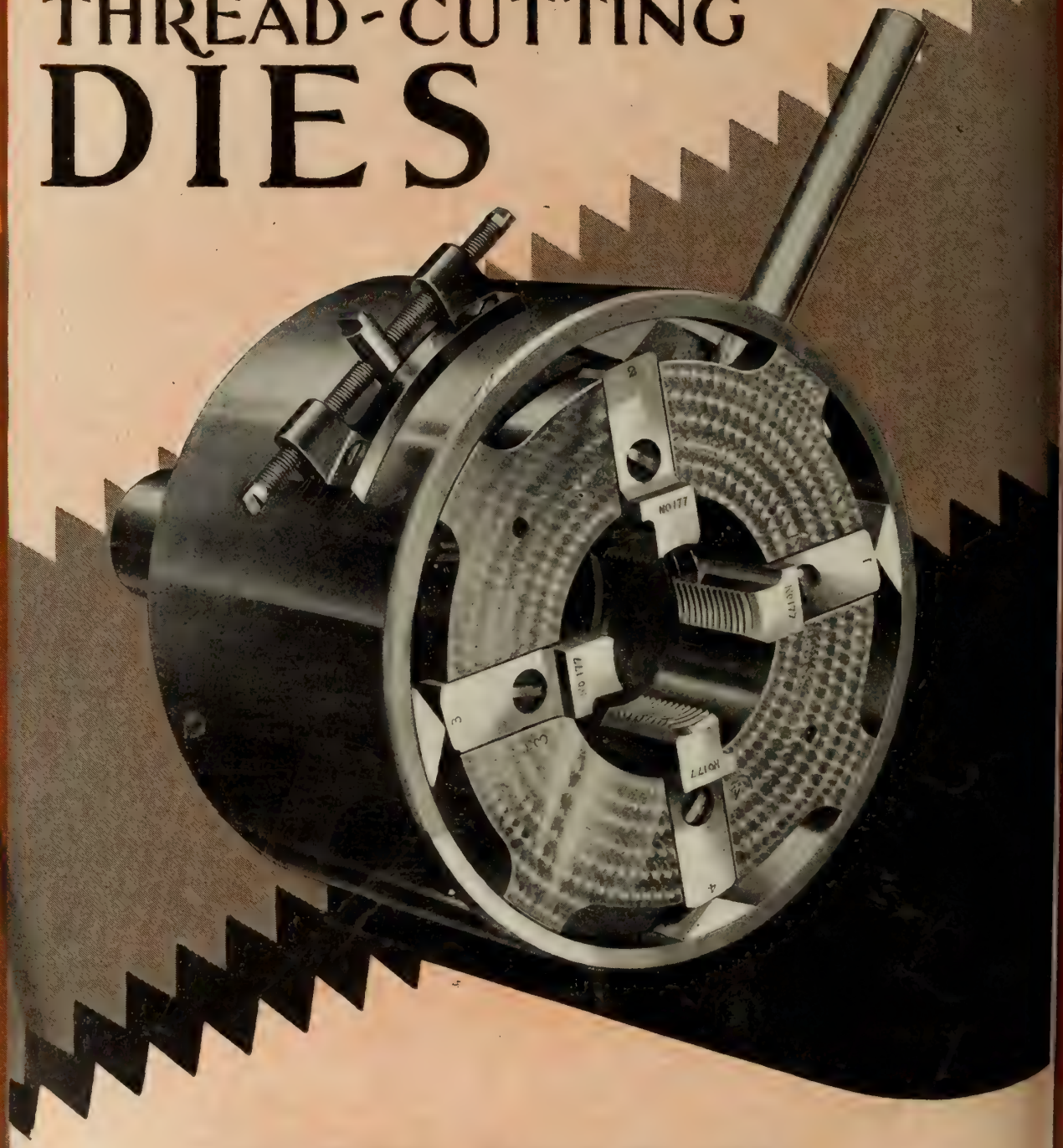
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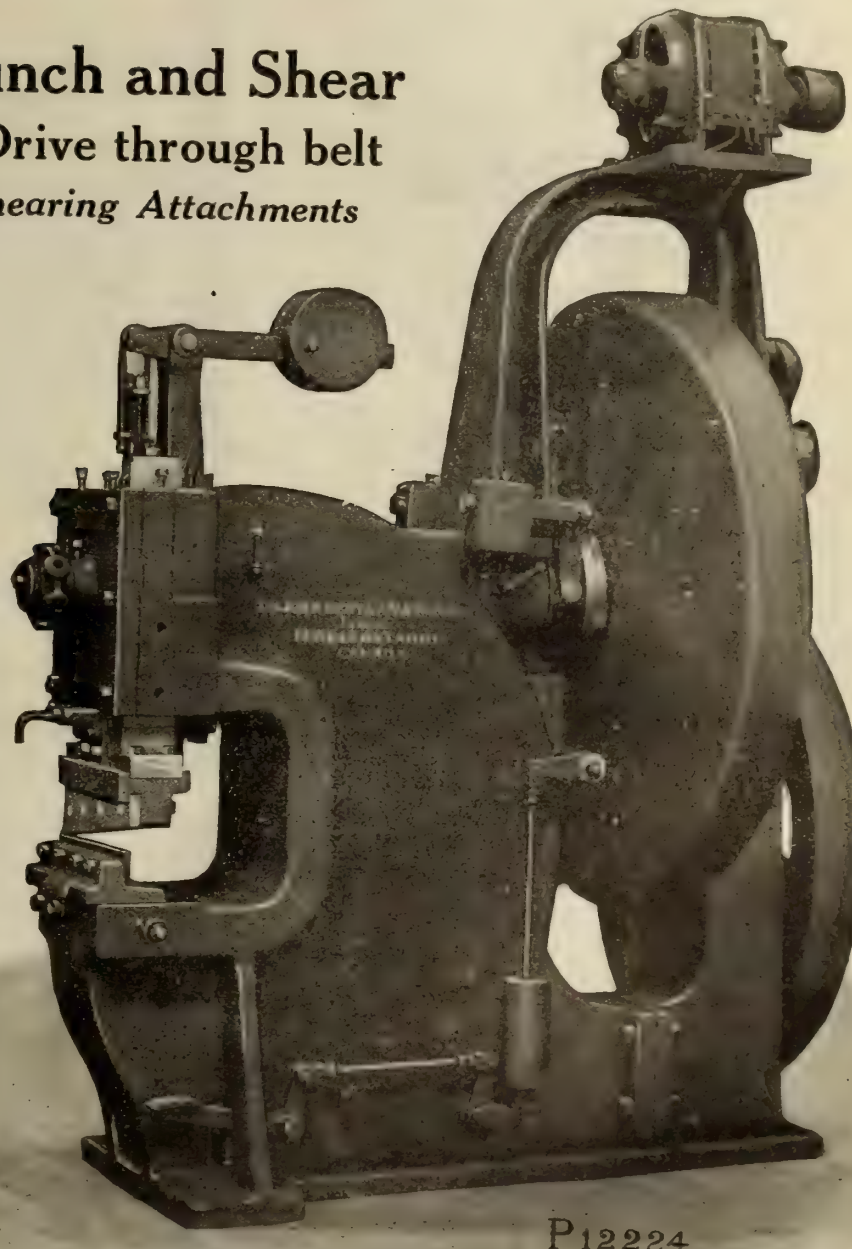
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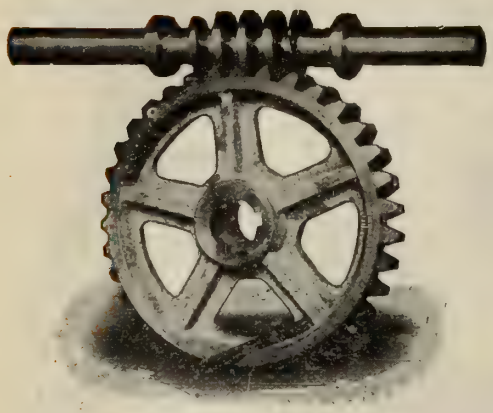
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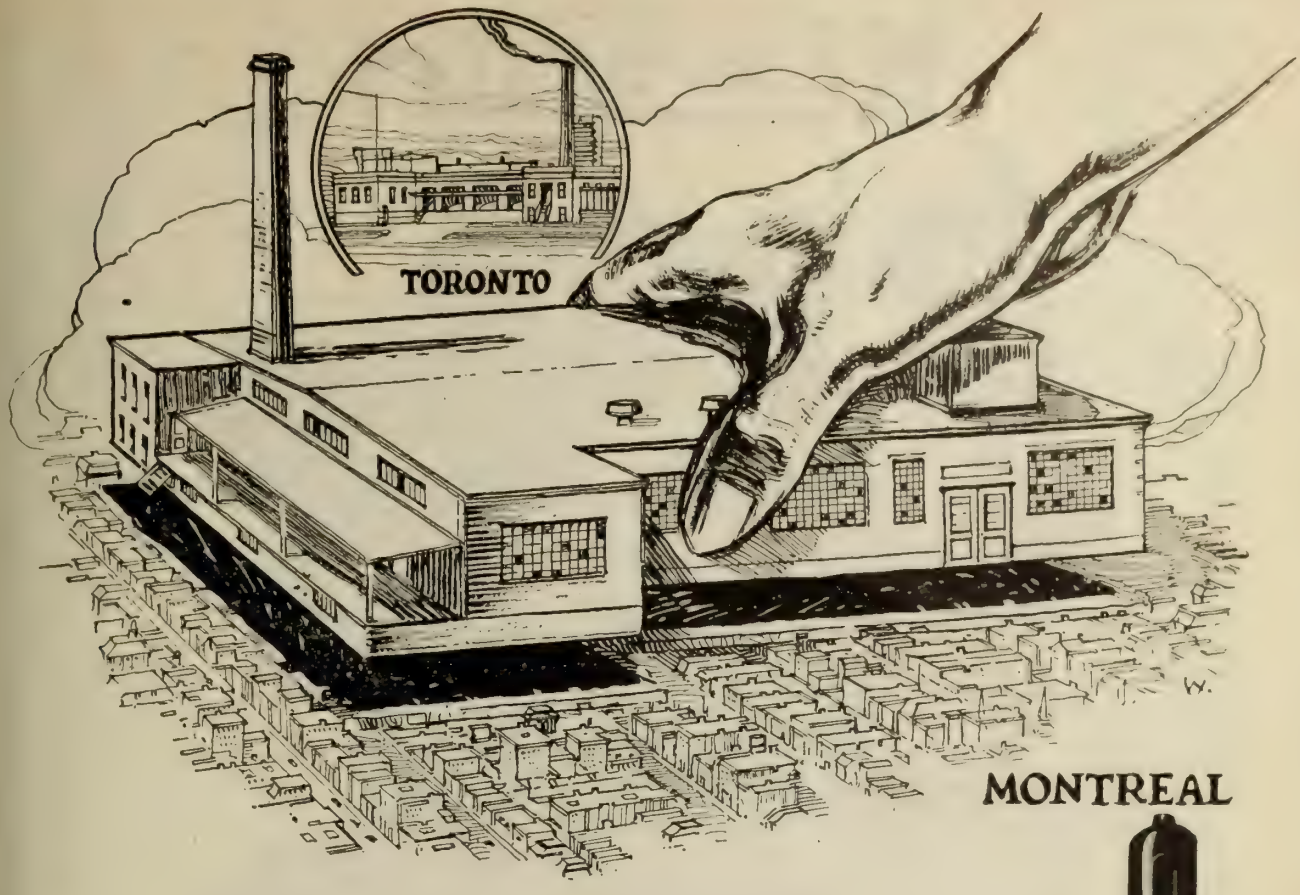
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And with the doubling of our producing machinery — employees and equipment—Dominion Oxygen consumers receive double insurance that our policy of filling all orders on the day of receipt will be rigidly maintained.

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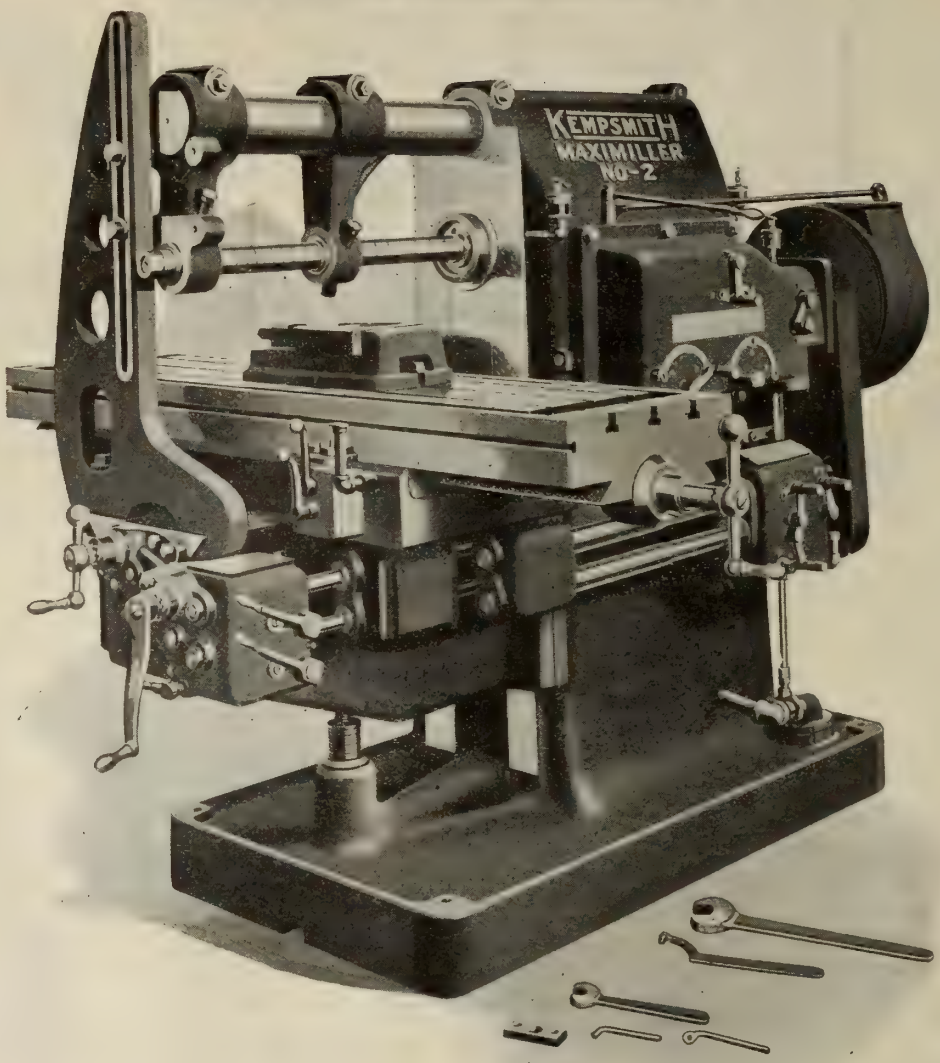
Dominion Oxygen Company, Limited

Hillcrest Park, Toronto

Hamilton, Merritton, Montreal, Welland, Windsor.

D20

KEMPSMITH



NO. 2 PLAIN MAXIMILLER

Kempsmith Millers are built in three sizes each in the Plain and Universal Cone Types, two sizes of Maximiller Geared Head Types, a Production Type, with a choice of three table ranges, and two sizes of Vertical Geared Head Type. Our Knee Type Millers can be fitted with a complete line of attachments, which greatly increase the range of the milling machine.

Literature will be gladly sent upon request.

THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U. S. A.

FOREIGN REPRESENTATIVES:—Barandiaran & Co., 3, Alameda, San Sebastian, Spain; Bevan & Edwards Pty., Ltd., 117-29 King St., Melbourne, Australia; Edgar Bloxham, 12 Rue du Delta, Paris, France; Nielsen & Winther Blegdamsveg 60 Copenhagen, Denmark; Park & Lacey Co., Ltd., 60 Clarence St., Sydney, N.S.W., Australia; Selson Engr. Co., 19 Via Botero, Turin, Italy, and 85 Queen Victoria St., London, E.C., England; Spliethoff, Beewukes & Co., Leuvehaven, W. Z., 159 Rotterdam, Holland; American Trading Co., Tokio, Japan; Societe Anonyme Belge Alfred Herbert, 35 Rue de Laekin, Brussels, Belgium; Turner, Hoare & Co., Ltd., Bombay, India.

CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

NUTS

S·A·E and A·L·A·M

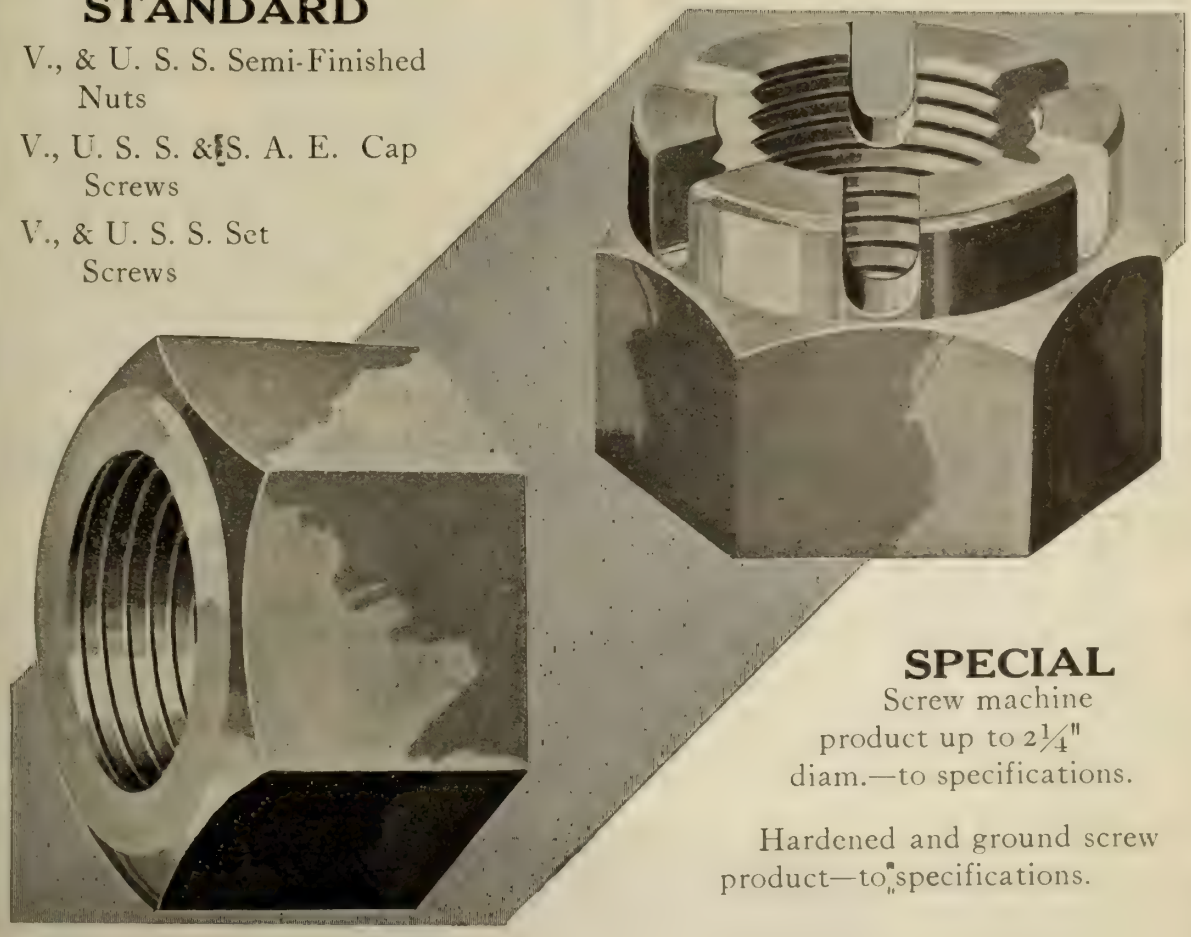
PLAIN OR CASTELLATED

STANDARD

V., & U. S. S. Semi-Finished Nuts

V., U. S. S. & S. A. E. Cap Screws

V., & U. S. S. Set Screws



SPECIAL

Screw machine product up to 2¼" diam.—to specifications.

Hardened and ground screw product—to specifications.

THE NATIONAL ACME COMPANY

MONTREAL, QUE.

De Courcelles **G.T.R.R.**

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

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Taylor Instrument Companies
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There's a Tycos and Taylor Thermometer for Every Purpose

78

STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

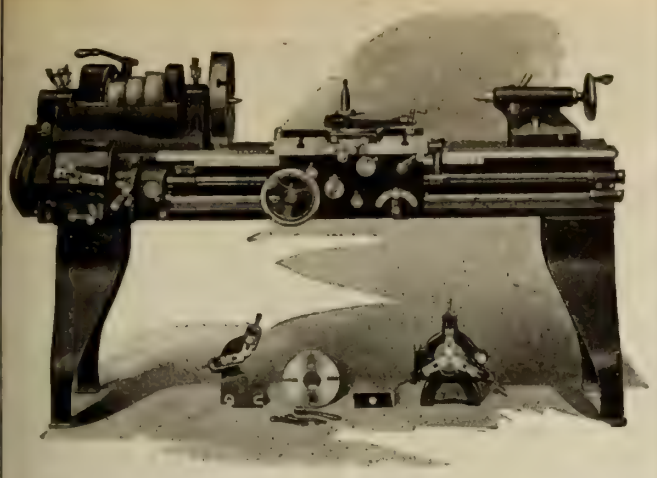


Steel Ingots *by the* HARMET Liquid Process

Nova Scotia Steel and Coal Co., Limited

Head Offices:
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MONTREAL



Sufficient Weight and Power to Handle Modern Production

Though small in size, the "Economy" Double Back Geared, Quick Change Engine Lathe is strong and powerful. Its extreme accuracy makes it particularly adapted to the tool room of the modern manufacturing plant. Made in 14 in., 18 in. and 22 in. swing.

Write for complete information of this small, heavy duty lathe, without delay.

Rockford Lathe and Drill Co.
Rockford, Illinois, U.S.A.

WHY EXPERIMENT ?
WE DID IT FOR YOU YEARS AGO



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



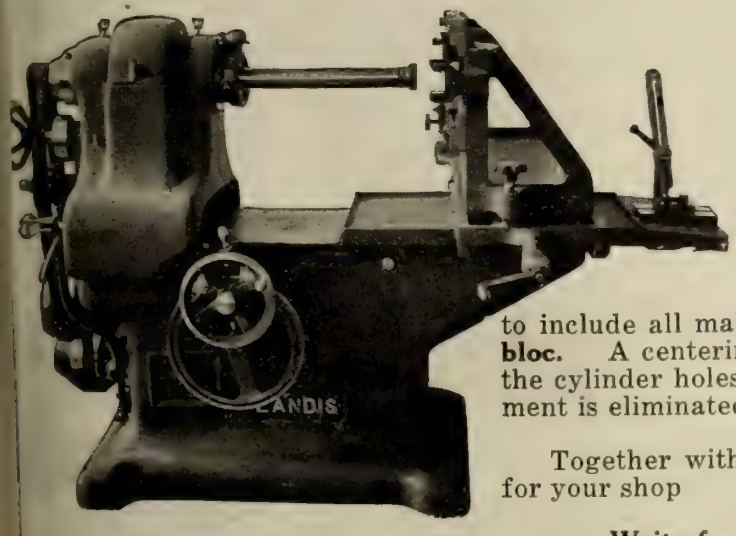
Matchless

Suitable For Slow-Moving Bearings

Write For Prices

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

A New Machine For Repair Shops
THE LANDIS NO. 5 CYLINDER GRINDING MACHINES



LANDIS

The insistent demand for a machine to meet the requirements of automobile cylinders re-grinding, resulted in the designing and manufacturing of this new type grinding machine.

The machine will handle cylinders rapidly and accurately, and has a capacity great enough to include all makes and types of motor blocks, cast singly or **en bloc.** A centering device, the exclusive feature, properly locates the cylinder holes with center of wheel rotation. Vertical adjustment is eliminated which permits a quick set-up.

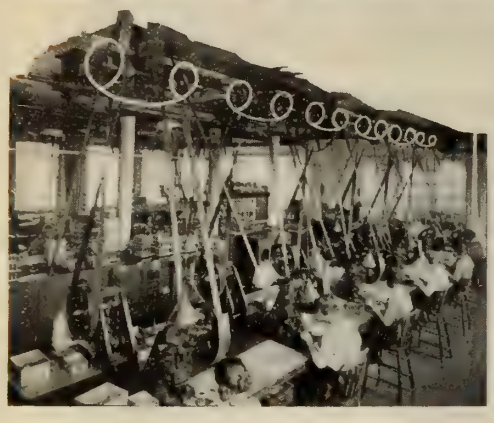
Together with other important features, this machine is ideal for your shop

Write for Circulars.

LANDIS TOOL CO. WAYNESBORO, PA.

NEW YORK OFFICE: 51 CHAMBERS ST.

THE JOHNSON FRICTION CLUTCH



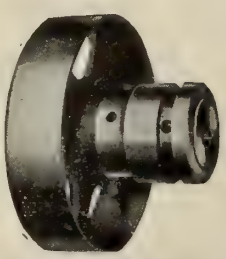
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

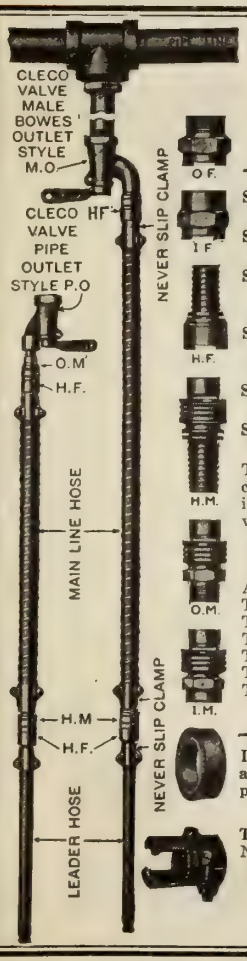
"Clutches As Applied to Machine Building." and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps and Cleco Grooved Hose Nipples and Hose Clamp Tool



STYLE O.F. is an Outside Thread Female Pipe End. made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼ inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

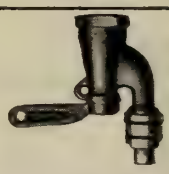
The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO VALVES







Style P.O. **Style M.O.** **Style A.**

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style M.O. Valve—Has 1 in. Inlet and Bowes Coupling Outlet, Connects with Bowes sizes ¼ in. to ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lightening Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.



In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.

Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 43, 44, 46 and 47 mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. **337 Craig St. W., MONTREAL, QUE.**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal



Cast Steel Circuit Breaker

Electrical Machinery

Parts of every description in cast steel

Small Forged Motor Shafts

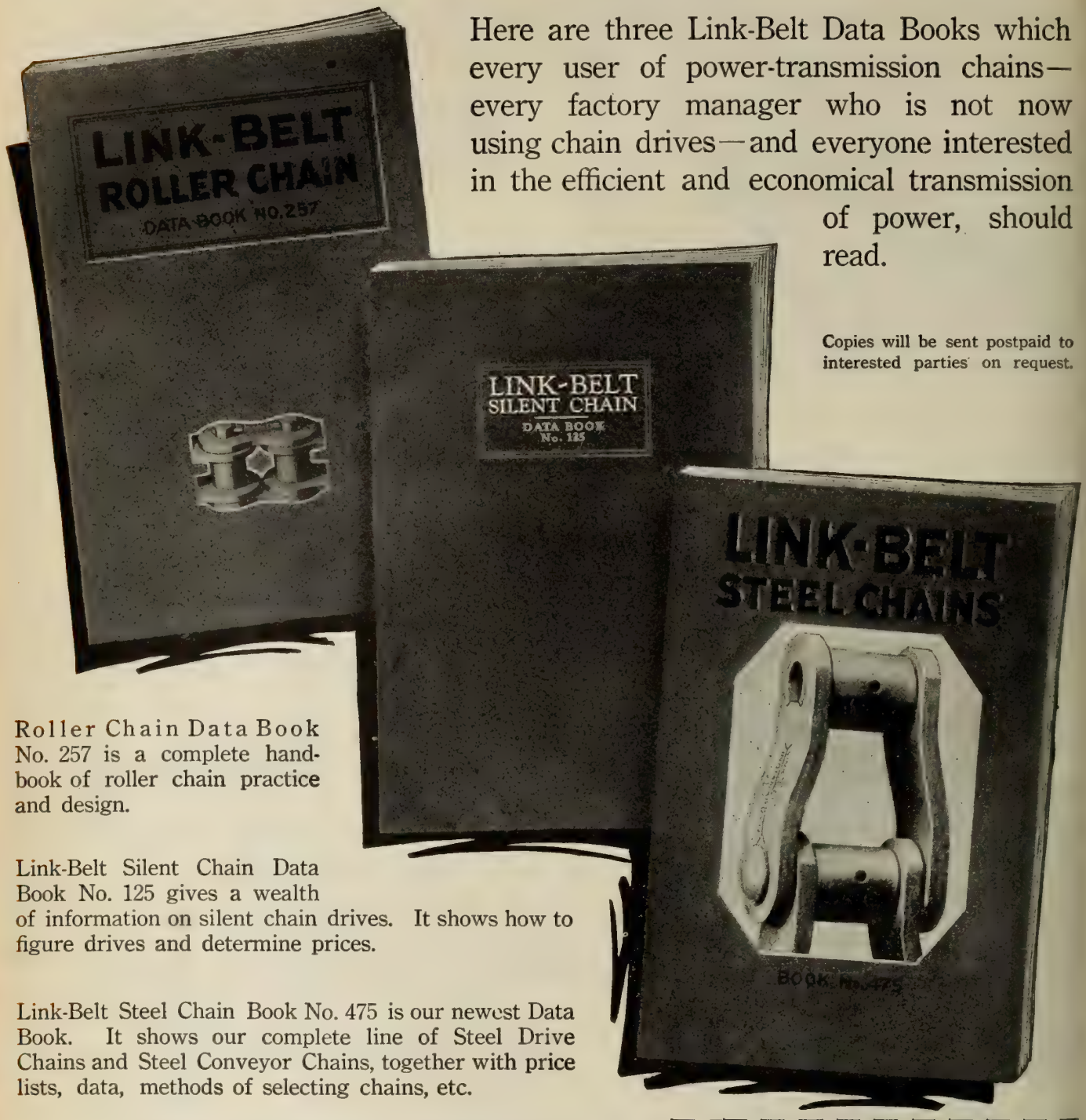
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Alloy Steel Gear Blanks

DOMINION FOUNDRIES & STEEL LIMITED

HAMILTON, CANADA

Books on Power Transmission Chains



Here are three Link-Belt Data Books which every user of power-transmission chains—every factory manager who is not now using chain drives—and everyone interested in the efficient and economical transmission of power, should read.

Copies will be sent postpaid to interested parties on request.

Roller Chain Data Book No. 257 is a complete handbook of roller chain practice and design.

Link-Belt Silent Chain Data Book No. 125 gives a wealth of information on silent chain drives. It shows how to figure drives and determine prices.

Link-Belt Steel Chain Book No. 475 is our newest Data Book. It shows our complete line of Steel Drive Chains and Steel Conveyor Chains, together with price lists, data, methods of selecting chains, etc.

CANADIAN LINK-BELT COMPANY, Ltd.

TORONTO: Wellington and Peter Sts. MONTREAL: 10 St. Michaels Lane

_____ 1921.

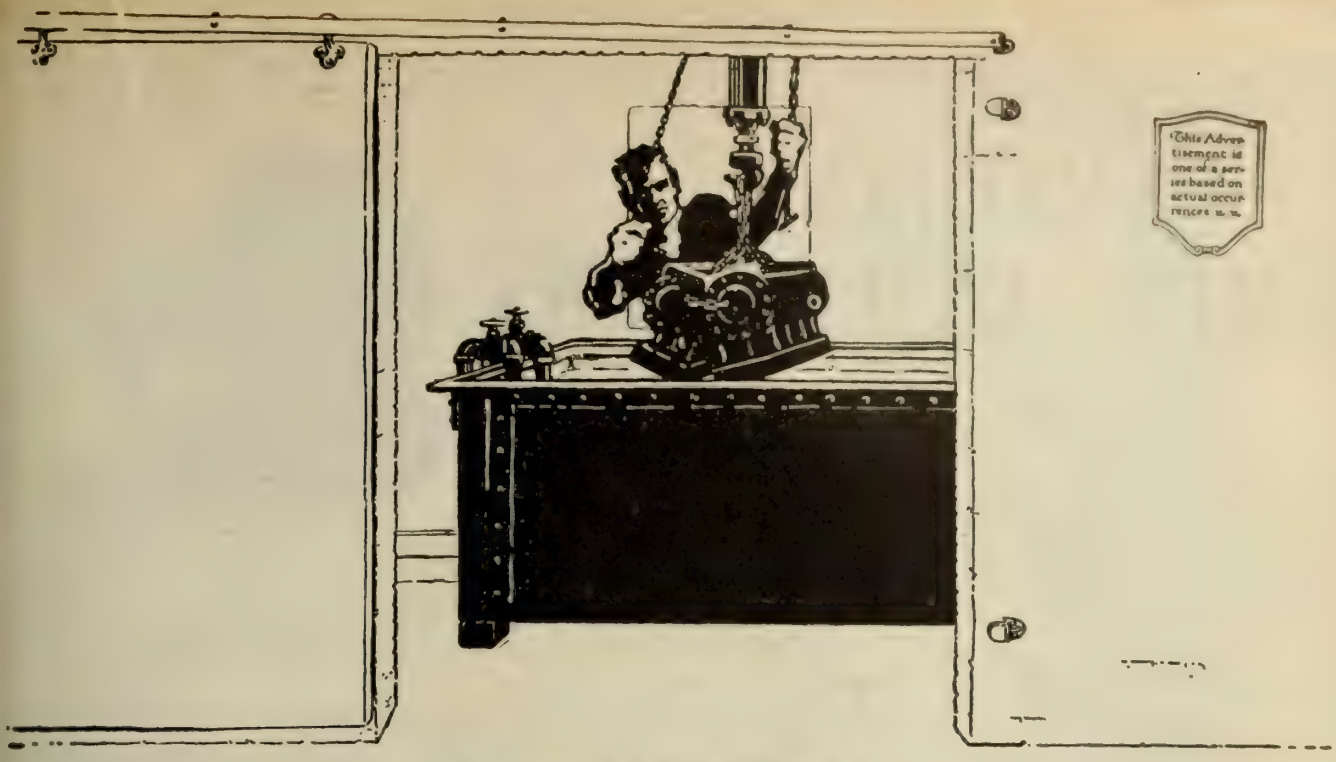
Please send me copies of the books checked:

☐ Silent Chain Data Book No. 125 ☐ Roller Chain Data Book No. 257 ☐ Steel Chain Data Book No. 475

*Name*_____ *Firm*_____

*Address*_____ *Town and State*_____

780



This Advertisement is one of a series based on actual occurrences in a

Saves $180 Weekly Since Cleaning Auto Parts With OAKITE

An Auto Factory now uses Oakite materials instead of caustic soda for cleaning fenders, dash plates and other sheet steel parts, because Oakite saves at least $180 every week in labor, and does faster and better work

Formerly had trouble with rejects after japanning ---which ran 6% to 8%, sometimes as high as 15%. Parts are now so thoroughly cleaned that japan takes perfectly and rejects are unknown.

With caustic it was necessary to wipe parts with gasoline before tack ragging. The elimination of this step, together with the fact that parts cleaned with Oakite are easier to wipe than parts cleaned with caustic, has made it possible for two men to do as much work as eight men did under previous conditions.

Write for booklet--- Oakite Service for Automobile and Aeroplane Manufacturers. Sent free on request to responsible concerns.

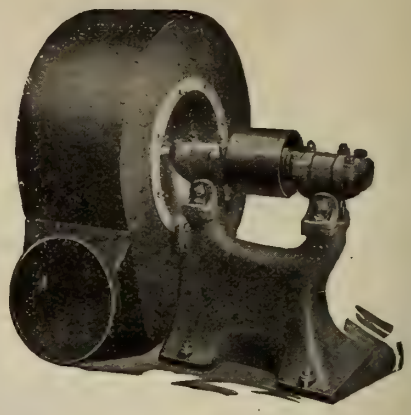
Resident Canadian Representatives: Mr. C. P. Murphy, Toronto, ar d Mr. C. Burgin, Montreal

OAKITE

MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET NEW YORK

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhausters will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.



They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co. Ltd.
KITCHENER, ONT.

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

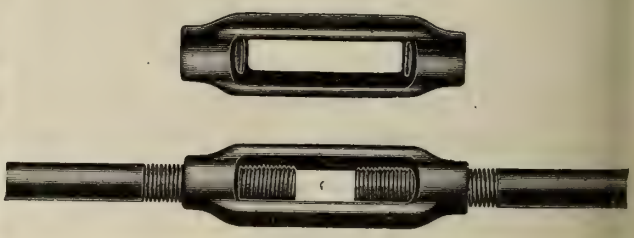
QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

CANADA FOUNDRIES & FORGINGS LIMITED

Drop Forged Steel



SOLID—NOT WELDED

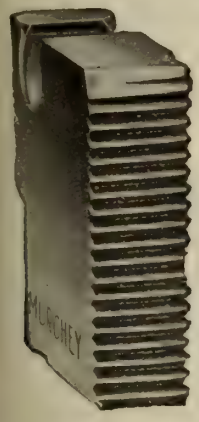
16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.

Talk About Saving Time and Labor—

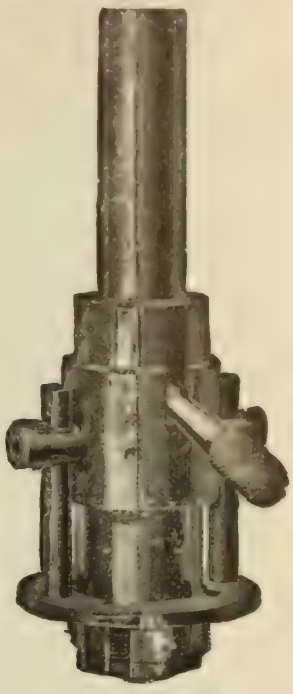
Murchey Collapsing Taps and Self-Opening Dies

will boost your production fifty per cent. and at the same time turn out better and more economical work than ordinary tools.



Murchey Tools are built for long, hard service. The fine materials and workmanship, their extremely simple design and rugged construction, enable clean, accurate threading under all conditions.

If you would experience a new kind of tap and die satisfaction send for a trial order of Murchey Taps and Dies.



Murchey Machine & Tool Company

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Coats Machine Tool Co., London, Glasgow, Newcastle, Eng.
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Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

A. R. Williams Machinery Co., Ltd.

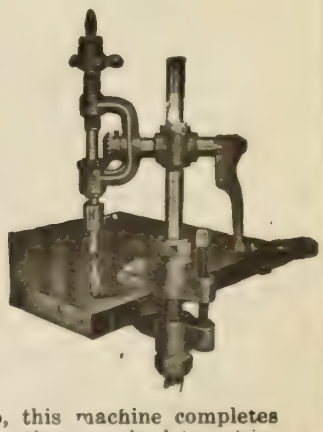
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Halifax St. John, N.B. Montreal Winnipeg Vancouver

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.





On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

Grey Iron and Semi-Steel Castings

Any Weight up to 75 Tons

Special Equipment for Heavy Machining including:

Boring and Turning Mill to swing 35 ft. diam.

Heavy hydraulic work a specialty.

Your enquiries will have our careful attention

Dominion Engineering Works Ltd.

Montreal **Quebec**

Buying a Pig in a Poke

The buying of advertising space used to be buying "a pig in a poke." The quantity and quality of circulation was shrouded in mystery and often the bag was tied against investigation.

That day has passed. The advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has untied the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

In buying advertising space in the Canadian Machinery you are not buying "a pig in a poke." Our A. B. C. statements will stand the analysis of the most exacting investigator.

Good Times Just Ahead

PROSPERITY is within our reach in Canada.
All we need to have and to hold it is a sane, sure grasp on its simple elements.

They are Industry, Integrity, and Faith.

These are the cardinal virtues of human relations. They are the underpinnings of healthy, natural business life and the foundation of a wholesome social system.

They are the fountainhead from which Progress springs. A well-known business economist has called them the "Fundamentals of Prosperity."

Your purchases are an expression of Faith. They are evidence of your Industry. Make them confidently from business institutions of Integrity.

Buying is the backbone of prosperity. An active market means more employment, steadier earnings; benefits are passed around.

Wise spending gives stability to earning and for that reason is far-sighted thrift and sound economy.

The call of to-day is for cheerful thinking, willing working and constructive action by you —everybody—NOW.

To-morrow's change for the better will come about through the combined efforts of each and every one of us.

By sheer force of numbers and co-operation, by the high power of heart and mind, we can put Business on a firm, stable basis.

We can do this because all of the material factors making for better business are right.

Let us link our faith with industry, our vision with courage, and forge ahead.

Let's make an uncommon effort toward a common end—Good Times.

TRADE MARK

"AW" DRILLS

Milled or Twisted



High Speed Twist Drills

From the raw materials entering the steel to the finished drill a rigid inspection is given after each operation, which assures a superior product.

The Drills for MAXIMUM PRODUCTION

Prompt Deliveries on Special Sizes

All Standard Sizes Carried In Stock.

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OXYGEN AND HYDROGEN

(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER

We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle the Well-Known

The Torch for Welders OXYGEN PUROX HYDROGEN Who Want the Best!

WELDING AND CUTTING TORCHES

Our entire organization—technical and sales—is always at your service.

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LIMITED

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PRESSES
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SAW TABLES
ETC.

If interested tear out this page and place with letters to be answered.

UNIVERSAL SHAPING MACHINES

15" Type

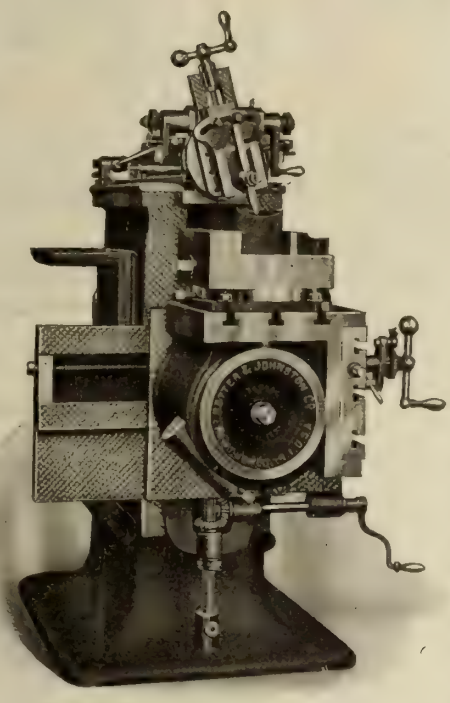
Swivel table with auxiliary tilting side.

Power down feed on any angle.

Automatic feed stop.

Graduated collars on tool head feed screw and table feed screw.

Swivel vise with graduated base.



24" Type

Swivel table with auxiliary tilting side.

Power down feed on any angle.

Automatic feed stop.

Graduated collars on tool head feed screw and table feed screw.

Swivel vise with graduated base.

Swivel table raised and lowered by power.

No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to;—

Die Work
Tool Making and
General Manufacturing

Canadian Offices: POTTER & JOHNSTON MACHINE CO.

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ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.

PROMPT DELIVERY

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in shop and laboratory use the

Standard Scleroscope

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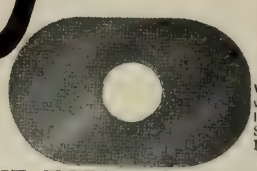
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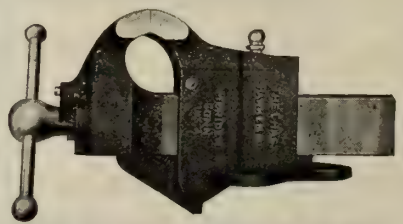
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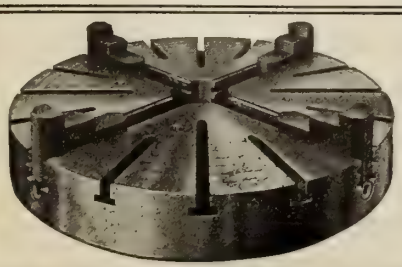
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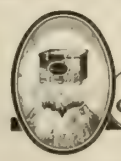


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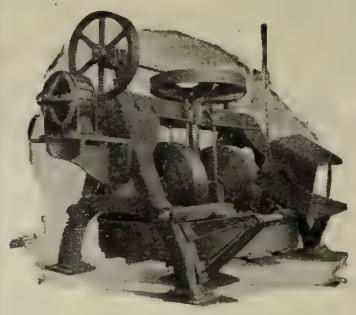
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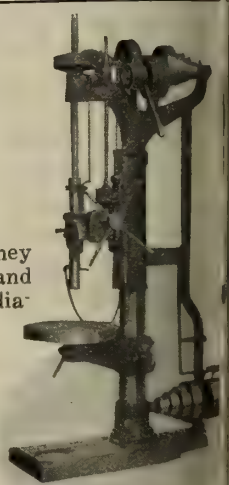
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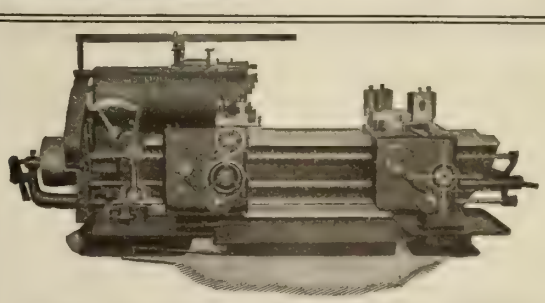
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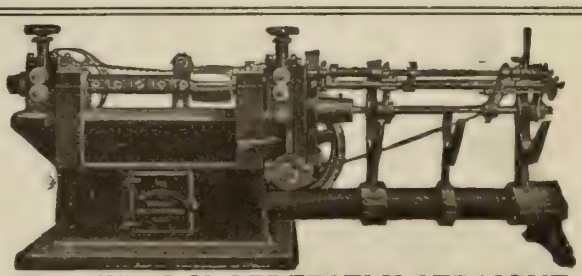




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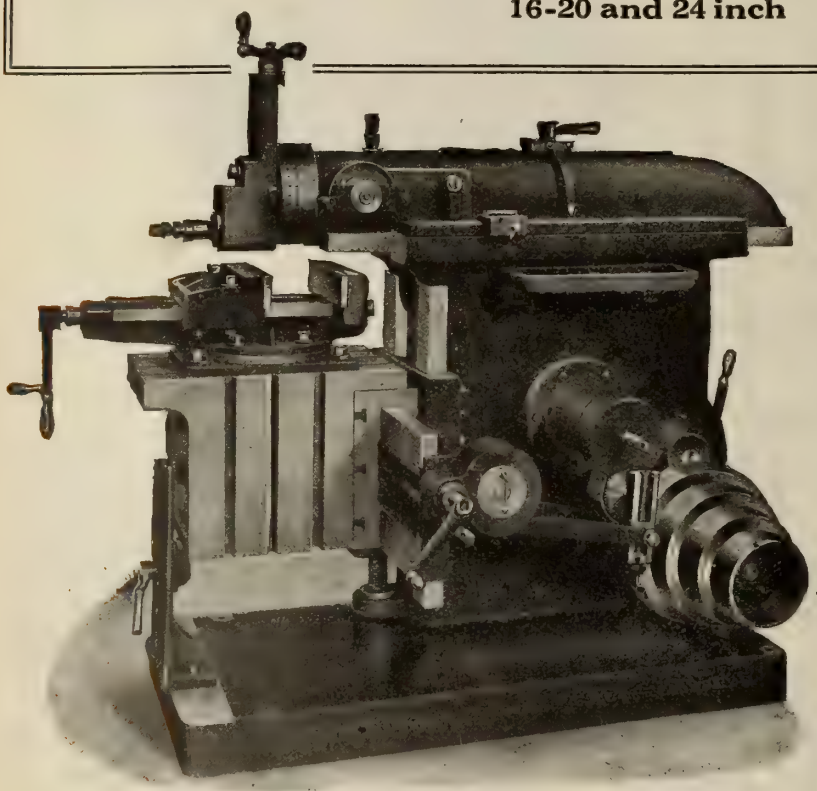
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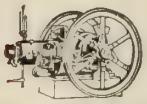
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CANADIAN MACHINERY
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MANUFACTURING NEWS

Volume XXVI, No. 6. August 11, 1921

Machining One Hundred Engine Pistons per Hour

Talk on Automatics—Examples of Work Produced These Including a Valve Stem Guide—Engine Valve Cage—Steering Gear Side Plate—Automobile Fan Hub—Air Drill Cock Body.

By J. H. MOORE

LIKE practically everything else, machine design has developed and improved with the times. This is especially true in the automatic field, until at present, even a machine designer catches himself shaking his head when looking at an automatic and remarking "It's almost human in its action. Isn't it?"

Wasted movement has been attacked from all sides, the chief aim being to produce parts accurately and in the shortest possible time.

The automatic, whose work we are going to consider in the present article is built in two distinct types, —single and double head. The former type is used for machining pieces which require operations on one end only, or on parts which already have one end machined; while the double-head style handles parts requiring operations on both ends. The cost of handling both ends at once is self-evident, viz., that it only takes one half the time that would be required were each end finished separately in a single head machine.

These machines have several spindles ranging from four to six. These spindles revolve and carry the tools where several pieces of work are held stationary in a multiple chuck turret, which, when it indexes, brings each piece of work in line with the next succeeding tool. All machining operations take place in the intervals marked by the automatic progression of the turret indexing mechanism, the time necessary to complete a piece involving a series of operations within the time required for the longest single operation only—or sub-division thereof.

In the case of the single head type the turret advances and feeds the work against the revolving tools, while in the double-head style the revolving tools advance from both sides, thus performing their operations on each end of the work. In this way a series of operations is carried out on several pieces simultaneously, the parts approaching completion as they progress from one tool to another.

The tool spindle centres are in line with the centres of work holding chucks while the omission of a spindle opposite the upper turret position provides an idle chuck, which allows the operator to remove the finished piece and insert a rough part while the machining operations are progressing at the other positions.

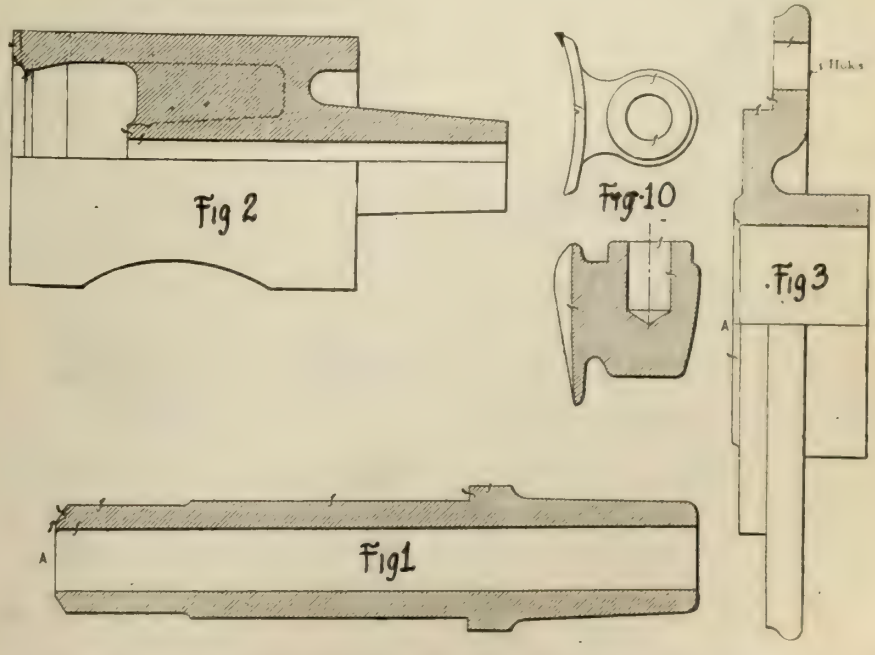
It would be well to add that various styles of work holders are used, these including two and three jawed chucks; draw in arbors; integral chucks; in fact, any other special work holder that may be necessary to hold the pieces securely.

This, briefly, explains the procedure. Certain sizes of machines are better adapted for some classes of work than others, but this is only natural and the examples of work which follow will give readers a good idea of the types used.

Examples of Work

Fig. 1 shows a valve stem guide made of grey iron, which is finished at one setting on a machine having a maximum swing of five-and-a-half inch diameter outside of chuck jaws.

The operations are to turn, drill, face and ream in the time required to drill one third the length. Subdividing the drilling operation not only greatly increases production, but insures a true hole. The performance of the operation in three



FIGS. — 1, 2, 3, AND 10. TEXT MATTER EXPLAINS OPERATIONS PERFORMED.

Illustrations of work and machines, through courtesy of the New Britain Machine Co., New Britain, Conn.

stages also removes the tendency for the drill to clog up and run out. Stellite turning tools are used for turning and facing, high speed drills being the medium adopted for the centre hole. Production on this piece is 100 per hour.

The next example, Fig. 2, shows a grey iron gasoline engine valve cage. This piece is completed at one setting in a machine having a maximum capacity of seven-and-a-half inches outside of jaws, and the operations are to face end, rough seat, drill and ream. On this work intenal high speed spindles are used, the main spindles handling the large diameters, while the internal spindles take care of the drilling operation. The high speed spindles turn at approximately five times the speed and one fifth the advance of the turning tools, thus increasing production, and at the same time reducing drill upkeep. Sixty cages are produced every hour by this method.

At Fig. 3 is shown a steering gear side plate which is produced at the rate of 120 per hour. In this case the piece is made of malleable iron, and is finished at one setting on a single head machine of the same size that completed Fig 2. The operations are, bore, turn, face, chamfer, ream, and drill four holes in the flange with a multiple drill head.

On work of this nature, where the flange has to be machined as well as drilled with accurately spaced holes, a multiple spindle drill head can be placed on the machine. These drills operate through guide bushings located from the reamed hole, thus insuring uniform accuracy without involving an additional operation.

Fig. 4 shows a carburetor mixing chamber cap that is finished at one setting on a single-head machine having a maximum capacity of five-and-a-half in. diameter outside of jaws. The operations are, turn, face, drill centre, and flange holes. By means of high speed drills installed within the main spindles, it is possible to drill the centre and turn the flange simultaneously, yet at the same time maintain the proper cutting speeds at the tools. There are three holes in the flange, these being drilled with a multiple drill head without an additional operation. One-hundred-and-thirty of these parts are produced per hour.

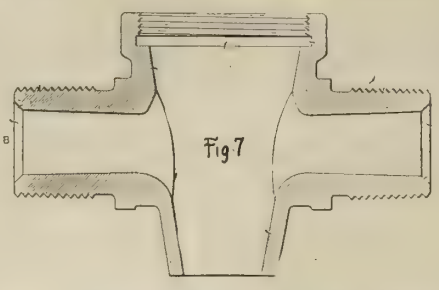


FIG. 7—AN AIR DRILL COCK BODY WHICH WAS SUCCESSFULLY PRODUCED.

Automobile Fan Hub

At Fig. 5 is shown a good example of double head machine work. The part is an automobile fan hub made of grey iron. The piece is finished at one setting on a machine having a maximum swing of 7¼ in. outside of jaws, and following are operations: The flange and hub of end A are faced; end B is faced and bored; while end A is bored and reamed. The production on this part is 50 per hour.

Another double-head machine job is shown at Fig. 6. The gasoline engine piston is finished at one setting and the operations are: drilling both sides, boring and reaming. This is a good example of double head work, and in this case the bottom is faced and the inside bored before coming to the machine. he turret is equipped with special fixt es which locate the pieces from these chined surfaces. The pistons are dr ed and bored from both sides simultane sly, while the reaming is completed through from one side only, thus in ing absolute alignment of the two ings. The tools operate through guide bushings, and the productio these pistons is 100 per hour.

Fig. 7 is an ideal illustration, in that it defines clearly the use of s and double head machines. In fa shows where both types can be us advantage. The part is an air drill body made from malleable iron, an end A is finished on a single head chine, while the ends B and C are pleted on a double head type.

The operations on end A are: bore, taper ream, neck, and tap; at B and C the steps are to turn, chamfer and thread. The productio end A is 90 per hour, while the two B and C are completed at a like In this way the single head ma handles all work at end A in the required to rough taper ream, whil double head machine completely fi both ends simultaneously in the required to rough turn one end onl

Fig. 8 is a typical illustratio work admitting the use of a double combination tap and die head. On a head both the tap and die are from the same spindle, the tap le with its coarse pitch, and the di lowing at a rate corresponding wi finer pitch.

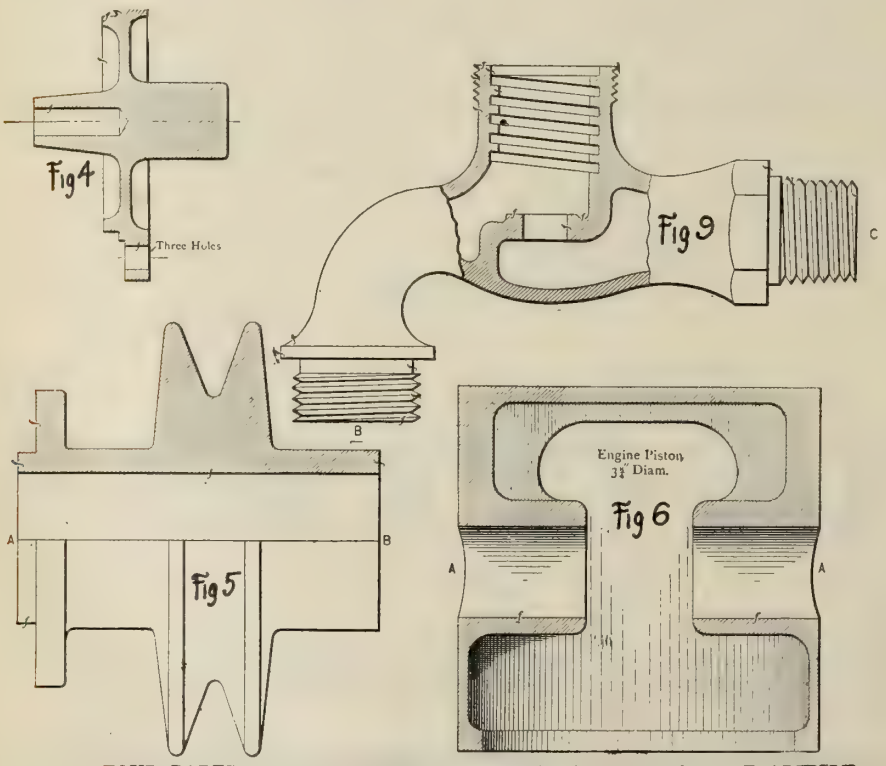
The part is a bronze valve b and it is finished at one setting single head machine of 7½ in. ca outside of jaws. The piece is turned, faced, necked, tapped and t ed at the rate of 160 per hour, a entire part is finished in the t the boring operation.

Bronze Bibb Body

A compression hose bibb body, of bronze, and finished at three se on a single head machine of 5 maximum diameter outside of ja shown at Fig. 9. The operation End A, bore, turn, face, seat, nec of thread, tap and thread. End B turn, back, neck, back of threa flange, and thread. The other f has to be bored, turned, face threaded. On face A the produc 280 per hour; on face B 300 per and on face C 320 per hour. The ination tap and die head already red to works in to good advanta side A of this piece.

Fig 10 shows an oil stove elbow of brass that is finished at one s on a single head machine, the tions being to turn, face, drill, an 600 are produced per hour. At is shown a stove doorhandle o iron which is finished at one on a single head machine, the tions being to turn end, face an shoulder, face flange, and mill f shank, The production in this 500 per hour.

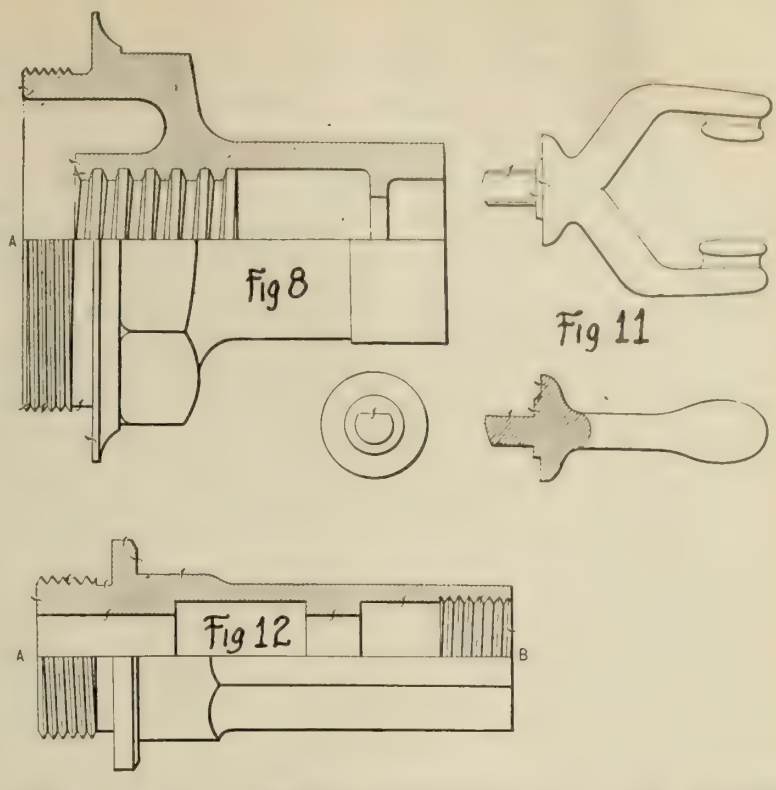
It will be noted that in both thes



FOUR PARTS, THE DESCRIPTION OF WHICH IS GIVEN IN THE ARTICLE

a illing operation is included as well as the regular turning, drilling, and boring operations. In such a case, a special off-center milling attachment is used, so that milling can be accomplished incidentally with the other operations. Uniformity in distance between centers of the two operations is assured by reason of their being performed simultaneously and at the same setting.

The concluding example, Fig. 12, shows a door check gland made from malleable iron. This part is finished at two settings in a single head machine, and the operations on face A are:—Turn, bore, face, ream, neck and thread. On face B, the part is turned, bored, faced and tapped. The production at end A, is per hour; at end B, 95 per hour. On this work it was absolutely essential that the machining operations should be concentric and parallel with the octagon exterior. For this reason draw-in octagon collets were used in the universal work holding turret, this insuring the desired



FIGS. — 8, 11 AND 12. SHOWING THREE EXAMPLES OF WORK COMPLETED.

PORTABLE PETROL DRIVEN CRANE.

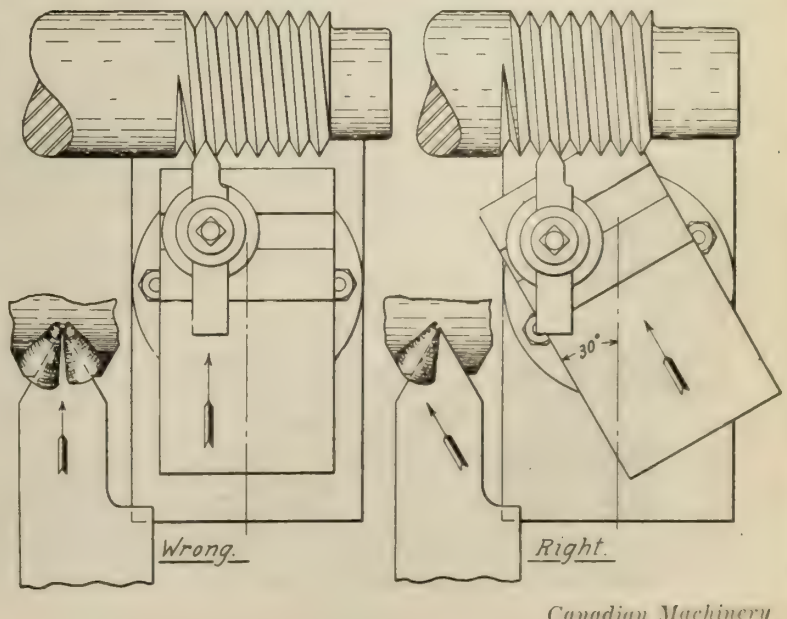
Steam and electricity have hitherto been the chief means of driving cranes of large size larger than could be operated by hand, but the compactness and the convenience of the petrol engine have recently to its application to cranes of lighter grades. A good example of this new type is a portable crane designed by a British firm mainly for use in building operations. It is driven by a four-cylinder petrol engine and is made in two sizes, one capable of lifting half a ton and the other with a capacity of one ton. An important feature of this crane is the special gear which enables the driver, simply by moving a control handle to lift a load at any speed from a crawl to the maximum, while the engine runs continuously at its most efficient speed. If for any reason the handle is released the brake is automatically applied on the instant and the crane comes to rest with the load suspended. The engine acts as a counterweight and the whole equipment is so light and well-balanced that it can be easily moved about on its four wheels or slewed as desired.

WATCH THIS.

If for any reason it is necessary to blow out an acetylene pipe line with compressed air, great care must be taken to eliminate all air and gas mixture from every branch of the line before starting to use welding and cutting torches. Air and acetylene mixture in the pipe line is exceedingly dangerous; a flashback from a torch may cause rupture of the pipe line.

Thread Cutting on the Lathe

When cutting V-threads on the engine lathe it is nearly always advisable to swing the compound rest to an angle of 30 degrees with the main cross slide. The point of a cutting tool loses its keenness due to the heat generated through friction, not alone of that between the tool and the work, but also by the curling of the chip and the breaking up of the same. When the feed of the tool is at right angles to the axis of the shaft, the cutting takes place on both sides of the tool—as shown at the left of the sketch—causing chips to curl against each other and creating excessive heat, and breaking down the point rapidly. At 30 degrees inclination the cut is made as shown at the right, allowing chip to curl freely and retaining edge longer. Feeding is done with the compound rest. When thread is just about finished, feed lightly, and alternately, by the cross and the compound feeds.



Canadian Machinery

Grinding Practice—Variety Of Fixtures Used

Grinding Machines are Very Diversified in Character—Grinding Conditions Should be Closely Considered by Operators—Examples of Cutter Grinding and Other Fixtures

By F. SCRIBER

IN no field of the machine tool industry can there be found the basic differences in design as in that of grinding machines. When we say lathe, shaper or milling machine, at once there leaps to the mind a conception of the general types of machines employed for this purpose. When we say grinding machine we have in reality left no impression on the mind, for in this class of machine tool there has been incorporated features which are to be found in most every type of tool. For example, there are plain cylindrical grinders, surface grinders, internal grinders, tool grinders, cam shaft grinders, oscillating head grinders, vertical surface grinders, and a multiplicity of varying shapes and construction incidental to these general principles. Nevertheless, it is surprising, in spite of this fact, how one general type of machine will be used in many factories for various styles of work, including tools, much of which might be more suitably handled on a machine of specialized construction. The purpose of this article is to dwell briefly on the principles of some of these machines, to show how the grinding wheel comes into contact with the work, and describe a few grinding set-ups.

Referring to Fig. 1, we have shown illustrations of two machines, the lower view depicting a small internal grinder of a type known as a bench grinder. On this machine the wheel shaft A is driven by the shaft B, these being contained in a suitable adjustable bracket mounted on a base C. The work is held at D, on spindle E, said spindle being made to revolve the work. The work spindle is carried in a bracket F, which has longitudinal and cross adjustment, all of which is mounted on a pivoting piece G contained in the base of the machine. This construction permits of adjusting the work around to various angles so that either tapers or straight holes may be ground, and also permits of radial grinding. The machine is usually set on a bench or stand, and when grinding radial surfaces the work is set the required distance from the center from which the work carrying spindle oscillates. Graduations on the surface X of this pivotable bracket permit of accurately setting the work to the required angle.

Now let us consider the machine illustrated at the top of Fig. 1. This is of the type usually employed for medium and heavy cylindrical grinding in which work H is ground by a wheel J, the work b revolved and traversed longitudir past the wheel by means of table K, action of which is controlled by the dles shown at the front of the machir

Figure 2 depicts a few typical grin jobs. The first of these is a tapered ib ground as indicated at G. This surface grinding job and requires a ture for holding it on the proper ar Below at Y is shown a tapered spi

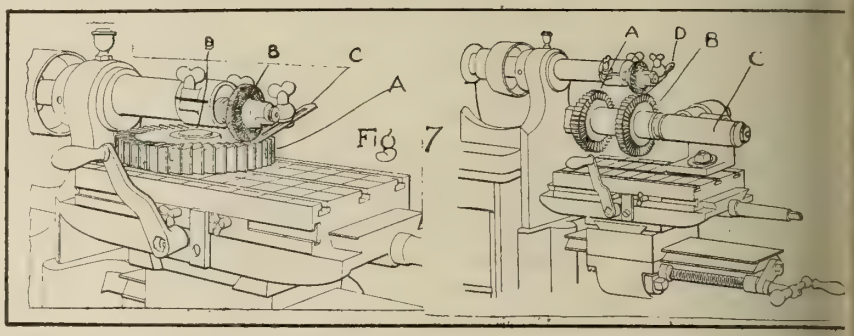
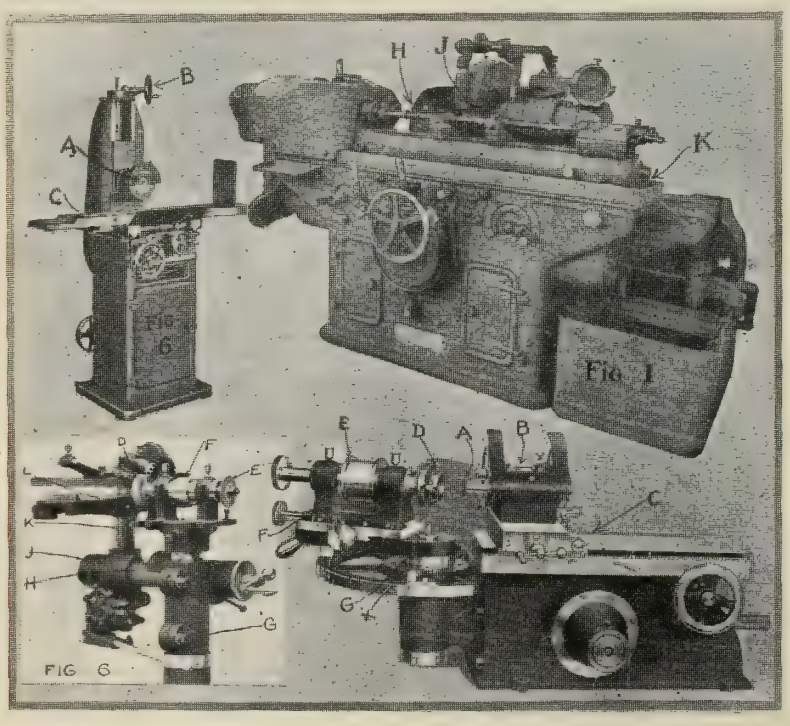


FIG. 7. — TWO SET UPS FOR CUTTER GRINDING.

This is a cylindrical grinding job, piece being ground as indicated at G It is necessary to set the grinding mac table on an angle to grind this taper. W is shown a form tool blank. Th a surface grinding job, it being cus ary to cut a form in surface P, of shape to make the work wanted screw machine, and after hardening tools, to grind the surfaces indic using formed grinding wheels w necessary. At Z is shown an eccer roll on which it is necessary to grind hole and outside diameter. The could be ground on a machine such shown in the lower view of Fig. 1, v the outside eccentric diameter menti could be ground on a machine of type shown in upper view by settin on an off-set arbor.

Before going further it is desire point out certain grinding condit which should be closely considered operators and those who have charg such machines. These relate to w contact and the handling of the wh on the machine, Fig. 3, which is a grammatic illustration emphasizing s of these features.

At A is shown a grinding whee contact with a piece of work of s diameter X. This view and arc indic the length of grinding wheel contact the work. At B is shown a wheel in tact with a piece of work of much la diameter, and the point that I wis bring out is this, that owing to the l arc of wheel contact for taking the s depth of cut on the large diameter, tive to the same depth of cut on the s diameter, it is desirable that the speed of the machine be slower



FIGS. 1 AND 6. — SHOWING VARIOUS STYLE GRINDING MACHINES.

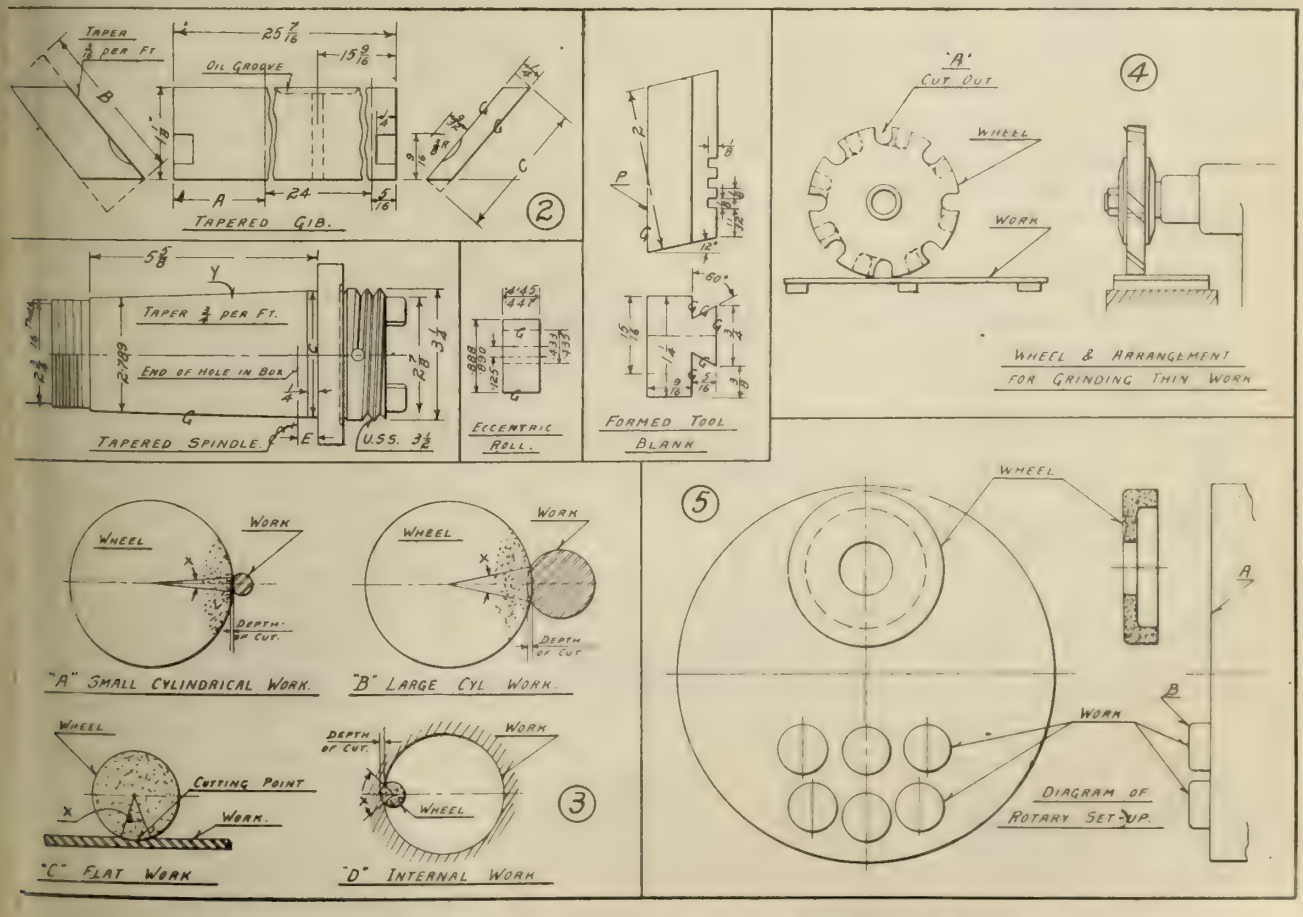
guding the large diameter, than when guding the small diameter. This condi on prevents excessive wheel strain ar overheating of the work. At C is shvn a grinding wheel in contact with a fla piece of work for surface grinding, an here it will be obvious that the arc of ontact is even larger for a given de h of cut. At D is shown a small rding wheel in contact grinding a o in a piece of work, and it will be noicl that the arc of contact is relatively ne long. The importance of regulatng he peripheral speed of the work to a e fine degree will be readily appreisd by considering the conditions exstg when grinding work such as hen in these diagrams. It is an imoant part of the operator to so regut the work speed of his machine that fi a given grade of wheel, a definite eh of cut, and a grinding wheel reding at a proper cutting speed, that t mount of stock removed will be the u during each feed of the work past tewheel regardless of whether cylinrid, surface, or internal grinding is i done. As is well known, a grinding l of a given grade will vary some h in cutting properties, so it is pracy impossible to set definite rules for l but an experienced operator should oo become familiar with and underg these basic conditions, and govern i peration of the machine accordingly, l is to obtain maximum production nstent with a good grade of work.

I Fig. 4 is illustrated a wheel which has been cut away as shown at A. This wheel was used for surface grinding on work which became warped on account of extensive heat generated in grinding, and in cutting the wheel out as shown, in addition to obtaining intermittent contact with the work, the revolving wheel creates air chambers and acts as a fan which helps considerably in grinding thin flat work. It will be noticed in this connection that the slot is cut diagonally across the face of the grinding wheel, the object being to have part of the wheel cutting at all times so that the wheel and grinding wheel spindle will not vibrate as the slots pass over the work. As the wheel revolves, the work traverses under the wheel lengthwise, and at each passing of the wheel across the work, the table carrying the work is fed crossways, so as to present an unground surface to the grinding wheel every time the work passes under the wheel.

Another principle often employed in grinding is to grind with a vertical wheel and a rotary work carrying table. A setup of this type is shown in Fig. 5, where the work is mounted on a table A, which may or may not have a magnetic chuck on it. The wheel revolves at high speed and is brought down in contact with the upper surface B, and as the table revolves under the wheel all the parts held on the table are brought intermittently in contact with the wheel and are thus ground. When grinding on this type of machine the work has quite a long contact with the grinding wheel, therefore the speed of the work in its rotation must be regulated accordingly.

Fig. 6 depicts two types of grinders which are very popular in the tool-room. The one at the top is a surface grinder in which the grinding wheel spindle A is carried in a slide and is fed vertically down upon the work by means of a hand-wheel B. The table C travels longitudinally under the wheel and carries the work, while this same table is carried in a saddle and is fed crossways under the wheel by means of a hand-wheel at the front of the machine. At the bottom at Fig. 6 is shown a tool grinder. This is applicable for use when grinding various types of cutters and reamers, the work carrying members being made universal so that with suitable attachments most any type of cutter can be ground. Two grinding wheels D and E are carried on a spindle driven by pulley F. These are mounted on a column to which is attached a bracket G which is free to swivel thereon. Attached to this swivel bracket is a post H, upon which is mounted a swivel unit J. In this unit is a post K carrying a platform L on its upper end to which is attached various fixtures for grinding different types of tools.

Two examples of cutter grinding are shown at Fig. 7, the one view showing the side teeth on a side milling cutter being ground, the cutter being indicated at A, the wheel at B, while C is a suitable gauge. The cutter is placed over a stud D, and one tooth on the cutter comes against the gauge C, thereby locating it



FIGS. 2, 3, 4 AND 5. — SHOWING VARIOUS CONDITIONS MET WITH IN GRINDING PRACTICE.

radially about the stud D. The cutter, which is on a table, is then fed crossways under the grinding wheel, thus grinding one tooth. It is then revolved to the next tooth and this is likewise ground, continuing until all the teeth have been finished. The other view shows the same machine arranged for grinding the face of two of these milling cutters, and it will be noticed that the cutters A and B are mounted on an arbor in a bracket C. The gauge D comes against one tooth and locates the cutter radially on the arbor, when by feeding the table crossways the face of one cutter is ground, or if both cutters are to be the same size, the wheel is fed across both cutters. If they are not to be the same size, one cutter is completely ground on its face, following which the knee of machine carrying the cutters is fed up the required distance so that the next cutter can be ground to the correct diameter.

Having treated at some length on the generalities of grinding machines, and illustrated some principles of construction and operation, the remaining illustrations will show various methods of holding work while grinding. The first of these is the internal grinding job shown at Fig. 8. This is a rocker arm made in two sections bolted together. The arm is carried on a cast iron face plate A held to a revolving spindle on a cylindrical grinding machine. Two studs B and C are mounted on this face plate so that the two small holes on the rocker arm will slip over these and locate. The nuts D, when tightened, hold the rocker arm in place, and a small grinding wheel E, revolving at high speed, is fed longitudinally forward and back through the large center hole of the rocker arm, this of course doing the desired operation. The cross feed of course is used to feed the grinding wheel into the work to the required depth of cut, thus bringing the work to desired size.

Grinding in the tool-room at the present time is practically indispensable where any quantity of accurate work is to be produced. A large percentage of tool-room grinding consists of gauge grinding, cutter grinding, and tool grinding, much of which is handled on a surface grinder similar to the type shown in Fig. 6. A good percentage of the work ground in the tool-room is left to the tool-maker's judgment as to how it should be set up and handled. In Fig. 9 is shown a single point threading tool A being ground, and as quite a number of these tools had to be made from time to time, it was found advisable to use the fixture shown for holding them at the correct angle while grinding the surfaces B and C. As is obvious from this illustration the cutter to be ground is held in the formed block D which holds it at an angle so that the grinding wheel E may be fed across the face of the tool. The clamp F, tightened by nut G, holds the tool securely in the block, and after one side has been ground, it is laid aside until all other tools in the batch are similarly ground, following which they are reversed and the opposite side C completed.

An example of gauge grinding is shown in Fig. 10, this being a tool-making proposition. The gauge A is held in a vise B and is not removed therefrom until the completion of the grinding of surfaces C and D. The grinding wheel E is fed across the surface D in the usual manner until this surface has been rough ground, after which the wheel is raised and surface C rough ground, the upper surface of the wheel coming in contact with this latter mentioned face. The finish grinding of surface C is then completed. The wheel E is next lowered and surface D finish ground, the work testing between the surfaces by means of his measuring instruments until they are the correct size.

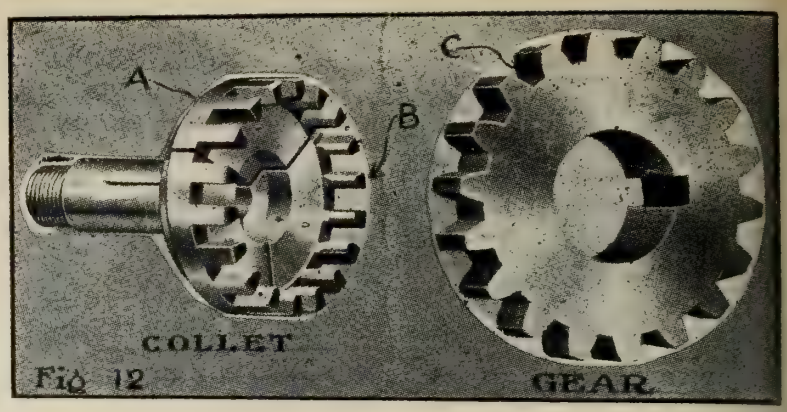


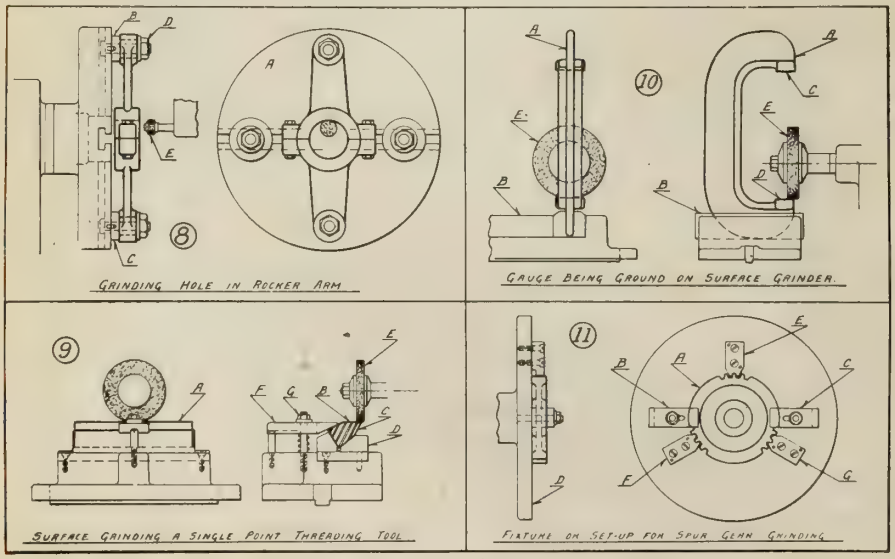
Fig. 12

COLLET USED FOR HOLDING THE GEAR SHOWN.

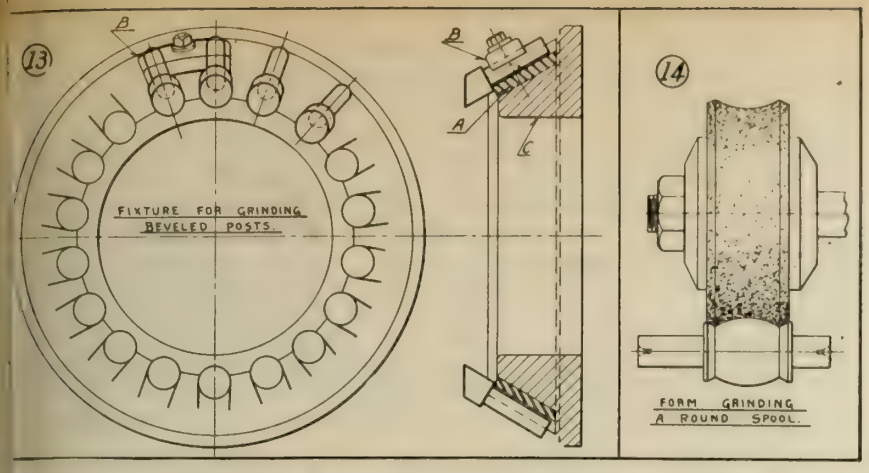
A fixture suitable for holding a gear while the hole is being ground in a cylindrical grinder is shown at Fig. 1. The gear A is held to a face plate on the revolving head of the grinding machine by means of two clamps B and C, which hold the gear against surface D in the usual manner. To locate these gears centrally on the face plate, three pins E, F and G are attached to the plate, these having one tooth space accurately cut in them so that they will just mesh the gear on the pitch line, thereby locating the gear centrally from the pitch diameter. After grinding the hole, the gear is placed on an arbor and the side diameter ground. This insures that the hole of the gear will be accurate with the pitch diameter, and likewise that the outside diameter of the gear will be concentric with the hole and pitch diameter.

Another method of holding a gear while grinding is shown in Fig. 12. This consists of a spring collet A, having a series of teeth cut into a surface B. The gear C is placed into this collet, and the collet is caused to contract and grip the gear on the pitch diameter in the usual manner, the collet having three slots cut in it for this purpose.

Mention was made in Fig. 5 of a rotary surface grinder, and an example of work being held on one of these grinders is shown in Fig. 13. Here we see a number of beveled posts held in a fixture which is attached to the rotary table of the machine. The posts are held on an arbor, all being located in a ring A, being held thereto by clamps B. These clamps grip two posts each, holding them securely to the ring. The ring is held to the face of the fixture C by means of screws and dowels, and with a number of parts set in the manner shown the vertical grinding wheel may be brought into contact with the posts, all the bevelled surfaces being thus ground simultaneously. Many parts machined on a rotary surface grinder are merely held thereto by means of a magnetic chuck where the work may be laid on a flat surface.



FIGS. 8, 9, 10 AND 11.—SHOWING VARIOUS GRINDING OPERATIONS.



IG 13 AND 14. — FIXTURE FOR BEVELED POSTS, ALSO METHOD OF FORM GRINDING A ROUND SPOOL.

Before concluding, it is desirable to al attention briefly to form grinding. g. 14 is shown a formed spool which round by feeding the wheel trans- ly into it, the spool of course re- ing while this is being done. Many ferent shapes are ground by this od, it being of course necessary to the wheel to the proper form for ing the work.

While extensive description of any one type of machine has been avoided in this article it is thought that the versatility of the application of grinding wheels will be more generally appreciated from its perusal. A very small portion of the grinding field has been covered and anyone confronted with grinding production problems will do well to investigate the widely divergent designs before selecting the type most suitable for his particular need, or concluding that the job is not applicable to grinding.

RECORDING THE TEMPERATURE CURVE IN NEW CONTINUOUS KILN FOR THE CERAMIC INDUSTRY.

By H. CHAMBERS.

The General Combustion Company has recently installed a continuous kiln for the heat treatment of ceramic ware at the plant of Lennox Inc., Trenton, N. J. Figure 1. shows a cross section of the kiln. It will be noted that the material to be treated moves through the kiln on cars. The car on the right hand side moves in the opposite direction to that on the left. The reason for this movement of the cars in opposite directions will be apparent on inspection of Figure 2, showing sectional plan and elevation of the kiln.

The material to be treated enters the kiln cold and is gradually heated to a maximum temperature at the center of the kiln, which portion is known as the "heating zone." After passing through this heating zone the material gradually becomes cooled as the car approaches the exit end of the furnace. The reason for using two chambers in which cars move in opposite directions through the kiln is to increase the thermal efficiency by making possible a heat exchange between cars opposite one another at any point in the kiln. Due to the fact that the material on one car is increasing in temperature while the material on the car opposite to it is cooling, air currents are set up by which heat is transferred from the cooling car to the one opposite which is increasing in temperature.

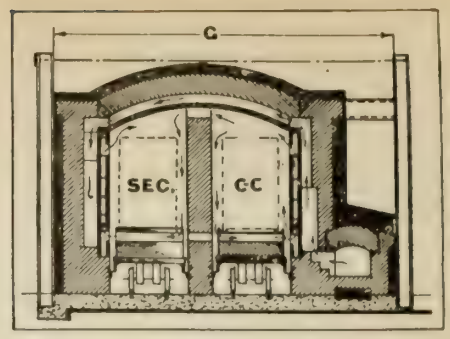


FIG. 1. — CROSS SECTION THROUGH FIRING ZONE.

In the heat treatment of one class

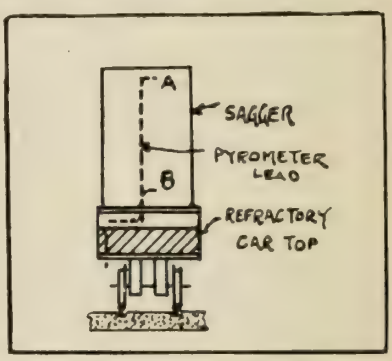


FIG.3. — SHOWING CAR TOP, SAGGER AND PYROMETER LEAD.

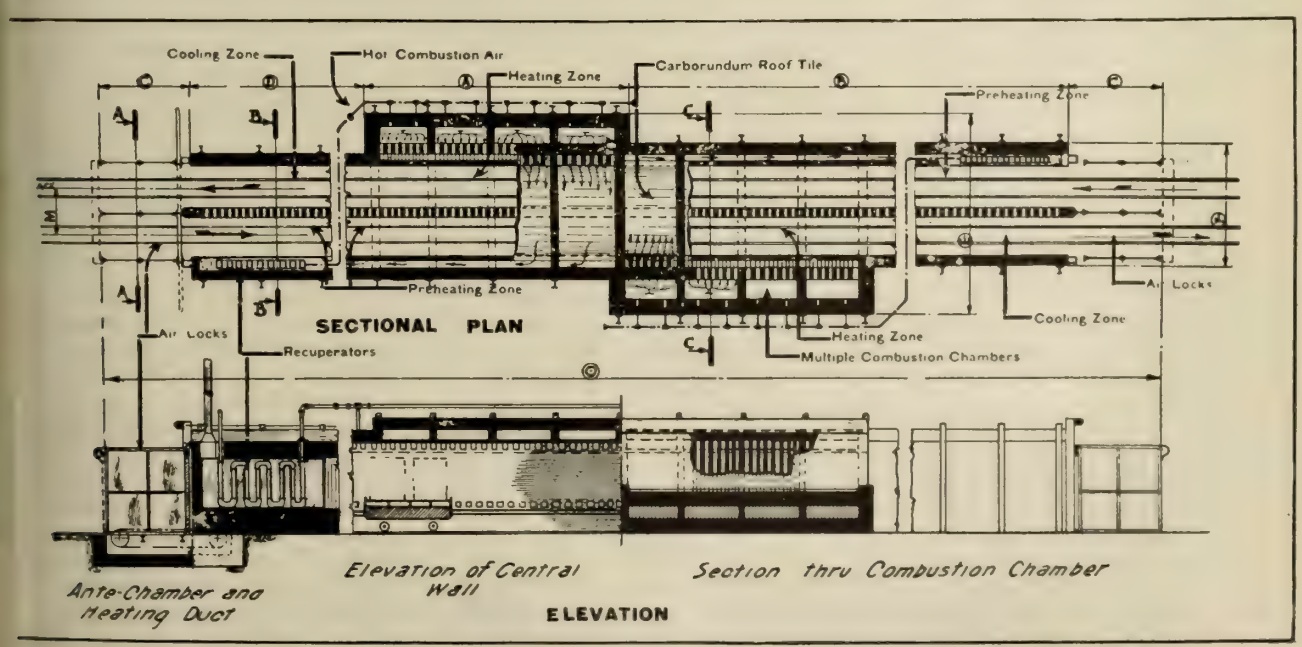


FIG. — SECTIONAL PLAN & ELEVATION OF A DOUBLE CHAMBERED CAR TYPE TUNNEL KILN FOR HEAT TREATMENT OF CERAMIC WARE. NOTE THE FIRING ZONES OF THE TWO CHAMBERS ARE LOCATED DIAGONALLY OPPOSITE EACH OTHER.

of ceramic ware, it is desired to gradually heat the ware for a period of about thirty hours, to a temperature of 2,000° F. The ware is held at 2,000° F. for a period of about 3 hours and then gradually cooled over a period of about sixteen hours. The ware is packed in cylindrical clay saggers standing about four feet high on the car. The temperature of the ware inside the saggers must follow a pre-determined time —temperature curve, within fairly close limits. Curves taken have shown excellent results.

Figure 3 shows the manner in which the two thermo couples, A and B, are placed in the saggers. A and B record the temperatures near the top and bottom of the saggers respectively. The cable connecting the couples with the Recording Pyrometer is sufficiently long to allow the car to travel the full furnace length of sixty feet. The connecting cable is either fed by hand or unrolled from a drum as the car progresses through the furnace. Successive cars having refractory tops serve as a moving hearth for the heating chamb Hydraulic rams travelling one foot p hour move the cars through the kiln.

For correct furnace operation the t variables which must be determined a firstly, rate of travel of cars throu kiln; secondly, temperature of heati zone. Having fixed the rate of trav of the cars, the correct temperature the heating zone is obtained by repe ed trials until the correct time-temper ture curve is obtained.

Hints on Packing and Shipping Goods for Expor

Packing Should Be As Light As Possible, Keeping In Mind The Strength And Resistance to Shocks Necessary to Carry Goods In Proper Condition to Their Destination. Present Method Shows Room For Improvement

PACKING and Shipping for export will always be a live subject. Many hints have been given, Major Gordon B. Johnson, Trade Commissioner in Glasgow, Scotland, being the latest to air his views. Here is what he says:—

"No part of the technique or machinery of overseas trade is of more importance than the packing and despatch of shipments. On the manner in which goods are packed depends their condition on arrival at destination, the amount of rail and ocean freight charged, and the amount of customs duties imposed at the port of the country of destination. Packing should be as light as possible keeping in view the strength and resistance to shocks necessary to carry intact and in proper condition to the end of the journey, not forgetting the numerous and exceedingly rough handlings to which all overseas shipments are subjected, and certainly not forgetting the possibilities of pilferage. This evil has grown enormously since a few years ago and is so great that marine insurance companies will no longer accept risks, unless the packing is especially well done. For example, tin-lined cases. If it is necessary to increase the weight by means of a heavier caes with metal bands and straps in order to obtain sufficient strength, then this course should be followed. It should be borne in mind that ocean freights are charged according to weight or measurement at the option of the transporting company, so that all shipments regarding which there is a possibility of a measurement basis should occupy as little space as possible.

In the case of shipments to Great Britain where import duties apply to only a small number of articles, the wishes of the buyer should be carefully considered, as they are based on a long and thorough knowledge of overseas trade and its requirements. and on the customs and preferences of the market concerned.

Canadian methods of packing following American methods, are looked upon by importers overseas in a general way as inferior to British and Continental methods, particularly British, and this is the impression that anyone is likely to have who has knowledge of Canadian overseas trade in general. Nevertheless it is surprising, on investigation, to land so many Canadian products of diverse kinds packed and shipped not only in an exemplary manner, but in some cases in a way not reached by shippers of any other country. On the whole, however, there is decided room for improvement.

Marking.

Packages for export should be marked with the mark of the consignee, the point of destination, the serial number of the package of the shipment, the weight and dimensions. Such marks should be plainly stencilled. Labels and tags, whether tied on or glued should not be used except where absolutely necessary, and only in cases in which stenciling is inapplicable. The mark of the consignee is usually placed inside a geometrical figure corresponding to his mark in the bill of lading, the serial number of the package and the point of destination being placed outside.

Handling at the port of destination, particularly in customs houses, is facilitated if the marks are in duplicate, on opposite sides in the case of packing cases.

Lumber.

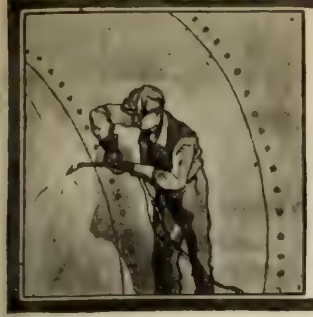
As a rule Canadian lumber appears to be shipped in a way that calls for little or no criticism, but there are one or two points in the minds of importers in the Scottish market regarding shipments which should be brought to the notice of such of the shippers as ha failed in the past to observe certa precautions. For example, large floori should be shipped in fairly small bu dles, wired and protected at the edg Anything thicker than 1-inch st should be shipped loose. Thin lumb should be properly bunched—that the widths should be picked, and ca observed that the narrower widths not placed inside the wider, as the la ter, because of the tight wiring of t bundle and because they overlap t narrow widths, are subject to being be lengthwise and thereby broken. In fa this often happens.

Each piece should be properly mar ed with the consignee's mark shown the bill of lading. Deals are marked the same way sometimes stencilled the ends.

What appears to be legitimate grou for complaint among importers of lu ber is connected with bills of lading, a is directed against shipping compani rather than against the exporters. bill of lading issued by the shipowne to the shipper may state that so ma bundles of lumber have been receiv on board, containing in total so ma pieces. As bundles may be, and pr bably are, of different sizes, the co signee has no redress against the tran porting company if pieces are missi by bundles becoming loose through wi or string giving way. Similarly t statement in the bill of lading regardi a shipment of loose lumber that " many pieces more or less on board to delivered" is also unsatisfactory to t consignee. A definite number of piec should be stated, thereby providing "clean" bill of lading.

Another cause of complaint is in co nection with the through bill of ladi for rail and ocean transport. Buyers this side would feel more secure

(Continued on page 53)



WELDING AND CUTTING



Fillet and Butt Welding by the Electric Arc

Fillet Welding is Very Useful in Sealing Leaks in Riveted Joints —Various Methods of Producing the Weld—Butt Welding— How to Successfully Perform Such Welds.

IN THE July 14th issue of "Canadian Machinery" we discussed the welding of heavy sections by means of the electric arc. In the present article we shall consider fillet welding and butt welding as accomplished by the same process. Fillet welding is very useful in sealing leaks in joints made with rivets, or by any other method, but care must be taken in case the joint is loose to make it secure and rigid before trying to seal with the fillet weld, because with the loose joint the entire strain is thrown on the fillet which, in general, is not of a cross section equal to the original plate, and hence weld will be blamed for tightness failure where an entirely different cause was the trouble. If the joint cannot be made tight before welding, sufficient fillet must be added carefully to secure strength at least equal to the original joint.

It will be noted that in Fig. 1 at (a) the fillet welding for tightness is simply a single bead carefully run so that it sinks in equally in both plates. This can be accomplished practically by the arc being drawn directly over the crack to be sealed with the electrode held pointing slightly more towards the upper or vertical surface, as gravity will take

Permission secured from the Electric Arc Cutting & Welding Co., Newark, N. J.

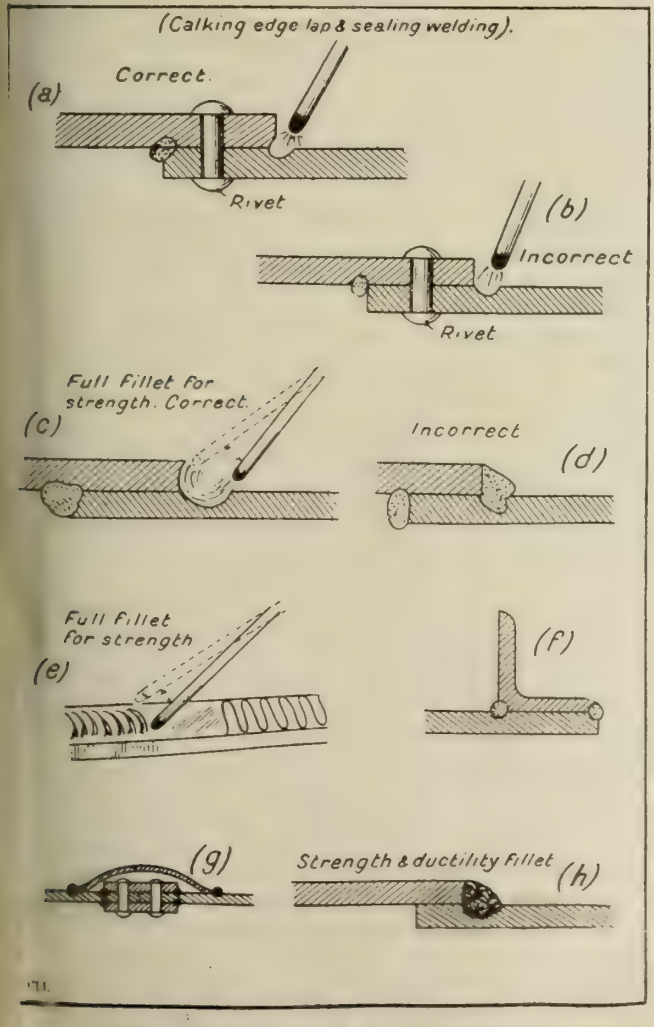


FIG. 1—EXAMPLES OF FILLET WELDING.

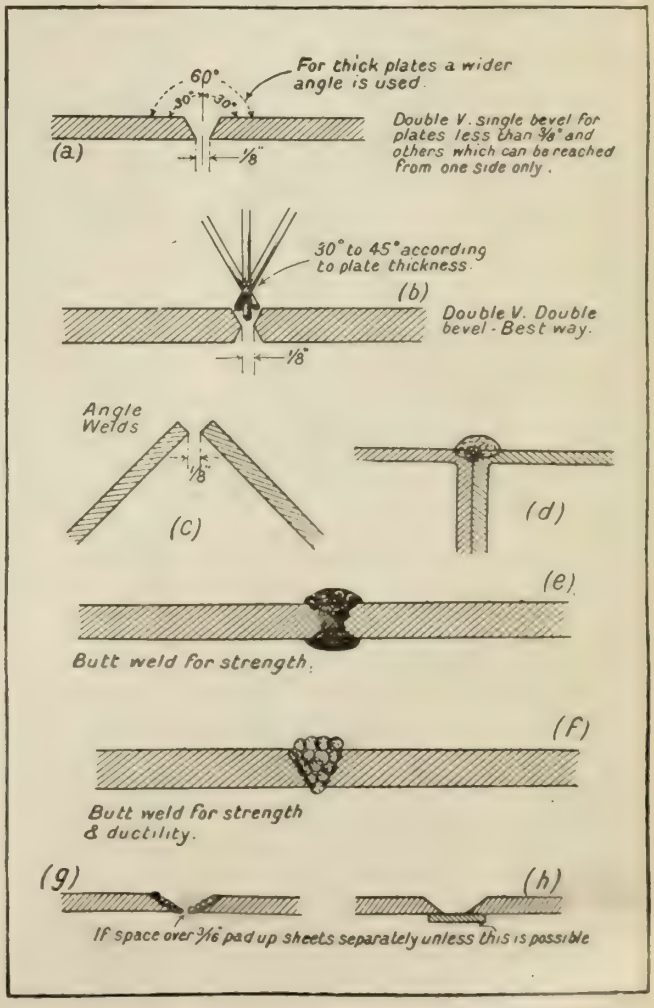


FIG. 2.—EXAMPLES OF BUTT WELDING.

care that enough metal from the electrode is deposited on the horizontal surface. If the electrode is held as shown in (b), i.e., somewhat exaggerated, of course, a beautiful weld may be made to the horizontal face, but none to the vertical face, thereby not sealing the joint although the weld may apparently be solidly against the vertical face. This comes from the arc not having been drawn from the vertical face and hence no crater having been made there, and although the electrode may have been pointed towards the face it simply runs down lying against it without welding.

Welds by Spreading

Fig. (C) shows fillet welds made by spreading, i.e., the electrode is moved back and forth either side of the crack so that the arc is forced to follow, forming a trough alternatively in the horizontal and vertical faces into which the electrode material is to be deposited. This method requires more skill than the single fillet, or a succession of single fillets, but, on the other hand, is quicker for full strength fillets. The most reliable way of all is to make one single bead as shown at (a) directly over the crack and then fill in for strength as shown at (c), advancing in such a manner that the bottom or horizontal part of the weld is always slightly in advance of the weld on the vertical face so that there is minimum danger of the molten metal running down and ahead of the arc. Fig. (e) shows how this should be accomplished by a side view.

Fig. (d) shows incorrect fillets with the metal overlapping, i.e., run ahead of the arc and with welds lying up against, but not fused into, the vertical face. Fig. (f) shows the manner of successive short beads necessary to obtain ductility in the weld. This method is necessarily slower and must be done more carefully, but where the weld is made up to resist bending strains, there is much greater chance of obtaining the necessary ductility than with the method shown at (c) although the combination method of (a) and (c) as described above, will give ductility of the sealing bead but not the second and final layer. In order to have the final layer reasonably ductile, even with the metal shown at (f) an additional layer should be added at generally a higher current value in order to anneal the entire mass. This additional layer for fillet welding must, in general be left in place, as it also adds additional strength, and whether the fillet is slightly larger makes no particular difference unless for jobs where fit is necessary, in which case it can be machined off. In machining a weld, sufficient annealing layer should be added so that as little as possible of the weld on which strength and ductility depend is to be removed.

The welding of boiler tubes after they have been rolled, beaded and often processed, is the most prevalent example of a single bead fillet for tightness only. Here the tube is secured in place to start with, even when a new tube is put into an old flue sheet, generally a ferrule of copper is put in between the new tube end and the old sheet to allow for the difference in size caused by the first or previous expansion. When a copper ferrule is properly applied, none of it sticks out beyond the bead, but even if irregular pieces do stick out the sealing weld can be made as usual, as a reasonable amount of copper fuses well with the steel of weld, bead and sheet. The proper cross section of the tube sealing bead should be egg-shaped with the large end welded in, and there is no need of chipping off the small protruding end, as experience has shown that no scale or soot results. In rolling and beading tubes, oil is used, and this oil must be burned out of the sheet so it is out from under the bead, or in welding the oil gas will bubble out through the weld, causing leaks and no job. The edge of the bead and flue sheet should be cleaned of scale by chipping or sand blast, the latter being the better, but not always available.

A heavy fillet, i.e., one that cannot be made in one bead, can be easiest and most reliably made by welding vertically from the bottom up, the bead into the two plates or surfaces of the fillet sides being welded first, following across the weld one layer behind the advance into the work surfaces. If the reverse method is followed there is danger of metal running down ahead of the puddle into the pocket of the V.

Butt Welding.

Butt welding, especially of plates, is the most satisfactory method, and in general is much stronger than lap welding unless with the possible exception of a joggled lap weld, i.e., one or both of the plates bent in lapping so that the weld is in the direct line of the pull or stress, which in the case of a joggled weld with one plate only joggled may be virtually a butt weld, with the additional overlap welded edge of the plate in which the jog is made.

Lap welds in general are not as strong as butt welds, because of the tearing and twisting strains due to the weld not being in the line of stress. A weld with additional plates such as the strap weld is stronger than a plain butt weld, but in fact, a butt weld is used as a foundation for strap welds. Riveting and welding where strength is the quality desired do not mix with advantageous results. For instance, one might expect that 50 per cent. strength could be made in a joint by riveting and the other half by welding, or that 50 per cent. of the strength could be made by spot welding and the remainder by arc welding. This assumption has been proved entirely erroneous, and an explanation is that in plates the joints are called upon to withstand the stresses one at a time, and that cases arise where the strains come on in a wave, so that the maximum at one point may be more than the factor of safety for half the strength of the plate, and would tear off different kinds of welds at 50 per cent. strength, like buttons on a coat, if the pull were on one at a time, whereas a direct pull coming against all the buttons would be withstood, and could be relied upon for the figured strength. In other words, the riveted joint must be considered at its strength and the spot or arc welded joint at its strength, and the strength of the joint be considered as the strength of the maximum, but not the strength of their addition.

In making a butt weld better results can be had by double bevel double "V" as shown at (b) Fig. 2, but where the plate is not unduly large, i.e., less than one half-inch, but where access for welding can be had only from one side, the single bevel and double "V" is almost as desirable. For work thicker than half inch the single "V" has to be widened out to such an angle that the electrode can be added with assurance at the bottom of the "V" so that the amount of metal to be added is from two to three times as much as with the double "V". Geometrically, a single "V" is twice the area of a double "V," but in welding this ratio is not exactly borne out because in both the single and double "V" the butt edges are left slightly apart and this reacts more to the advantage of the single "V" than the double "V"; however, as explained above, due to depth of the opening the single "V" requires more metal to be added, takes longer, less chance to make a perfect weld and internal strains, if any, not balanced. In other words, if a single "V" weld of any appreciable thickness is made lying flat the ends of the plate will turn up like the wings of a bird. If the plate is held down there will be a strain in the weld of the adjacent steel, and if this strain is less than the ult strength, the steel will take it up; if not, a crack will result either in the weld or the adjacent steel The double "V" offers the solution of balancing these strains, especially if the weld is not made all at one time or one side, i.e., run the first bead on each side and then fill in on the side opposite to the second bead run. On large work two men sometimes work on a double "V," one at each side.

Double "V" Weld

The double "V" weld has the advantage of the great liability of the metal falling through the abutting edges and as is well known, where no weld is made the metal is necessarily burnt because there has been no means for conducting the heat into the plate and lowering the massed temperature to the desired point for welding. If the correct heat adjustment of the machine was made for the metal to be burned from falling free there would never be a large enough crater in the parent metal to make a weld. Any metal thus falling through a double "V," if not cleaned out before the bead on the side is started, will exist as burned metal, or is liable to exist as slag due to the heat of the second bead completely devitalizing both the metal fallen through from the first bead and the new metal of the second bead because the burnt metal of the first bead will not conduct away the heat which is required in welding into the parent metal. This is gone into in detail to show that on imperfectly joined work, if the metal appears protruding it must be stripped off.

(Continued on page 53.)

What Causes Explosions in Air Compressors?

Effect of Cylinder Wall Temperature—Dust and Carbon—Carbonization of the Oil—Ignition of the Carbon—Removal of Carbon and Oil Deposit—Air Valves Should be Cleaned.

*By A. D. RISTEEN.

MANY who have speculated on air-compressor explosions have attributed them to the ignition of il vapor. The air in the compressor cylder has a rather high temperature uring a part of each cycle in conseuence of the heat developed by comession. In an ordinary air compressor ith tight valves the theoretical limit of mperature might be somewhere about 0 or 700 deg. F. if the compression ok place without any loss of heat. ctually, however, there is a considerle cooling action on account of water ckets and intercoolers, so that the aximum temperature should not exed something like 400 degrees.

It has been maintained that lubricatg oil is likely to give off an inflamble vapor at this temperature, which, en mixed with the air in the comessor, is capable of exploding. Some the opponents of this theory have, wever, confidently stated that explons occur in connection with high sh-point oils even oftener than they in conection with those having low sh points.

ffect of Cylinder Wall Temperature.

Most of the oil that is present in a mpressor cylinder is lodged on the lls of the cylinder, and owing to the oximity of the water in the cooling j'kets these walls do not have a temp'ature anywhere near as high as the a in the middle of the cylinder. Under gd operating conditions and with welldigned apparatus the inner surface of tl cylinder wall is probably not much nre than 50 deg. F. hotter than the naximum temperature of the jacket w er. If this is so it follows that the o that is adhering to the cylinder is n giving off any significant amount of lammable vapor, because the greater pt of it is adhering to the comparatily cool metal.

ome of the oil will be lodged on the to of the piston, and this may be hot enough to give off a certain amount of inammable vapor if the flash point of th oil is lower than the maximum temperature of the air in the cylinder. It is nportant, however, to note that unde normal working conditions the air in the cylinder is comparatively cool during the greater part of every cycle, the high temperature being attained only toward the end of the compression stroke. Hence, the total evaporation of oil from the faces of the piston will be far smaller than the advocates of the oil-vapor theory have probably assumed.

Oil spray in the cylinder or connections is sometimes suggested as a source of explosive action. It is hard to understand how spray could be formed from oil that has once adhered to the metal walls, except in consequence of the rupture of some part of the apparatus; any spray of this kind that does not immediately lodge on the walls is swept out into the receiver with the next discharge from the compressor; and moreover the amount of such oil spray would be so small that any explosion that it might produce would not even be noticeable.

Dust and "Carbon."

We come, now, to the consideration of such combustible solid matter as may be present in the cylinder or its connections; and here we are encountering a far more serious item. The free solid matter that is found in the cylinders, piping and receiver of air compressors is of two general kinds. First, it contains whatever may have been introduced into the air compressor in solid form; for example, dust drawn in through the intake. The dust held in suspension by the air that is taken into the compressor usually contains more or less mineral matter, which is likely to be either sandy or clay-like. Such matter is incombustible and probably would not be directly harmful except as it may increase the friction and the wear. But the incoming air may also contain combustible material, and this must be reckoned with. The combustible matter may be of an organic nature, or it may consist largely of particles of carbon. This last condition is most likely to prevail when the intake of the compressor is near a coal pile, or where it can take in more or less smoke from a chimney or stack.

"Carbonization" of the Oil.

The other source of solid matter in the cylinder or receiver or connections is the so-called "carbonization" of the oil itself. We speak of solid deposits of this nature as "carbon," but although they contain free carbon they consist largely of oil in various stages of disintegration, and of compounds formed from the oil under the influence of heat and the oxygen of the air.

Carbonization is due in large measure to the use of improper oil or of an excessive amount of it. The oil should have such a composition that it is reasonably stable at the temperatures that are likely to occur in the compressor or its connections; and this means, among other things, that it should not contain any animal or vegetable constituents, but should be purely mineral. Any oil will undergo a certain amount of decomposition, however, under the conditions to which it is exposed in air-compression apparatus. Slow oxidation is favored by the fact that the oil is spread out in a thin layer and exposed to heated air. Moreover, at the temperatures that prevail in the apparatus the oil is likely to "crack" to some extent. That is, it is likely to break down slowly with the formation of somewhat lighter oils and the simultaneous liberation of a certain amount of free carbon.

No oil that is worth even momentary consideration contains, in its original state, any free carbon; and the percentage of carbon present in the oil (in combination with hydrogen) is no criterion whatsoever of the likelihood of the oil to deposit carbon. The carbon deposits thrown down by paraffin-base oils are said to be hard, gritty and specially adhesive, while those that are derived from asphaltic-base oils are

OIL USED IS IMPORTANT

Carbonization is due in large measure to the use of improper oil, or of an excessive amount of it. The oil used should not contain any animal or vegetable constituent, but should be purely mineral. No oil that is worth even momentary consideration contains, in its original state, any free carbon; and the percentage of carbon present in the oil (in combination with hydrogen) is no criterion whatsoever of the likelihood of the oil to deposit carbon.

Any oil that gives a considerable deposit of so-called carbon is objectionable in connection with air compressor lubrication, whatever the nature of the deposit.

* he author is connected with the Travellers In-ance Co., and presented this article before th Engineering Section of the National Safety Co cil at Philadelphia.

described as fluffy and easily removable. However that may be it is certain that any oil that gives a considerable deposit of so-called carbon is objectionable in connection with air-compressor lubrication whatever the nature of the deposit.

Ignition of the Carbon.

It is well known that these "carbon" deposits take fire at times, and this can hardly be due to the air in the compressor attaining a temperature high enough to ignite pure carbon, especially when the carbon is in compact form.

It is not unlikely that the free carbon that is present in the deposits occasionally acts as a catalyzer, in promoting the rapid oxidation of the oily matter with which it is associated. Catalysis plays an important part in modern chemical manufacturing, and we are enabled by means of it to bring about many chemical reactions that will not occur unless a suitable catalytic agent is present. Charcoal and coke are among the substances used in this way to promote certain chemical actions; and perhaps it is not unreasonable to assume that the carbon in a compressor or its connections may sometimes induce rapid oxidation of the oily matter. It is known, too, that some of the products that would be formed in this way are themselves capable of acting as catalyzers, so that they might accelerate the action when it had once become well started. Fine metallic particles, worn off from the cylinder or the piston, are sometimes present in the deposit, and iron oxide often occurs to a significant extent, both being active catalyzers under certain conditions.

The heat generated by the beginnings of the oxidation would facilitate further action, and so the thing would go on until presently we might have a glowing or burning mass. This in itself might precipitate an explosion by heating the metal walls so that they could no longer withstand the normal air pressure to which they are subjected. Furthermore, the carbon deposit, if it happens to be of a light and fluffy nature, may be disturbed so that we have what is in effect a dust explosion, the finely divided carbon playing the part of the dust and the ignition taking place in consequence of the catalytic firing of the oily matter in the manner described.

Hard carbon deposits often prevent the valves of a compressor from closing properly, and this is likely to cause serious overheating. The piston, in making its return stroke to fill the cylinder with a fresh charge of air, will be followed by a certain amount of the compressed and therefore heated air, flowing back through the leaky valves from the receiver and its connections. Under these circumstances the contents of the cylinder are already, and before the compression begins, at a temperature considerably higher than that of the surrounding atmosphere; and this means that when the next compression stroke is completed the temperature in the cylinder may be a good deal higher than it would be if the valves were tight. The increase in temperature produced in this way and also by the friction of the air in churning back and forth through the restricted valve opening naturally accelerates any tendency toward the production of fire and is, therefore, a serious matter.

Removal of Carbon and Oil Deposits.

Every effort should be made to prevent the accumulation of "carbon" deposits anywhere about the compression apparatus, and such matter as may be deposited in spite of all reasonable precautions should be cleaned away, frequently and regularly. A good deal can be accomplished in the way of cleaning the compression apparatus by discontinuing the oil from time to time and feeding soapy water into the cylinder for two or three hours—say once a week. The solution may be made up of one pound of soft soap to seven or eight quarts of water, and it is advisable to feed it into the cylinders at something like ten times the rate at which the oil is ordinarily supplied. The frequency with which this treatment should be given depends upon the experience with the particular air compressor under consideration.

Some authorities recommend the introduction of a solution of lye into the pipe between the cylinder and the receiver every month or two. The lye solution may be made up by using one pound of lye to eight or ten quarts of water, and it may be delivered into the air discharge pipe by means of a sight-feed lubricator at the rate of 60 to 70 drops per minute. After using the lye or the soap solution the receiver should be blown off, and oil should again be used in the cylinder for a time before stopping the compressor. Otherwise rusting is likely to occur.

When hard carbon deposits form which are not removable by the treatment here suggested, they should be cleaned out by whatever means may suggest itself as most effective. For instance the air valves should be removed whenever necessary and cleaned by mechanical means. No kerosene or other inflammable solvent should be introduced with the air, however. This practice which is far from unknown, is exceedingly dangerous.

HOW TO GET RID OF RUST ON IRON OR STEEL BEFORE ELECTRO-PLATING

By RALPH H. BUTZ

In the electroplating of iron and steel it is always necessary to clean the surface from grease, oil, rust and other foreign matter previous to plating, otherwise, of course, the deposit will not adhere to it. The cleaning of the surface leaves a chemically clean surface and one which is in the ideal condition for rusting. It is not uncommon to find a plater who will carefully clean rust from an iron or steel surface for the purpose of plating it, and then, before the actual plating operation takes place, unknowingly allow it to rust again.

After pickling or cleaning off the grease or other foreign matter, the plating operation will be satisfactory if the article is carried, after being rinsed, directly to the plating tank, as it then will not have an opportunity to rust; but if it is allowed to remain some time, as it is usually required to do, before plating, then trouble usually commences.

Iron or steel which has been cleaned and is ready for plating should never be allowed to dry, if possible. If it is allowed to dry, then it will invariably rust. As it is always impossible, however, to plate the articles immediately after cleaning, and they must remain for some time previous to this operation, then some process is necessary to prevent rusting during such interval.

Clean surfaces of iron or steel ma be prevented from rusting by immersio in an alkaline solution of some natur It does not matter just what this alka line solution is, but it must be strongl alkaline. Among the substances tha can be employed are: Sodium carbo ate, sodium bicarbonate, potassium ca bonate, caustic potash, caustic soda c lime. These substances, of cours should be dissolved in water. The on which is most satisfactory is sodiu carbonate (carbonate of soda or sa soda). This is cheap and readily di solves in water. Lime water can be use but is not as good as sodium carbona for the reason that it is apt to leave film of carbonate of lime on the wor and this must afterwards be remove with weak acid. The sodium carbona is the best substance for the purpos

Editor's note:—At present there a several preparations on the market th claim not only to cleanse the parts, b protect them from rust. Recently w were privileged to watch a demonstr tion of such a compound, and the par dipped were not only allowed to dry, b were left for some considerable tim without any sign of rust. Rust can likened to one rotten apple in a barr of good apples. Once let it get a sta and it will go through the whole barr



WHAT OUR READERS THINK AND DO



SCREW CUTTING QUERY

(Answered by J. Davies)

I notice a screw cutting query in the May 5th issue by J. H. R. The following is my solution:

$$\frac{9.875 \text{ inches}}{6 \text{ inches}} = \text{Pitch to be cut.}$$

$$\frac{1 \text{ inch}}{4 \text{ threads}} = \text{Pitch of the lead screw.}$$

$$\text{Thread ratio} = \frac{9.875 \times 4}{6 \times 1} = \frac{39.5}{6}$$

$$= \frac{79}{12} \text{ gears required.}$$

We will next proceed to compound the gears; as 79 is a prime number and cannot be divided or factorized, it is impossible to cut this pitch without a 79 gear. The gears required would be 79-75—45-20, the first two being the driving and the last two the driven gears. This gives 79 revolutions of the lead screw to 12 revolutions of the work. In order to put the nut in at the right place for each cut it would be necessary to reverse the lathe or measure off 19¾ inches (79 divided by 4) on the lathe bed. The nearest approximation with the gears available in the given set would be

$$\frac{13 \times 6}{2 \times 6} \text{ or } \frac{78}{12} \text{ instead of } \frac{79}{12}$$

This would mean 65 into 30 and 60 into 20, and the actual pitch cut with such gears would be $6.5 \times .25 = 1.625$ inches, an error of twenty thousandths per thread.

SCREW CUTTING QUERY

(Answered by J. McL.)

The necessary gears can always be arrived at by the simple method of multiplying the decimal pitch by any number that will give an even number of inches. Multiply this number by the number of threads per inch on the lead screw and thus obtain the desired ratio for the gears. In the example stated, the pitch of the work screw is 1.6458 inches, and this multiplied by 48 gives 78.998 inches. Taking 79 as the resultant (an error of .002 in 79) the threads of the lead screw in the same length would be 79×4 equals 316 threads. The desired ratio then would be 316 to 48. However, gears with teeth of these numbers are not available, so it is necessary to obtain the same ratio by compounding the train. By the simple process of cancellation this can be done. Multiplying each term of a ratio by the same number does not alter its value.

To prove the accuracy of this statement, multiply the teeth in the driving gears by the pitch of the lead screw, and divide the product by the teeth in the driven gears, thus:

$$\frac{79 \times 75 \times .25}{20 \times 45} = 1.6458 \text{ inches.}$$

SCREW CUTTING QUERY

(Answered By S. Leeman)

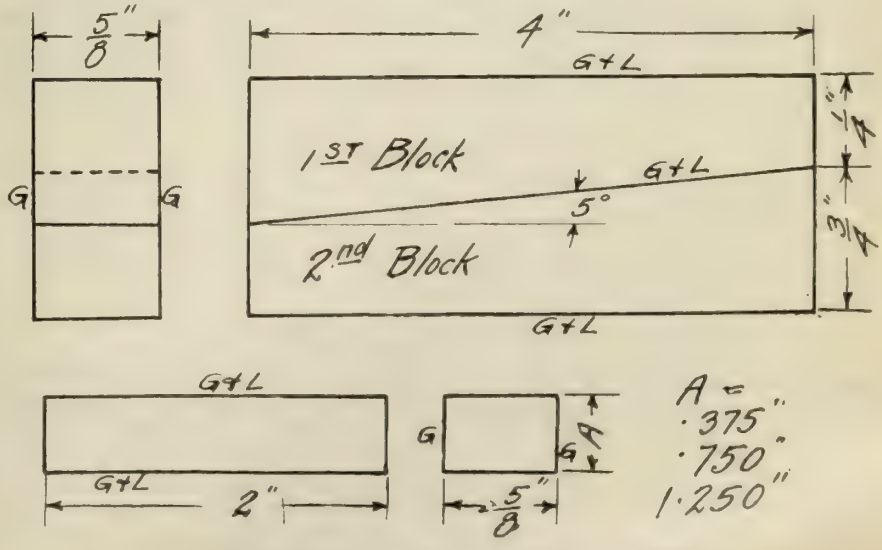
From the nature of the "screw cutting query" in the May 5th issue of Canadian Machinery, it would appear as though the piece might be a troublesome one to handle, if done in the ordinary way on the lathe, and if these are required in quantities it might be advisable to rig up a separately driven end mill of the proper angle, instead of the single pointed lathe tool. As the gearing is obtained from the relative pitches of the work and the lead screw, or 6 turns of the spindle to 39½ turns of the 4-thread lead screw, gears of a like ratio are required. As it is impossible to use gears with 6 or 39½ teeth, we try doubling them, giving 12 and 79, but as 20 is the smallest gear in the given set, we use it in place of the 12. This slows down the lead screw 3-5 of the required number of revolutions, but by using the 50 and the 30 gears—both of which are included in the set—on the intermediate stud we can overcome this. The gear train, starting from the spindle, would then be, 79 into 30 and 50 into 20; the 79 being the new gear to make. If an 80 gear was used instead of the 79 there would be an error of about one-eighth inch in 6 turns of the spindle.

SLIDING PARALLELS.

By GEORGE R. BROOKS

The sketch shows a set of sliding parallels that are inexpensive, yet save both time and money. They eliminate making a master check with each different size of snap gauge, and the beauty of it is, that any gauge maker can make them.

I made mine from Jessop's tool steel, this showing about 80 on the scleroscope. The angle surfaces should be lapped to wring together, and the



SHOWING HOW THE PARALLEL BLOCKS ARE USED.

straight sides should be ground and lapped parallel. The parallels will give a range of ⅝ in. to 1⅜ in., and the three additional blocks ⅜ in., ¾ in., and 1¼ in., will give a range sufficient to cover the majority of small snap gauges. Of course additional blocks can be made for any larger size required. An accuracy of .0001 in. can be maintained with these parallels.

SCREW CUTTING QUERY

(Answered by R. H. Hicks)

Regarding the screw query by J. H. R. in the May 5th issue. The thread ratio is 1.6458 inches divided by .25, or 6.5832. To obtain the greatest accuracy have a new gear made with 66 teeth and use the train 66-40—80-20. This will give a ratio of 6.5999, which is very close to that of the required ratio of 6.5832.

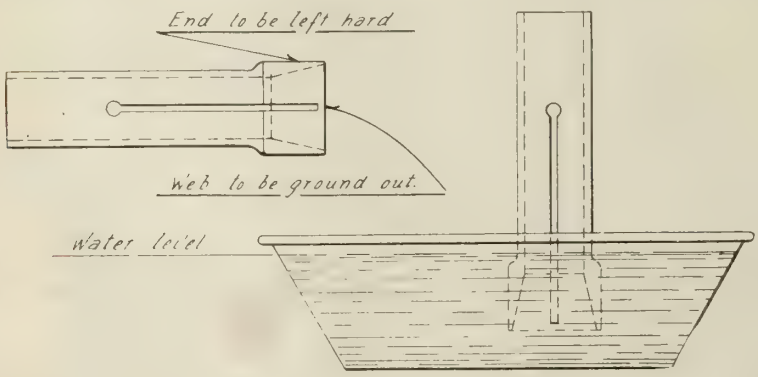
HARDENING DRAW-IN COLLETS.

By C. E. H.

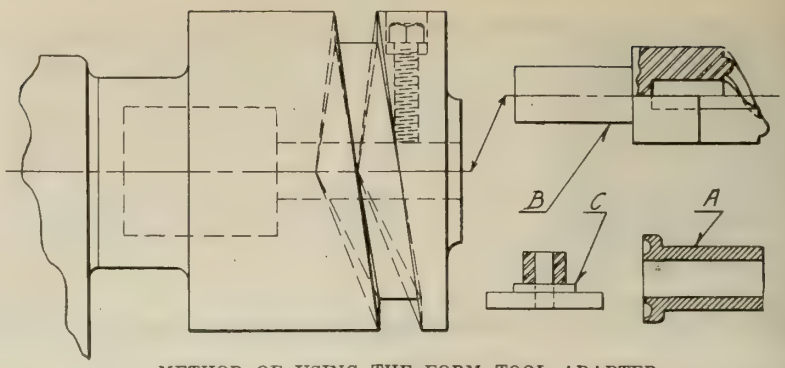
Having several small draw-in collets to make which were to be left very hard at the end, and being a cheap job which was not to be ground afterwards, the following method was adopted by the writer, and good results obtained without any trace of distortion. The collets which were less than 1/32" in the walls, and about 1½" long, as shown in sketch, had three slots milled lengthwise 1" in length. They were bored and turned to size, and the slots milled within about 1/32" or less from the top edge.

They were then heated and quenched in oil, nose downwards and perpendicular to the surface of the oil bath. They were then drawn with a torch to a spring-temper from the back end, with the nose (to be left hard) just held below the surface of a dish of water. The small webs left at the end of the slots were then ground out with a small carborundum wheel about 1" dia. and 1/32" thick, held in a small dental hand-piece.

While the hand-piece may not be available in the average shop, the small wheels with suitable arbors may be had at any dental supply house for a few cents, and can be held in the lathe chuck with fair results, but the high speed necessary for such small diameters is lacking.



HOW THE DRAW IN COLLETS WERE HARDENED.



METHOD OF USING THE FORM TOOL ADAPTER.

Just in passing it might be well to mention that the small cost of a flexible shaft and hand-piece and small motor, with the many handy little attachments such as burrs, polishing bucs, points, brushes and small grinding wheels, (which are obtainable in every conceivable shape and size) will be offset in a few weeks in the time saved on the hundred and one little jobs which can be done in a few minutes, which would take an hour or more if done by hand or other inconvenient methods.

This handy equipment has to be used but once to be appreciated; and in the machine shop where they do the finer class of repair work its value is inestimable.

Some time ago the travelling mechanic for an adding machine company was in town, and he had with him a small hardened cam which was to go to make a repair he had in hand. It was an odd-shaped thing and did not quite fit; and had to have a little ground out of an out-of-the way corner. Well he "peddled" it around to several machine shops but they could not touch it, as it was too small for their equipment. The last place he went to was a shop who did out heavier work, and they sent him to us. The manager brought him to the writer to see if we could help him out. He looked devoid of hope and was positively leg-weary; but when we did his little job with the ever-ready handpiece in two minutes, using a small wheel about ¼" dia. and 1/32" thick he became quite enthusiastic and has since paid us two visits with similar "bugbears."

I mention this at length to illustrate the extreme usefulness of a tool which until quite recently, has only been looked upon as an instrument of torture when the dentist says sweetly "open please."

FORM TOOL ADAPTER

When form tools are required that do face forming, and are to be ground without changing their form, an adapter made to fit the lathe spindle can be used to advantage. This adapter is bored out to fit the shank of the forming tool and on the outside is a cam slot running around with the necessary amount of lead to give sufficient clearance on the tool (b). The tool blank is first made up and then a quarter of the land is milled away so as to permit the tool to withdraw when making the cuts to form it. The carriage of the lathe (one that the pinion can be withdrawn from the rack so as to permit easy travel) is connected to the cam by the strap (c) which is fastened across the carriage. On this strap is a hardened stud and roller. The product of this type of form tool is shown at (a). Owing to the peculiar shape of the form tool, care should be taken in its hardening.

NEW ZINC ALLOY.

A new zinc alloy for bearings is discussed by Heinrich Falkenberg in "Metall und Erz." According to an abstract in "Technical Review," it is known that an alloy consisting of iron 1.6, zinc 94.9 and lead 3.5% is a mixture very suitable for bearings. The production of this alloy requires a melting temperature of 405° C. The product has a crushing strength of 1,740 kilogs. to the square centimetre. Futher investigations have shown that a higher temperature, up to 1,000° C., and a corresponding increase in the iron content up to 3%, give a greater resistance to compression strains—namely, 1,620 kilogs. The process of producing this alloy is as follows: In a graphite crucible, 6.5 parts of hard zinc are melted with 3 parts of iron at a temperature of 1,000° C., well stirred and the dross removed. To this bath, 3.5 parts lead are added.



Heat in Bearings

CLAIMING that the heat in a bearing is not the cause of fear, C. H. Norton, in Mechanical Engineering, comments as follows:—

"The bugbear of mechanics has always been hot bearings. We have tried to develop bearings that would work without generating any heat at all.

"I conducted some experiments with a pair of journals running in half boxes with the upper side of the journal exposed. A recess on the leading side of the journal was made in the box to receive the oil and the corner was rounded to induce oil to flow between the journal and the box. This recess was filled with a heavy oil which rolled under the journal and remained upon it when it was slowly turned. As its speed was increased, oil was left in the recess until at a speed of 1,000 feet a minute on the journal periphery nearly all of it was scraped off into the recess. Even at this speed there was enough left on the journal so that it did not abrade the metal. Though the temperature was so high that it would burn the flesh the journal continued to run uninjured.

"The heavy oil was wiped off, kerosene was placed in the recess, and a similar test was made. At high speed the kerosene appeared to remain on the journal and it revolved practically cold through quite a long period.

"Next an ordinary machine oil was placed in the recess and the journal revolved as before. At high speed part of this oil was scraped off into the recess. Some heating was developed, but not enough to burn the flesh and the heat did not increase above the original point.

"In the fourth test a universal spindle oil was used, which remained on the journal at all speeds. So little heat was generated that it was just barely warm, regardless of the length of time it ran.

"These experiments tend to show the correctness of the report on lubrication made by Lieut. G. S. Bryan, of the United States Navy, in which he said, 'The first effect of a high temperature in a bearing is to thin the oil. The effect of cooling the bearing is to increase the friction. There is no virtue in keeping a bearing at a low temperature by the use of a considerable amount of cooling water, and there is no reason why it should not be run at a high temperature as long as it is in good condition and is getting plenty of good clean oil.'

"My thought in connection with this is that we have been deceived into a state of fear because there is heat in a journal. Any journal that will revolve long enough without abrasion to allow us to manifest this fear and worry, I consider to be perfectly safe."

Speeds of Grinding Wheels

SPEAKING on the subject of "The Speeds of Grinding Wheels," W. T. Montague in Grits and Grinds, brings out some valuable points. He says that in general a soft grinding wheel revolving rapidly permits a higher production than a hard wheel revolving more slowly.

This is true, he states, because the more open structure of the soft wheel provides greater clearance for the grinding chips, which results in a freer and cooler cutting action. Theoretically, therefore, the correct speed for grinding wheels is the safe maximum speed at which the wheel may be operated. In actual practice, however, certain ranges of peripheral speed have been found to give good results on certain classes of ground work. For example, a satisfactory wheel speed for sharpening wood-planer knives is around 3,500 surface feet per minute; for off-hand snagging of castings, 5,500 surface feet per minute; for cylindrical grinding of crankshaft pins and bearings, around 6,000 surface feet per minute; and for cutting off hardened and high-speed steel, tubing, and the like, the proper speed approximates 9,000 or 10,000 surface feet per minute.

In surface grinding, lower wheel speeds are used than for cylindrical grinding, because mechanical limitations usually prevent the work-table being traversed fast enough to keep the wheel face opened up and free-cutting; but, generally speaking, certain grits and grades of grinding wheels operating under these speed conditions have given satisfactory results.

It is generally thought that the faster a grinding wheel revolves, the greater its productivity in a given time. This is not altogether true in precision operations, as in cylindrical grinding for instance. It is only true to a limited extent in off-hand grinding, such as the snagging of castings. In cylindrical grinding, the production of a given wheel is determined by the depth of cut, the table traverse, and the diameter of the work. Hence, the controlling and limiting factors are the rigidity and general sturdiness of the grinding machine to permit deep cuts, and the traverse speeds of the table or wheel, if the wheel-head travels instead of the work-table. Increase of wheel speed in cylindrical grinding changes the size and shape of the chips. The rate of production is not greatly affected, unless the higher speed permits the use of a softer wheel, which might cut more freely. But for a given wheel there is no difference in production, whether 4,500 or 6,500 surface feet per minute is used, provided the grade or the work speed is adjusted to these different wheel speeds.

He then speaks on off-hand grinding, after which he draws the following conclusions:—

1. The grade of hardness to be recommended for a grinding operation depends on the surface speed of the wheel.

2. The grinding wheel should be as soft as is feasible for the operation, and whenever possible operated at the high end of the recommended range of speeds.

3. For a given wheel used for precision grinding operations, not much increase in production is to be expected from increasing the speed of the wheel alone.

4. The logical way to increase production in precision grinding operations is to increase the traverse of the work past the wheel or the depth of cut of the wheel.

Self-Lubricating Bearings

A NEW bearing material which is a mixture of graphite and high grade synthetic bronze, and which has self-lubricating qualities of a high order, has recently been developed in the G. E. Research Laboratory following successful tests under service conditions. Perfection of this material—genelite—came after research extending over a period of several years.

The new material, says Scientific American, contains graphite amounting to 40 per cent by volume of the whole mass. Tests have shown a high degree of porosity, the metal being able to absorb as much as 2½ per cent by weight of oil. Another characteristic is that the bearing never siezes or freezes, that is, the metals of the shaft and the bearing never flow or weld together. If a bearing sticks, owing to too close a fit, all that is necessary is to reassemble it with the proper fit, no damage being done to the shaft or bearing.

Among the self-lubricating uses for the new bearing are brake-rod bushings, clutch-centering bushings, throttle control, fan and pump shaft bushings, where such material saves much trouble and expense of overhauling and repair. On the main engine genelite has proved useful for places such as main bearings, crank-pin bearings and piston-pin bushings, which are supposed to be well lubricated at all times, but where wear is likely to be excessive. The metallic component of the new bearings is made from the oxides of tin, lead, and copper, composing a high grade bronze, all the materials being in a finely divided state. Graphite is added in sufficient excess quantity to reduce the oxides to the metals, and leave the required graphite content in the finished material.

The mixture, still in powdered form, is then pressed as nearly as possible to the required shape in massive metal molds. In this pressed form it will not stand much rough handling, so it is given a final bake, which sinters the metals together into a homogeneous bronze, holding the graphite uniformly distributed throughout its mass. Baking clamps the graphite particles securely within the mass of bronze so they cannot be washed out or detached save by dissolving away the surrounding metal with acids.

Suggestion Dont's

THE General Electric Co., Schenectady Works, used their shop paper to good advantage recently to help employees who were offering suggestions. They issued a series of "Dont's" which aided the employees generally in sending in more complete ideas for perusual. Here are the "Dont's" that were published:

"Don't make suggestions of a general nature without giving instances of how and where same may be applied.

"Don't get the idea that your foreman will be 'sore' because you make suggestions. The average foreman in this plant is a 'regular fellow,' and is usually glad to help you get your suggestions into shape for submission.

"Don't forget to put your building and check number on the suggestion blank.

"Don't forget to give drawing and part numbers and also the name of the apparatus to which the suggestion applies. This is of great help to us in investigating the suggestion.

"Don't forget that even a rough sketch is of great help in making your suggestion clear."

Prevention of Accidents

THE prevention of accidents in the various branches of the petroleum industry differs but little from accident preventions in any other industry in this country. Though there are some hazards in this business which are peculiar to it, most personal injuries result from general causes, such as the men falling, being struck by falling objects, and injured in the use of hand tools.

In analyzing the reports of 1,000 accidents in this industry, continues C. L. Turner in Petroleum Magazine, it was found that over 31 per cent. were due to the workers being struck by falling objects; 10 per cent. were caused by the improper use of hand tools; nearly 9 per cent. by men falling or tripping; and about 8 per cent. by the men being struck by passing objects. Injuries by stepping on nails caused 4 per cent. of the accidents.

Thus, about 62 per cent. of the accidents reported were caused by the fact that the workmen had not fully acquired the safety habit. Very few of these accidents could have been prevented by any engineering revision.

Many accidents in the production division of the industry could be avoided by properly instructing the workmen and by the issuance and posting of notices showing the methods of procedure in the different processes where accidents are likely to occur.

Unguarded belts and shafting are always a source of danger and should be avoided wherever possible. Thorough and complete inspection of motor trucks at regular intervals, and care in the selection of drivers will materially reduce the accident hazard in the automotive branch of the industry.

The latest airplane journey of importance, that of the trip to Fort Norman, a distance of nearly 1,600 miles by airplane, has been completed in safety. This is one case where there is not the slightest suggestion of stunt. The main idea was SPEED. The Imperial Oil Co. wanted a party to arrive at their new oil fields as quickly as possible and the airplane was used as the best method available. It is significant that while the journey by airplane was exceedingly fast, the return journey by water took almost a month.

Selling the Sales Force

SPEAKING of a recent strike that the S. F. Bowser & Co., Inc., Fort Wayne, Ind., experienced, Frank H. Williams, who is an industrial consultant, states in Industrial Management, that as a result of the strike the plant lost 800 workers. He continues in the following strain:

The strike was broken, but,—and this is the interesting thing about the new workers,—in order to fill the 800 vacant places, over 4,000 men were employed at one time or another. In other words only one man in five measured up to the necessary qualifications.

Without going into details as to just what tests the company went through in order to pick its workers, it is interesting to know that one of the things the company did with these new employees was to "sell" them the sales organization. And in this selling of a concern's sales organization of the factory workers is a thought which might be made use of to good advantage by other plants.

Isn't it a fact that in many plants the factory workers have very ittle conception of just what the sales organization means to them? Isn't it a fact that many factory workers give the sales organization mighty little credit for the company's success and in fact, think of the salesman only as "guys" with a soft job, and the chance to dress up with white collars every day? And isn't it a fact that a better understanding on the part of the factory workers that without an efficient sales organization there would be no work for the factory, would tend to make the workers more respectful of company management and less inclined to feel that they are the whole works?

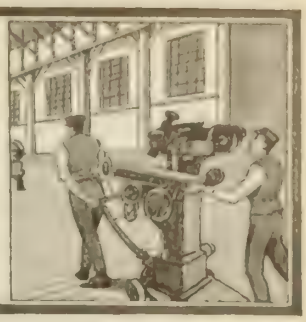
A Successful Experiment.

In the case of the Bowser company the effort to sell the sales force to the factory workers met with signal success. At the annual convention of salesmen held at the company's plant during the summer and attended by several hundred of the leading members of the sales force from every state in the union, a special effort was made to establish a co-operative point of contact between the salesmen and the workers. The salesmen were sent into the factory and were given in charge of specific workers who showed the salesmen around and explained to them just what the factory was doing. The salesmen, in turn, became chummy with the workers and told about some of the difficulties experienced on the road and finally, the salesmen gave badges to those workers who took them around the shop.

All of this was an eye-opener for the workers. Most of the workers had known practically nothing about the operations of the salespeople and it came as a considerable surprise to learn how hard the salespeople worked and how important they were in keeping the factory in operation. And that this all operated to create a splendid feeling among the new workers was attested in more ways than one.



DEVELOPMENTS IN SHOP EQUIPMENT



PRECISION DRAFTING INSTRUMENT.

E. Lawrence, 2533 McClellan Ave., Detroit, Mich., has developed a drafting compass that is intended for precision work, or for general use on the drafting board. The instrument is intended for the drawing of circles from 1/16 to 12 in., and by the use of an extension bar circles up to 24 in. diameter can be drawn. Plain points are provided, these being inserted in both arms of the instrument when using it as dividers.

The principal feature is the fact that the two legs are always parallel, or normal to the plane of working, hence the name, "Normal Precision Drafting Instrument." Because of this fact, the centers of circles being described are not gouged out, as frequently occurs when the points strike the paper at an angle. The instrument can be quickly set to the radius desired, and is then readily clamped in position, so that the radius will not change while the circle is being described.

The inventor claims that there is no back-lash or shake in the joints, as all of the pivots are of conic construction, made of steel and hardened and ground. The tightness of the joints may be adjusted by means of lock nuts. The grip is of large size and is made of aluminum, while the working parts are made of steel, tool steel being used for some parts and mild steel for others. The arms are rust-proofed by either of two methods. The first is the Parker process, which makes the arms jet-black; the second is by electro-sherardizing, by which process a coating of zinc is amalgamated with the steel, leaving the instrument gray in color.

SPOT-WELDING MACHINES

The Taylor Welding Company, of Warren, Ohio, are now manufacturing a welding machine for spot welding pieces of sheet steel from 1-64 to ⅛ inch thick. The machine may be operated either by hand or foot. Duration of contact is controlled by means of automatic switches. And control of the welding process is obtained by means of a button in the end of the hand lever. Adjustment can be made for seven different travels for the hand lever and the foot treadle. Pressure on the work is also adjustable. Water circulation is provided through both electrodes.

CYLINDER RE-BORING MACHINE

The Central City Machine & Tool Co., Syracuse, N.Y., have developed a reboring machine which is said to be able to rebore motor car engine cylinders without taking the engine out of the car. The machine is self contained and is provided with three bronze bearings supporting a boring-bar. These bearings are split to take up wear and keep the machine in perfect alignment. The boring-bar is driven by a worm-gear that insures a uniform drive from the motor, which is of ¼ horsepower capacity and may be provided for alternating or direct current.

Three cutter-heads are furnished for cylinders from 2¾ to 4½ inches bore, and they are constructed with a cam adjustment that gives a smooth equal movement. The four inserted cutters are placed opposite each other, and revolve on the boring-bar, which is accurately centred. This construction equalizes the pressure of the cutters during the entire operation. The cutters are made of "Rex AA" high-speed tool steel. The machine is the invention of L. S. Keeler of the above mentioned company.

TAP AND DISC HOLDER

The Warner & Swazey Co., Cleveland, Ohio, have patented and produced a new clutch tap and disc holder. Instead of 23 parts, which there was in the old type, the new holder has only eight, and it will hold either right or left hand dies or taps. To change from right to left a screw driver is all that is necessary..

The only difference in the tool when used for right, and when used for left hand work is the position of the pawl. To change from one to the other, the pawl is turned half way around in its hole. A small pin holds the pawl in the position placed. When threading, the pawl holds the tool rigid, by a metal to metal contact, until the turret stop is reached. Then the head moves forward on the work, pulls the cam over the pawl which releases the head, allowing it to revolve freely. The spring cushions the pawl so that the release is without jar and practically noiseless. The material in each part has been carefully selected and especially treated to stand up under the work required of it.

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Is A Purchasing Agent Essential?

SPEAKING of the value of purchasing agents a few days ago, we were surprised to hear a certain manufacturer say that he wouldn't give such an individual house room. To our mind the purchasing agent is somewhat like the Englishman, as portrayed upon the vaudeville stage, the butt of many a joke he doesn't deserve. There are good and bad purchasing agents, and while in some cases the ridicule is warranted there are many cases where such men are extremely valuable to their companies. Opinions differ as to the necessary qualifications of the person holding such a position, and since the entry of women into this phase of our industrial world, many former opinions have been rudely shattered.

We know of one purchasing agent, who upon receiving a shipment of goods went to the forman and said: "I say—I have just received a miscellaneous collection of highly polished brass objects, some with threads on the exterior, others with threads on the interior, while some again have absolutely no threads on them whatsoever." Needless to state this purchasing agent was an Englishman, and upon investigation the goods were found to be some brass nipples; some brass couplings, and last of all some ordinary polished brass pipe. This is not a fanciful tale concocted for the occasion, but is an actual happening. The worth of such a man as a purchasing agent, supposed to guard a concern's expenditures, is self evident.

Another concern we know of engaged a young lady who not only acts as stenographer, private secretary and bookkeeper, but purchasing agent as well. Contrary to the thought that is apt to spring up in one's mind, this concern is not a one horse affair, but a recognized business establishment that handles a large volume of work yearly. The position of purchasing agent has been reduced to a science in this case, and this young lady we speak of is thoroughly conversant with the needs of the factory and office. She keeps in constant touch with the market situation; knows what she ought to pay for the different materials, and in the event of the price not being correct, can prove to the would be seller, that his figure is too high. There is no need for bargaining.

These two examples will suffice. The question remains: "What qualifications should a purchasing agent hold?" To our mind he should be able to procure for a firm the best goods at the lowest posible market price. He should know the ins and outs of railroad work, should be able to push shipments along, and should at all times be conversant with the actual stock an hand.

He should if at all possible, become familiar with the shop's routine and plan of manufacture, for in this way he may discover leaks in efficiency. He should not merely be a desk executive. By this we do not infer that he should serve his time at the machinist's trade for this is unnecessary. There is just as much danger in such a procedure as there is in the other extreme. A purchasing agent must not be unduly influenced by the foreman's views. He should consider the foreman, but only as a part of a smooth working machine. He must attend to the daily wants of the factory, but if in his opinion, the system of requesting material is not satisfactory, he should openly discuss the situation with the general manager.

The task of purchasing agent, if handled correctly, requires tact. One cannot purchase from every concern and enemies have been known to cause friction. A record of all orders placed should be kept, prices, conditions, etc., being checked upon the same. We could go on indefinitely pointing out things a purchasing agent should do, but we will conclude with something he shouldn't do—viz., tell the manager his business—until he gets to the point where one manufacturer we know exclaimed "that Purchasing Agents were only men who had failed to make good at their ordinary clerical duties."

An Important Decision

THE recent decision of the British Government to abandon their lighter-than-air craft will come as a distinct blow to those interested in this phase of air service. The present program is sweeping in its intention and calls for the scrapping of all airship stations, existing airships, and ships in process of assembly.

According to those who wish the service continued, the decision has been reached just at the point where the business has become efficient. This viewpoint, however, is more than likely to be very one sided, as naturally the men engaged on such work, wish it to continue. There is only one true method of arriving at a decision in a matter of this kind. Inspect the cost sheets; see what they show, and if the value received in service does not in some small measure vindicate the existence of such craft, then by all means scrap the service.

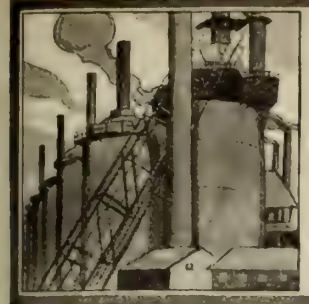
It may be a bad blow to aeronautics, but not so bad as would appear at first glance, for the decision only affects one section of the science. We still have our heavier than air machines which have proved of such value that there is not the slightest possibility of eliminating them. The money saved on the scrapped section can probably be devoted to the development of the other service with more satisfactory results.

Distilled Destruction

CAN YOU picture a poison so deadly that three drops placed on a man's skin will cause death? From Washington comes a report that the chemical warfare service of the United States have perfected such a fluid. It is claimed that 4000 tons of this fluid will wipe out 1,000,000 men, and that it will be possible to drop this death spreader from aeroplanes overhead.

The science of chemical warfare has certainly improved within the past five years, thanks to our past great war, and if those in charge of such departments all over the world keep on experimenting, they may yet succeed in making war such a horrifying business that nations will be afraid to start one.

In the days of Nero and Alexander, strength was the main factor in war, but at present victory goes to those nations possessing scientists with the greatest capacity of visualizing and perfecting horrors to inflict on the opposing forces.



MARKET DEVELOPMENTS



Expressions of Opinion Vary Considerably

The Market Shows Signs of Improvement, Although There Is a Tendency to Wait for Still Lower Prices—Steel Mills Operate at Greater Capacity—Railroads Are Possible Customers

THE observer who maintains an unbiased attitude cannot help but admit that the demand upon the steel market is slightly increasing, while on the other hand, prices are tending still further downward. Those who say there is no improvement, confess, when cross-examined, that there is at least some slight improvement, although as they say, it's not enough to do any good.

Some salesmen are complaining about present prices, saying that their customers will not take hold until prices are considerably lower than they are now. Others say that buyers are only taking what they actually require, and would not buy any more no matter what the price.

The middle of July can be safely said to have been the turning point in the steel market, as since that time improvement has been noted. True, the improvement is not very great in some lines, but others again have improved considerably, the greatest of all being sheets. From 30 per cent., on the part of the leading interests, and 15 per cent. for the independnets, the operative capacity of the steel mills has increased to 40 and 25 since the middle of July.

Although a wide open, competitive market in steel products exists, prices are not being slashed, nor can they be said to be in a regular course of decline. They sag now and again at one point or another, but it is quite certain that the market is not going to break any more.

The prospects in railroads are bright, and if present plans go through, the railroads will have money to pay their accounts and have something left over to spend on improvements.

PITTSBURGH, August 11.—As to the volume of demand upon the steel the steel market is slowly stagnating upward. As to prices, it is slowly stagnating downward. The observer who endeavors to maintain an unbiased frame of mind and watches conditions carefully can easily convince himself that these two trends do exist unmistakeably, also that the movements are very slow. Members of the trade exhibit the usual temperamental differences in their expressions as to the market Some express the greatest cheerfulness over the changes which have occurred. Others deny that there has been any improvement, but when cross-questioned have to admit that there has been what can be called an improvement, while they then insist that it is not enough to do any good. Steel salesmen who are anxious to see a big turnover complain about prices, saying that their customers will not take hold until steel prices are considerably lower. Those who are content so long as things are moving in the right direction instead of in the wrong direction, as they were for at least nine months, say that buyers are taking only what they absolutely need and cannot get along without, and would not buy any more no matter what the price.

There is more in this divergence of feeling than appears on the surface. There is a question involved, whether the old style of steel market movements is to be followed in future, or whether there is to be a new style of doing business. According to the old style prices would recede and recede until a level was reached too low to be permanent, and then a "buying movement" would start, jobbers and manufacturing consumers taking hold for forward deliveries because they expected prices to advance, filling the mills with specifications and laying in stocks because they expected the mills to fall behind in deliveries.

To many, however, it seems improbable that any such movement is going to occur. These others think the productive capacity is so large, and the mills are giving such good service in deliveries, that buyers will see no occasion to stock up, but will buy from time to time just as their requirements dictate, and that the mills, foreseeing such a condition as likely to last for a long time, will be careful not to let prices go down too far, lest they could not be gotten up again. If the steel market moves according to this style, it will not go down much more in the near future, but as time passes and costs can be reduced, it will sag a little at intervals.

Demand Broadening

The turn in the volume of demand upon the steel mills can be definitely set for about the middle of July. Some lines may not have improved noticeably since then, but they have not lost ground, and some lines have beyond question improved very considerably. The greatest improvement has been in sheets. At the middle of July the leading interest was operating at less than 30 per cent, and the independents at only about 15 per cent. In the past week the leading interest has been doing more than 40 per cent and the independents at least 25 per cent. The operations are a precise measure of bookings, whether of new orders or of specifications against contracts, most of the leading interests' business being of the latter character, for substantially all the business placed is for the quickest shipment that can be made. Tubular goods come next in point of improvement and merchant steel bars third. Rails are at the bottom of the list, being dead.

In some quarters there is reference to "improved sentiment" and all of that sort of thing. This is thinking in the past. There is no sentiment at all in this market, of one kind or another. Anyone these days who places an order or a specification does so because he knows he can work off the material at a profit and get his money. He has "confidence" in that, and is not trying to have confidence or avoid having confidence in the future of steel prices but simply expects to buy at the best price possible when he again has occasion to buy, which may be in a week, a fortnight or a month. It is plain, sound, substantial business.

Steel Prices

There is a wide open, competitive, market in steel products, and has been for several weeks. Prices, however, are not being slashed and can scarcely be said to be in a regular course of decline. Rather, they are

sagging now and then at one point or another. The market presents all the more appearance of stablity when there is open conpetition and yet so little happens. It is quite certain the market is not going to "break" any more. If there were going to be another break it would have occurred already. A break would have to be several dollars a ton. On carload lots bars are 1.75c and shapes and plates 1.85c. Possibly 1.60c has been done on some very attractive orders. If not, it is probably because orders sufficiently attractive have not appeared yet. It seems plain that prices could not go to less than 1.50c in conditions likely to obtain in the next few months.

These products went at 1.00c or 1.05c late in 1914. and that appeared to be an irreducable minimum. The freight rate advances since then add about $6 a net ton to the heavier finished products and say $8 a ton to the lighter, like tin plate, which requires a great deal of coal in its manufacture. Wages are likely to be on the basis of 30 cents for common labor, against 19 cents in 1914, and that means nearly if not quite as much as the freight advance, so that 1.60c would be approximately as low a price for bars, shapes and plates as 1.00c was in December, 1914, and that was extremely low. If one-third of the freight advances are taken off a few months hence, and the reductions will hardly be as much, that would be only about $2 a ton.

On attractive orders black sheets can be had at 3c and galvanized at 4c, representing declines of about $5 a ton in the fortnight, easily the heaviest decline in any part of the steel market.

Prospects

Railroads are doing more car repair work, particularly in the repair of box cars against the grain movement that will be heavy in a couple of months. Plans for putting railroads in good financial condition, recently matured at Washington, are going through. Railroads will soon be able to pay their accounts and will have something left over for improvements, while their earnings are increasing month by month. They will probably buy with some little freedom before the end of the year, and this will help business generally. The liquidation of stocks of steel and of manufactured goods is proceeding, the progress already made being the chief cause of the improvement in mill demand already witnessed. Labor and financial conditions are improving and in time this improvement will doubtless result in more construction work being undertaken. Henceforth all the trends affecting the demand for steel will be favorable, although the improvement will be quite gradual.

A sale of 2000 tons of basic pig iron has been made at $18, valley furnace, or $1 below the market as previously quoted. Bessemer is offered at $20, valley, or 50 cents decline. Foundry remains nominally at $19.50, valley, but on a firm bid the price could doubtless be shaded.

POINTS IN WEEK'S MARKETING NOTES

The demand on Steel is stagnating upward, while prices can be said to be slowly stagnating downward. Both movements are very slow.

Some dealers are cheerful over the change in the steel market, while others deny there has been any improvement. The latter when cross-questioned have to admit however that a certain amount of improve ment has taken place.

Salesmen, anxious to see a big turnover complain about prices.

They say that until steel prices are considerably lower their customers will not take hold. Other dealers claim that buyers are taking only what they actually need, and would not buy more at any price.

The turn in volume of demand upon the steel mills can be set for about the middle of July. Some lines have not noticeably improved since then, but they have not lost ground. Some other lines have improved considerably.

The wide open, competitive market in steel products continues. Prices are not very slashed however, but are merely sagging now and then at one point or another.

Wages can be pretty well set at around 30 cents against 19 cents in 1914.

On attractive orders black sheets can be had at 3 cents and galvanized at 4 cents. This representing declines of about $5 a ton in the last two weeks,, easily the heavest decline in any part of the steel market.

Plans for putting the railroads in good financial condition are going through. This means that they will probably buy with some little freedom before the end of the year. This of course will help business generally.

2,000 tons of basic pig iron has been sold at $18, valley furnace, or $1 below the market as previously quoted. Bessemer has a decline of 50 cents.

NEW INSTITUTION HAS BEEN FORMED

Engineering Trades There Still in Process of Making Their Adjustments

The larger engineering industries are still completing orders taken before the general trade depression took place. As the period between the taking of the order and delivery is always long in these industries, the goods being built to detailed specification, the worst effects of variation in trade are modified.

Advantage is being taken of the quiet period to reduce inflation and to put into operation many schemes for more effective working which have, perforce, been put aside until the present. Some of the more highly paid operatives, finding that their services are not remunerative to their employers, have agreed to substantial reductions, and the falling tendency of the cost of living has materially assisted in the deflation of the cost of labour without serious reductions in what economists call "real wages." The output of the individual workman has improved in correspondence with the ratio of unemployment, and this has made it possible still further to reduce the labor cost of each piece of work. In order to retain skilled workmen and avoid as far as possible the evils of unemployment, employers have co-operated to reduce costs in order to induce orders, and many cases are known of quotations in which profit has been entirely eliminated. These measures are having their effect in pulling the situation round, and many foretell an early return to more prosperous times.

The loom makers, amongst the textile machinery makers, have now reduced prices all round, but the makers of spinning machinery, with one or two exceptions, are not taking fresh orders. It is, of course, obvious that present work on orders booked two years and more ago is being executed at a loss, and the fact that a given branch of the industry is or is not able to quote lower figures bears no relation to the question of profit. In these trades it is well known that those who are not reducing prices are generally suffering from having taken on orders at fixed prices in a rising market.

A committee made up partly of employers and partly of representatives of workpeople in the engineering and shipbuilding industries are making preparations to pay visits to Holland, Belgium, and Germany, in order to study the question of the relation of hours of labor and wages on output. This is a sign of the obvious desire of all parties to return to the normal at the earliest possible date. Such visits can do nothing but good to all who participate in them.

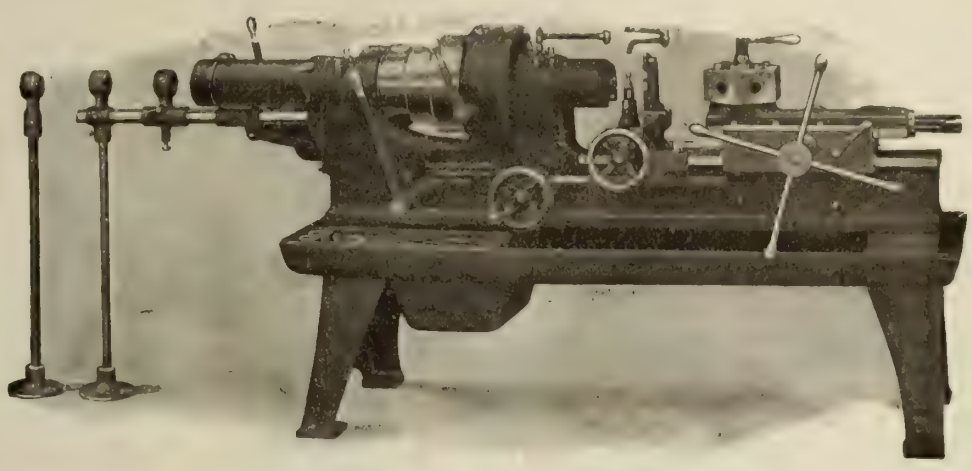
The shipbuilding industry has suffered from a strike of joiners who have declined to submit to a reduction of wages proposed by the employers in order to reduce the cost of reconditioning ships which was sufficiently high to drive orders to Continental yards. The strike has, unfortunately, had precisely that effect, and many contracts have been lost to the country because the shipowners cannot await the result of the strike Further, other grades of workers have suffered unemployment from this cause

A new institution under the title "Institute of Production Engineers" has been formed for the study of methods of production, with a view to improvement in quantity and quality and production, and the first meeting was held on 2nd April Without replacing or duplicating the functions of other institutions it will generally tend to a wider appreciation of the more commercial aspects of engineering, and is expected to assist the adminis

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We can supply you from stock immediately.



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Hand Operated
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BORING BARS
With Adjustable Cutters

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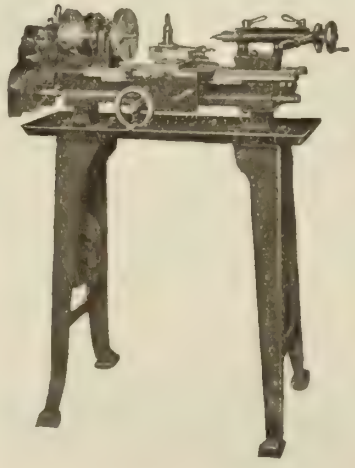
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trative and executive departments as well as the commercial organization of the larger and smaller firms whose members join the institution.

HARD COAL OUTPUT IN UNITED STATES

During the first five months of 1921 the production of hard coal for the United States was 37,700,000 tons net. This figure exceeds any since 1913 with the exception of 1917 and 1918, these latter periods being at the height of the war output. Below is given the production in May by years (in tons net):

Year	May	Calendar year to May 31
1913	7,945,000	38,300,000
1914	8,348,000	35,600,000
1915	7,807,000	35,200,000
1916	7,212,000	36,100,000
1917	8,933,000	39,500,000
1918	8,880,000	41,200,000
1919	7,525,000	32,500,000
1920	7,946,000	36,100,000
1921	9,497,000	37,700,000

WAGES IN GERMAN METAL INDUSTRY

Some wages are as high as 800 per cent over 1914. To offset this it is claimed the cost of living has increased 1,550 per cent since 1914 in some cases.

The Union of German Metal Workers is the largest trade-union in Germany and includes more than 1,600,000 members. This union has a statistical bureau which has collected statistics of wages and of cost of living in the metal industry, including in its investigation not only the members of its union but many other workers in the metal industry, so that the investigation covered a total of about 2,300,000 workers. It has published the results of its investigation in the Metallarbeiter, which is the organ of this union.

According to "Commerce Reports," the statistics of this union show that about 63 per cent of these workers are receiving wages which are more than 800 greater than those of 1914, about 36 per cent are receiving wages which have not increased as much as 500 per cent since 1914. It is impossible from these statistics to arrive at an average increase for the whole of this group of workers.

The trade-unions estimate that the entire cost of living for a family of four has increased about 1,550 per cent since 1914, while Calwer's Bureau (a private statistical bureau), which usually makes use of official statistics, estimates that the cost of food alone for a family of four has increased about 1,470 per cent since 1914.

H. T. Day, Mirrlees, Bickerton & Day, manufacturers of the Mirrlees Diesel Oil Engines, is in Canada on an extended tour. During the course of his stay Mr. Day will visit and inspect each installation made by his company.

TRADE GOSSIP

The F. Bowden Lumber Co., Toronto are contemplating building a planing mill in the near future.

Fire destroyed the warehouse of the Standard Vinegar Co., at Calgary, Alta. recently, the loss being around $30,000.

If present plans go through, Port Stanley will have a modern summer hotel, which will cost around $150,000.

The Empire Cotton Co., Welland have added some three hundred hands, and are now working a night shift.

L. E. Simoneau, 422 Rue Richmond, Montreal has commenced making electrical appliances.

The Galt Amateur Athletic Association, Galt, Ont., are going to erect an artificial ice rink at a cost of $100,000 if things can be properly arranged.

Labor will be paid at the rate of 40 cents per hour, on the Chippewa development scheme, this new rate having started on Aug. 8th.

The Massey Harris Co., Ltd., Toronto, Ont., closed its plant the other day. No definite date of re-opening has been announced as yet.

According to the "Canada Gazette" Pitt Railway Equipments Lted, has been incorporated with a capital of $100,000. This company will carry on the business of electrical engineers and contractor dealers and the head office is to be in Montreal.

Another company which has incorporated is the Continental Electric Co., Ltd. This company will have their head office at Toronto and is capitalized at $40,000.

The Lorne Tractors Ltd, will establish a factory in Chatham. A large tract of land has been secured, and this company intends broadening out considerably.

According to the decision of Judge Kelly at Osgoode Hall, Toronto the other day, the lands and buildings at Brantford, valued at $376,000, and occupied during the war by Motor Trucks, Ltd., belong to the United States Government.

A certain firm starting in Ontario, would like to get in touch with firms handling polishing lathes, drill presses, punch presses, grinding stands, nickle stands, anodes, and dynamo, also a 10 or 25 h. p. motor. These could be either new or second hand. W. G. Astle, 154 W. Haseltine Ave., Kenmore N. Y.

HANDLING ENGLISH LINES.

The Canadian Fairbanks-Morse Co Ltd., Montreal, Toronto, etc., are handling the "Allen" line of engines an pumps. These pumps are manufacture in England, and the concern producin them also manufacture a full line of en gineering specialties.

Following is a list of the bulletin procurable through the Canadian Fai banks-Morse Co., at any of their office Oil engine driven pumps, electric moto driven pumps, pumping machinery, stea engine driven fans, steam turbine drive fans, steam turbine driven pumps, stea engine driven pumps, steam turbi driven generators, steam engine drive generators and oil engine driven gene ators.

These are also obtainable: Gener machinery, high-efficiency condensi machinery, surface condensing machi ery, high-efficiency surface condensi machinery, high-efficiency surface co densing plants, description and illustr tions of condensing machinery, gene description of machinery, electric moto and control gear, enclosed forced lub cation double-acting engine and contin ous current dynamo, open double-acti steam engine and continuous current d namo.

PART OF ACT HAS BEEN REPEALE

The British Government has decided abolish the Agricultural Wages Boa The first part of the agriculture a which became effective six months a will be repealed, and agriculture will completely decontrolled. This means end of minimum wages and Governm control of methods of cultivation.

It is understood, states Trade Comm ioner Wilbur J. Page, at London, E land, that the repeal of the first part the agriculture act is due to the financ crisis through which the country is pa ing. The decontrol of agriculture been under consideration for some ti but the coal strike precipitated devel ments. It is expected that the Wa Board will continue to function for su ient time to allow necessary adjustme to take place.

In the July 21st issue of Canadian M tirely decontrol agriculture. The gu antees for wheat and oats will go w the present crops are harvested. Wages Board will ultimately go, as as all cultivation orders, including powers possessed by county council enforce proper cultivation. This leave nothing in the agriculture act cept the clauses giving security of ten

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WATCH THIS

In the July 21st issue of Canadian M chinery we presented a further talk Ralph E. Flanders on the machining pump rod. Of course it will be un stood by readers that the time 'c minutes and 32 seconds given in article was for the first operation c as that was the only operation under cussion.



It Was Just A Matter of Grinding

The same set of Thread Chasers cut these two threads.

Observe what a clean cut the Chasers gave on this open hearth stock after they had been correctly ground. Note how neatly the Chasers curled out the chip. Before given the right form of grind, the Chasers simply pushed out the stock.

How To Grind Thread Chasers

Instructions for the Care of Thread Chasers are very completely given in a 27-page booklet published by us.

The Book Is Free

To those having the care of Thread Chasers.

It is printed and distributed with the hope that the rules given will be followed, and if they are, it will be the means of an inestimable saving of time, money and trouble.

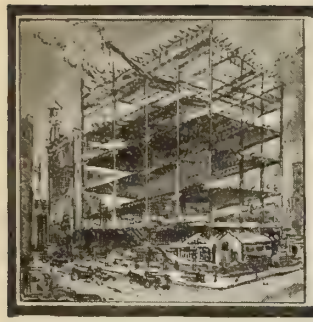
If you have anything to do with the care of Thread Chasers, ask us for the book. Although there is no charge for the book, it is full of value. It will cost you the price of a postage stamp only, and will save you trouble, increase your value to your employer and save a lot of money that is needlessly wasted in time and scrapped work.

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



WASTE IN WAGES IN BUILDING INDUSTRY HALF BILLION YEARLY

IT SEEMS strange how waste can accumulate so rapidly, but the recent figures issued in the report just made public by the American Engineering Council's Committee on Elimination of Waste in Industry are not only strange and surprising, but actually alarming.

According to the report half a billion dollars a year in wages is being lost in the building industry through unemployment. Lack of work is said to be the outstanding factor in this industry, and the condition is attributed to present high cost of construction.

Without going into the report in detail, here are some of the items mentioned: The chief sources of waste in the building industry are, according to the report, irregular employment, inefficient management and wasteful labor regulations. Customs or conditions prevailing throughout the industry and poorly designed equipment are given as secondary causes.

The annual economic loss due to accidents is estimated as high as $120,000,000. Application of safety methods, it is stated, would save to the industry 12,000,000 days a year.

Some Causes of Idleness

"The building trade workman," asserts the report, "is busy on the average about 190 days in the year, or two thirds of his time. A few contractors, individually or associated, are attacking this problem with effective results. The public also must be educated to the need of a sensible distribution through the year of its construction demands and requirements. Idleness, however, is due not entirely to seasonable demands; strikes and lockouts are appreciable causes.

"Haphazard management in planning and controlling work, and lack of standards, which often double the labor cost, characterize most construction undertakings. Here, again, a few builders, recognizing the waste in money and man power, are adopting methods that approach modern factory management.

"In some construction trades accidents involve losses up to ten per cent. of the labor cost in addition to the human loss of lives and energy. The average loss, computed from insurance statistics, is about two and one-half per cent of labor cost. Here also certain contractors have found it possible to cut their accidents in half through special efforts. Greater co-operation between the workmen and the employers is an absolute essential. This co-operation must be attained before we can approach the elimination of labor difficulties.

Inefficient Management

Inefficient management is blamed for failure to furnish continuity of employment; failure to plan work in sufficient detail; lack of proper schedules to allow proper co-ordination of scheduling, purchasing and delivery with job requirements, lack of standards and adequate cost methods as a means of checking productions; high labor turnover; failure to use proper amount or type of equipment; general failure to develop and use a greater amount of mechanical equipment; and waste of material through careless handling and improper plant operations.

According to the report the number of strikes and lockouts in the building trades increased from 302 in 1914 to 452 in 1919, an increase of 50 per cent. This increase is accounted for in part by the greater demand for labor in 1919, which inevitably makes the requirements of workmen more exacting and arbitrary. Of the 1919 figure, 452, only 18, or four per cent. are listed as lockouts, so that the waste due to lockouts is relatively small.

"If the greatest cause, the demand for an increase in wages, could be eliminated, strikes as a factor of waste would shrink into insignificance. The remedy that suggests itself is co-operation. Management and labor must forget the sore spots of past conflicts and through whole-hearted co-operation fix by proper studies a minimum wage to correspond with a standard amount of production, with additional compensation for additional output. This would furnish an incentive to the men and would give recognition to deserving mechanics.

"Unions must co-operate to the extent of eliminating the flat rate for all mechanics of a trade, and to the extent of modifying the restriction that forbids mechanics to accept piece work. With definite standards fixed and with the co-operation of both parties, fair incentives can be introduced.

"The most encouraging sign in the elimination of the above causes is found in what is known as the "Philadelphia Plan," put forth by the labor element of that city."

This plan concentrates into a single body, through associations, groups or committees, of each employing branch of the building industry, in number at least equal to the nineteen represented in the council of the Associated Building Trades. A heading-up committee composed of an equal number of representatives from the groups of employer and employed would constitute the tribunal or council of the building industry in Philadelphia. The plan purposes the establishment of a central bureau through which voluntarily all construction programs in the territory should be cleared including national, state, municipal and private work.

Accident Loss

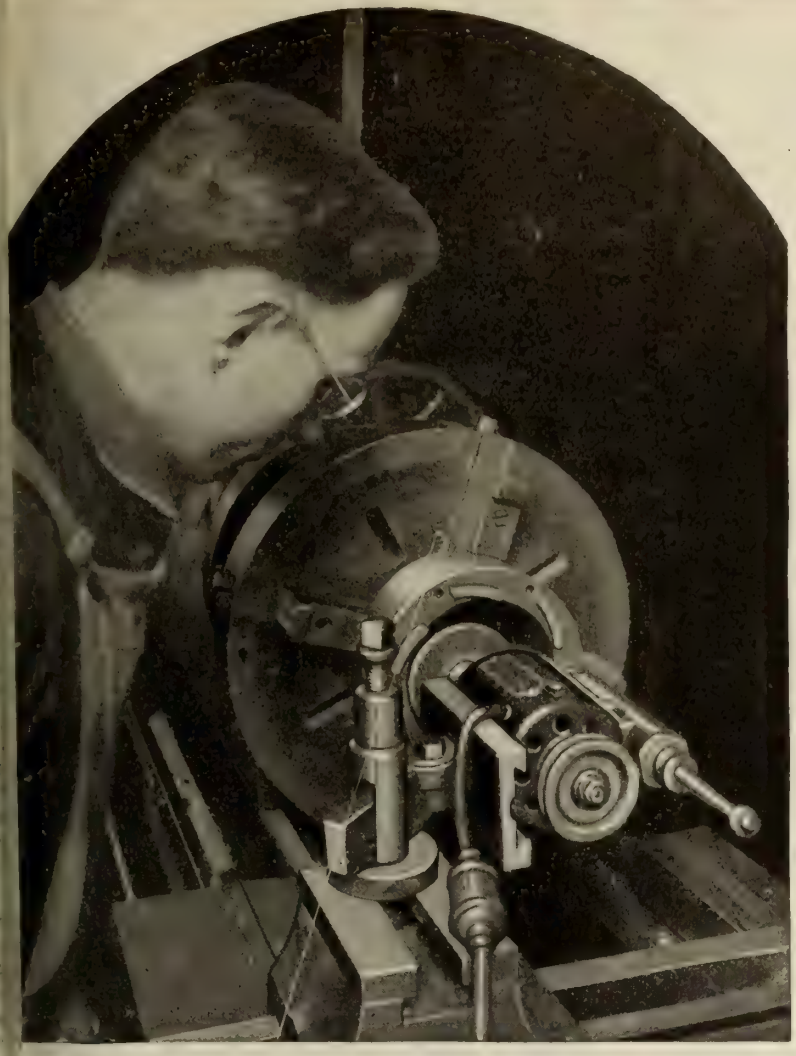
Enormous losses are suffered through accidents, the $30,000,000 paid yearly to insurance companies for compensation and liability insurance by no means representing the total lost, according to the report, which adds:

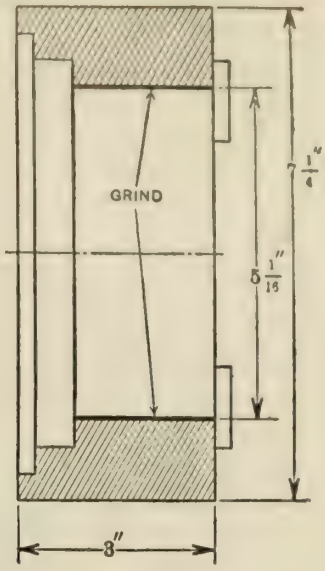
"In the opinion of one of the best authorities in the country the actual cost of insurance represents not more than 25 per cent. of the total economic loss which brings the total cost due to accidents in the vicinity of $120,000,000 per year, a staggering total."

In Massachusetts during one year accidents caused a loss of time of 485,48 days. In New York State, where four times as many workers are employed in the factories as are employed in building and construction work, there were more fatalities due to accidents in building than in factories during a four-year period. Accidents, it is stated, are largely caused by carelessness of the workmen or lack of ordinary safeguard Conditions which would not be tolerate in a factory for 24 hours are found o every job, it is asserted.

Great savings are possible, says th report. "An official of a large insurance company believes that by prope safety measures the waste due to acc dents can be reduced 75 per cent. to 8 per cent. in from two to five years honest effort, and that constructio labor cost can be cut three per cent. b these measures. Another official est mates, from actual accomplishment safety measures, that a total of mo than 12,000,000 days a year could b saved the industry by the applicatio of safety methods."

The most encouraging feature in th building industry concludes the repo is the action of a few builders and a fe groups of building trade workmen making intensive studies of the caus





CAM
FOR DIE HEAD

Attached to the toolpost of the engine lathe on which this cam has been machined, the Dumore Grinder accurately grinds the hole without necessitating another "set up." The high efficiency standards of the Geometric Tool Co. (New Haven Conn.) make comment unnecessary on this method of handling the job. It is sufficient that the work of the Dumore is so satisfactory, the finish so fine, that all cams this size or larger, made in this shop are ground in this manner.

The Average Shop Has Constant Use for Dumore Grinders

Dumore Grinders are made in types and sizes that can be attached to all classes of machines and used to successfully perform a wide variety of grinding operations.

Equally valuable for the important "odd jobs" that must be done in every shop and on some manufacturing work, they find a ready place in every part of every metal working plant—whether toolroom, factory or repair shop.

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Wisconsin Electric Company

2938 Sixteenth Street **Racine, Wisconsin**

DUMORE HIGH SPEED GRINDERS

and remedies for irregular employment and haphazard conditions of work. Along with this is the growing appreciation on the part of both labor and management that to build more buildings and maintain high wages, it is necessary to attain greater and greater productive capacity per man.

"They see as proof of those facts that the 1921 depression was caused and extended by too high costs of all products, and that business, either in manufacturing or in building industries is improving only as the costs of material and the cost of labor are reducing. All are recognizing, in fact, that no progress can be made without paying greater and greater attention to the elimination of waste.

CHROMIUM DEPOSITS IN VARIOUS COUNTIES

Canada Has Increased Output from 121 Tons in 1914 to 33,000 in 1917.

India Also Had Large Increase.

Speaking on the importance of Chromium in the steel industry, a writer in "The Near East American" tells of various places where such a material is found. He says that originally large supplies were obtained from the deposits near Brusa, Asia Minor, the production of chromite in 1908 having been 29,000 tons. Later, Southern Rhodesia, and New Caledonia became the chief sources of supply, and in the pre-war years the German steel industry used to draw upon Asia Minor. The inquiry for chromite was stimulated by the war. Canada, which had an output of 121 tons in 1914, soon produced 33,000 tons in 1917, while India increased her output of 5,888 tons in 1914 to 57,773 tons in 1918. The Indian deposits are scattered over several provinces. The mineral has been found in the peridolite rocks of the Chalk Hills near Salem, Madras, and also in the Andamans. Another deposit area occurs two miles east of Yhamogia, in the Pishin district, and it consists of a rich veinlike mass with 54 per cent. of chroms oxide. Good supplies are also available in the districts of Mysore and also in Singhbhum, Behar. The regions have not been well exploited. In July 1914, the Beluchistan Chrome Company, Ltd., was registered in England to acquire leases of chrome areas covering 6,159 acres in the Hindubagh district of Beluchistan. A railway from Khanai to Hindubagh has been constructed, and the shipments commenced in March 1917.

The Adanac Motor Syndicate has been formed at Lachine, P.Q. This company intends manufacturing motor trucks, and has produced its first sample truck. The present organization is composed of Messrs H. Milton Purnell, Gordon A. Emslie, B. H. T. McKenzie, B. A. Malkin, Robert Connon, H. Emslie, and A. T. Sutherland.

FRENCH EXHIBITION TRAIN WILL TOUR DOMINION WITH EIGHT CA S

SOMETIME about August 25th, an important French delegation will arrive in Canada. The purpose of the mission is to inaugurate the made-in-France sample train, which will tour the Dominion at a later date. This train will constitute an exhibition on wheels, composed of eight different departments—manned with a competent personnel travelling with the train and living in the sleepers and diner provided for their comfort. The eight exhibition coaches will each present some special products of France prepared and exhibited under the patronage of distinguished personalities.

Eight Cars

The first car, entitled "La Pensee Francaise"—the French thought; comprising literature, science and arts—will be under the presidency of Mr. Raymond Poincare, Senator and Ex-President of the French Repbblic. The second car, entitled "Industry, Commerce and Tourism," including transportation by land, sea and air, and civil and mechanical engineering, will be under the presidency of Mr. Dal Piaz, President of La Compagnie Generale Translantique, commonly known as the French Line.

The third car, entitled "Fashion, Tissues and Laces, etc," will be under the presidency of Mr. Auguste Isaac, Member of Parliament, Honorary President of the Chamber of Commerce of Lyons, and Ex-Minister of Trade and Commerce. The fourth car, entitled "Leather Industries," and ranging from the raw material to the glove and highest grade product, will be under the presidency of Mr. Poullain, President of the General Association of dealers in skins, hides and leather, of France.

The fifty car, entitled "Chemical Products, Drugs, Pharmacy, Perfumery, etc." will be under the presidency of Mr. Amic, Senator, and Vice-President of Le Comité Francais des Expositions. The sixth car, entitled "Articles de Paris, scientific instruments, etc., will be under th presidency of Mr. Emile Dupont, president of Le Comité Francais des Expositions.

The seventh car, entitled "Agriculture, Horticulture and Foodstuffs," will be under the presidency of Mr. Albert Viger, President of the National Association of Horticulture of France, ex-Minister of Agricuuture. The eighth car, entitled, "Jewellery, Objects of Art, etc.,, will be under the presidency of Mr. Paul Templier, President of the Jewellers and Goldsmiths of Paris.

It is expected that the train will be at the Toronto Exhibition for the duration of its run, but in addition to this, practically every important centre will be visited and the public given full opportunity to view the exhibits.

A tentative itinerary has been arranged, covering the following cities and towns: Montreal, Joliette, Shawinigan, Three Rivers, Quebec, Sherbrooke, St. Hyacinthe, Thetford, St. Johns, Valleyfield, Ottawa, Brockville, Kingston, Belleville, Peterborough, Toronto, N g- ara Falls, St. Catherines, Ham n. Brantford, Woodstock, London, Win r. Chatham, Stratford, Kitchener, Guelph, North Bay, Sudbury, Soo, Arthur, Fort William, Winnipeg, S toon, Edmonton, Banff, Kamloops, couver, Victoria, Calgary, Lethbr Medicine Hat, Swift Current, Moos Regina, Brandon, Winnipeg, Coch Cobalt, Ottawa, Montreal.

Concurrently with each stoppa suitable theatres, moving pictures display special goods and striking i trial processes. The circuit conten ed will cover over 8,000 miles, and e over a period of more than two m

Upon its completion the exhibit be placed in the museum hall o school for high Commercial Educ in the City of Montreal, and r there upon a fixed exhibition for ar six months, in order that the exhi after such a rapid journey throug land may have an opportunity to lish agencies, tie up solid commerci lations, and form the nucleus of a tele which it is hoped will grow time.

QUALIFIED MEN SHO DEVOTE TAL

In the opinion of Edwin S. Ca president of the American Society o chanical Engineers, it is throug fulfilment of the concept of "Serv Others" that engineers have won t teem of society at large. He say this is a mechanical age which pr opportunities to the engineerings p sion such as never before existed.

Mr. Carman who has recently pleted a series of visits to the A. Local Sections, said that the opp ties now before the engineering p sion can only be completely re "when they all work together as a with one aim in view, that of Se

After touching upon the incre membership, he mentioned that th gramme of service to be rendered American Society of Mechanical eers can only be accomplished a joyed to the fullest extent by the participation of the individual m There are still many qualified men mechanical engineering professio cording to Mr. Carman, who are devoting their talents to anythi yond the small circle in which th engaged, not yet having fully r the advantages accruing from asso with their fellow engineers and ing of "Service to Others."

The Canadian Westinghouse Co Hamilton, Ont. have taken on few new men in their Shur Air Dept., as this section is rathe at present. They have the ord the air brakes for the 200 new T street cars.

GARLOCK WALKER

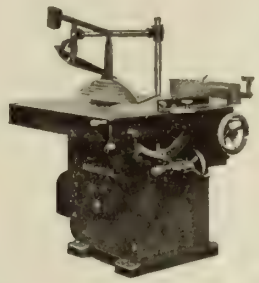
HIGH GRADE MACHINE TOOLS

Better Tools for Better Patterns

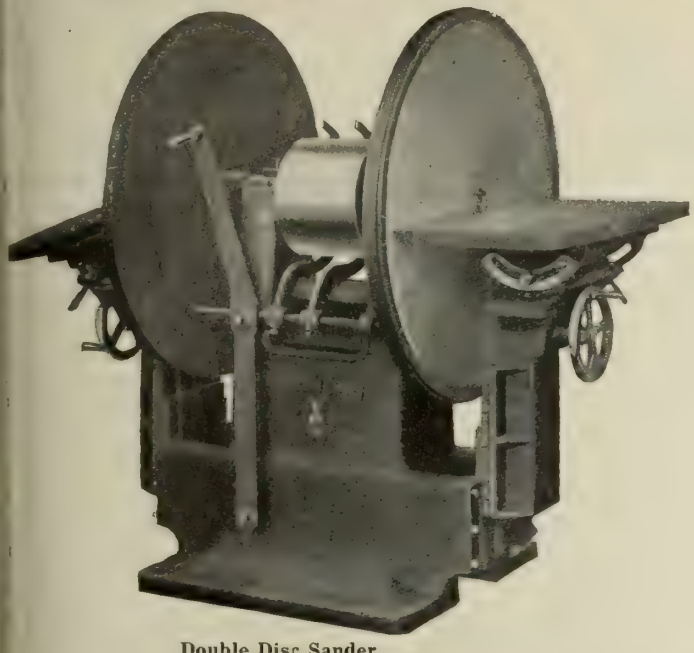
Up-to-the-minute machines for improving the output of your Pattern Shop.



Hand Feed Jointer for accurate work.
Sizes in stock 12″ to 24″.



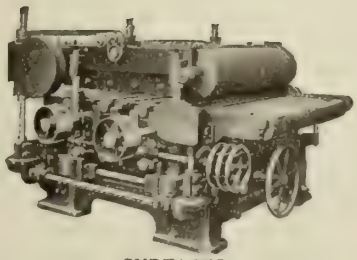
Universal Saw Bench for ripping, cross-cutting, dadoing, mitreing, etc. Indispensable in the wood shop.



Double Disc Sander

No. 200—Knife Grinder.

complete stock of machines for all wood-orking operation. They include American 0″ Outside Moulders; C.M.C. Hollow Chisel ortisers; Ballantyne 2-Spindle Shapers and any others. Let us have your enquiries.



SURFACER

"Everything in Woodworking and Metal Working Machinery"

Metal working machines by the foremost makers. They embody:

ENGINE LATHES
GAP LATHES
DRILLS
BORING MILLS
SHAPERS



G&W MACHINERY

MILLERS
HACK SAWS
PUNCHES
SHEARS
GRINDERS
COMPRESSORS

Garlock-Walker Machinery Company, Limited

32 Front Street West, Toronto, Canada

TORONTO MONTREAL WINNIPEG



THE "FLU" Stayed out of this PLANT

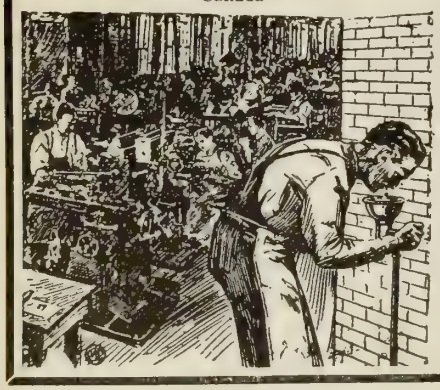
PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

888 F. St. Andrew St., Montreal, P.Q. Canada



CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

DIFFERENCE IN PRICE WOULD BE SMALL

Farmer buying power affected by recent drop in farm produce. Bulk of goods of this concern outside their control.

Speaking on the subject of the recent closing of the Massey-Harris Plant at Toronto, Mr. Thomas Bradshaw, general manager of the plant, states as follows:-

"Our country, in common with all others dealing with the farming community, has been greatly affected by the sudden and heavy drop in the value of farm produce. The farmer, not knowing all the conditions, has had the feeling, perhaps quite naturally, that manufactured articles should drop correspondingly in price with this produce. Such has not been the case, and this has prevented buying in some instances where it would be to his advantage to do so, even at present prices. We are quite sympathetic with the policy that he should buy what he really needs under existing circumstances.

"We did not expect normal sales in 1921, and made our plans accordingly. We did feel, however, for all the difference there was in the price of implements this year and the probable prices next year, that no farmer could put off the buying of an implement really needed, because the difference in price, spread over the life of the implements, would not amount to much.

"The bulk of the cost of the goods is quite outside our control, and, while a great deal of labor is involved in the cost, it comes to us in the form of materials. Such reductions in material costs as took place in our manufacturing season came too late to be of any help. The farmers, as are all our customers, are perfectly justified in demanding a reduction in the cost of manufactured articles, but this cannot come so abruptly as in the case of the drop in the value of farm produce because the channels through which it comes are so extended that it takes more time to make adjustments.

"Wages must come down, but great hardships would be caused by too sudden a drop, and we think the consumer should recognize this and give labor time to adjust itself to new conditions. Freight rates are a big item in costs, and there has been no adjustment along this line yet."

THINGS IN ENGLAND ARE PICKING UP

"Things in England are beginning to pick up, and from what I can see our revival is reflected in Canada." This is the opinion of H. Wickman, seed editor of the London Times, who is at present with Lord Northcliffe on his tour through United States and Canada.

According to the speach, the Pacific conference to be held in Washington will have far reaching results. Speaking of German trade he says that it has revived to any great extent. The change rate is against this, and there is less German produce coming into gland to-day than there was a year The existing rate of exchange ma it impossible for the Germans to re their trade to any great extent."

LARGE WATER POWER IS AVAILABLE HE

The water power actually avail in the Dominion of Canada has rec ed close attention of the Dominion ter Power Branch during the past years. A careful re-analysis and c putation of such resources have systematically collated, analyzed, co-ordinated with a view to prepa on a uniform basis from coast to c revised estimates of the power a able. While the analysis is not yet nally completed , sufficient prog has been made to warrant publica of the figures following:

The recorded power available thro out the Dominion, under conditions ordinary minimum flow is 18,255 h.p. The water power available u estimated flow for maximum deve ment i.e., dependable for at least months of the year is 32,076,000

There are installed throughout Dominion water wheels and turbine the extent of 2,471,000 h.p. Howev it would not be correct to place figure in direct comparison with minimum or maximum available po figures quoted above and therefrom duce the percentage of available w power resources developed to date. allowance must be made for the ave ratio between the water wheels insta and the power available.

An analysis of the water po plants scattered from coast to c concerning which complete informa is available as to turbine installa and satisfactory information as stream flow, gives an average mac installation 30 per cent. greater than six month flow maximum power. plying this, the figures quoted a therefore indicate that the present corded water power resources of Dominion will permit of a turbine stallation of 41, 700,000 h.p. In o words, the present turbine installa represents only 5.9 per cent. of the sent recorded water power resources

The total Hydro power developn installed during the past year or under construction represents app imately 560,000 h. p. of installed ca ity. This figure includes only the in installations of plants under const tion not their ultimate designed capa

According to reports the Stand Steel Construction Co., Welland, will resume operations at full capa It is said that some good contracts h been secured and present orders sufficient for at least the next t months.

...ILET AND BUTT WELDING BY ELECTRIC ARC

(Continued from page 34)

In single "V" the protruding metal ...o no moment as it is simply excess, ...d not relied upon, nor does it get in ...e of strain. It will be noted that ...a (c) and (d) there are many welds ...ere the "V" is made without special ...ching, simply by ingenuity in the ...eply of the parts to be welded. As ...ow at (b) the angle in any welding ...ould be so open that the electrode can ...ld at approximately right angles ...the face to be welded if there is to ...e surety that the metal deposited ...om the electrode will be deposited in ...ater, and in fact the arc cannot ...ided so as to make the crater at ...ive points desired unless opening ...shown at (b), i.e., electrode at ap...ately right angles to the face to ...ded. The angle of the weld then ...s upon the thickness of the piece, ...s pointed out, the virtual thickness ...cut in two by double veeing, dou...velling. As shown at (e) and ...re is a respective choice of spread...thods in filling up either single ...ble "V" welds, and in general ...strength only is desired, spreading ...used as at (e) and is quicker, as ...e current densities can be used as ...ksly explained.

...first bead in the neck of the weld ...not be made by spreading, as the ...r will notice at his first attempt ...t welding that the centre of a ...."V" double bevel weld will be ... absent from any welding quali... while the upper half and pad may ...tifully welded. It is also gener...visable to use the smaller size ...r this first careful work in the ... the "V." At (f) is shown the ... of using successive reliably small ..., and this is by far the better method ...ful results. Practical conditions, ..., limit the number of these beads ... or five, say of half inch plate. ... is a steel casting, and steel cast...n never equal the ductility of ... plates. Annealed steel castings ...uch more ductility and elongation ... annealed, and by putting down ...ively small beads, each bead an...the previous one, and by adding ...ver all at a higher current den...t entire weld may be annealed, ...annealed bead may or may not ...ved by machining. At (g) and ... shown two methods of over...too wide a gap between parts ...elded.

...KING AND SHIPPING

...ontinued from page 32)

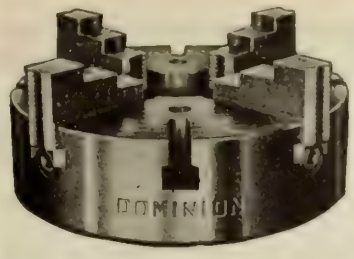
...ip companies would give to ex...a mate's receipt for so many ... accepted from the railway ... for shipment. These points ...portant in themselves, but if ...edit would add to the attraction of ...siness with the Dominion rather ... other countries, and would in-cidentally benefit the transportation companies.

There does not appear to be any possibility of improvement in the methods of packing and shipping nails to this country from Canada. On the contrary it is stated here that Canadian nails are packed in a much superior manner to those coming from Germany and Belgium. From Canada they arrive packed in casks and bags, in each case lined with waterproof paper. German and Belgian shippers use no waterproof lining and consequently the nails often reach here in a rusty condition.

TRADE GOSSIP

The Universal Craftsmen Convention, which came to a close in Toronto the other day elected the following officers for the ensuing year:—Grand Worshipful Chief, W. Warfield, Newark; Grand Assistant Chief, J. M. Patton, New York; Grand Warden, G. Brown, Pittsburg; Grand Guard, W. W. Law, Trenton, N.J.; Chairman Board of Trustees, W. H. Damon, Springfield, Mass.; Trustees, E. H. Blade, Chicago; L. C. Cuthbert, Toronto; Grand Chaplain, Patrick Earley, Milwaukee.

The Toronto, Hamilton and Buffalo Rly. Co., Hamilton, are contemplating the construction of a bridge to cost about $30,000.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

DOMINION STEEL PRODUCTS CO. LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

PATENTS
Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

BLACK DIAMOND OVENS
"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd.
Brantford, Canada

Rubber Mill MACHINERY
BERTRAMS LIMITED
SCIENNES EDINBURGH

HAMILTON ENGINEERING SERVICE
LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
195 KING WILLIAM ST. HAMILTON

Classified Opportunities

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

SALESMAN WANTED

WANTED — BY WELL-KNOWN AMERICAN manufacturers of pneumatic tools enterprising salesman for Canadian field. Reply giving full experience, present connection, etc. All replies will be treated in confidence. Box 782N, Canadian Machinery.

What can we do for YOU?

Through these columns thousands of dollars of equipment are disposed of each year. If you are not using Canadian Machinery now, let us tell you what others have done—are doing.

CANADIAN MACHINERY
Classified Advertising Section
143 University Ave., Toronto

SUNCLO BRAND
WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

POSITION WANTED

TOOL STEEL AND MACHINERY SALES REpresentative open for connection. Sixteen years sales experience in Canada and United States. Have had practical machine shop experience and thoroughly understand the metal lines. P. O. Box 539, Georgetown, Ont. (c5m)

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT
Builders of Reliable Machinery.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

REGO WELDING *and* **CUTTING APPARATUS**

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

CLOSING TIME

Condensed advertisements for this section must be in our composing room Tuesday morning prior to day of issue. Display advertisements for this section must be in Monday afternoon.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

FOR SALE

ELECTRIC STORAGE BATTERY LOC tives for sale. Two. 36-inch gauge. plete and in good condition. R. T. Gilm Company, Dept. "E," 211 McGill Street, Mo

ALMOST NEW 150 K. W. GENERAL ELEC Generator, 25 cycle, type A. T. B., 550 o Volts, 500 R. P. M., form B, class 5-150-500. Gray-Dort Motors, Chatham. (

FOUR NEW McKENZIE SAW TABLES; M. C. Bracket Band Saw, new. Also and heavy duty Lathes. We have everyth metal and woodworking machinery. A. R liams Machinery Co., 64 Front St., Wes ronto.

PATTERNS

TORONTO PATTERN WORKS, 65 J. Street, Toronto. Patterns in wood and for all kinds of machinery.

BRANTFORD PATTERN WORKS ARE pared to make up patterns of any kin cluding marine works—to sketches, blue pr sample castings. Prompt, efficient service 'Phone 631; Machine 'Phone 733. Brantfor tern Works, 49 George St., Brantford, Ont.

Modern Marine Machinery

Automatic Steam Towing Machines, S Windlasses, Cargo and Deck Winc Steam Capstans, Dock Gypsies, Steer Engines, Hydraulic Freight Hoists, Grey Iron and Brass Castings. Spe machinery built to order. The Corbet Fo dry & Machine Co., Limited, Owen So Ont.

Used Belting, Pulleys, Etc.

We carry right in stock a large quan of used Belting, Pulleys, Hangers, Sh ing, etc., in good condition, which we at half the price of new. Inquiries solici In writing mention sizes wanted. L. Tarshis & Sons, 92 Wellington St., M real.

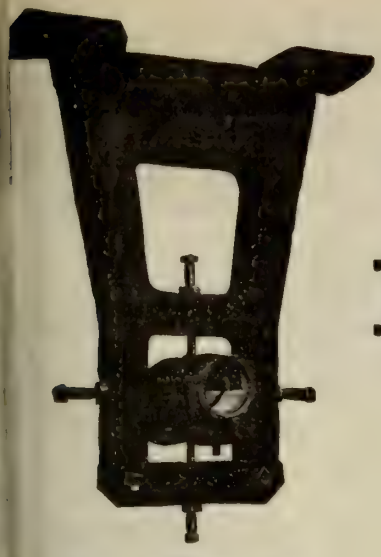
CANADIAN MACHINE SHOP

—

Will handle medium Specialty Line — Manufacturing and Selling

—

Apply Quickly
Box No. 715F
CANADIAN MACHINER



DODGE

Steel Shaft Hanger

DODGE

Hangers for line shaft service

Dodge Hanger users everywhere have learned that they can safely use whatever type of hangers they choose, as long as it is Dodge-built.

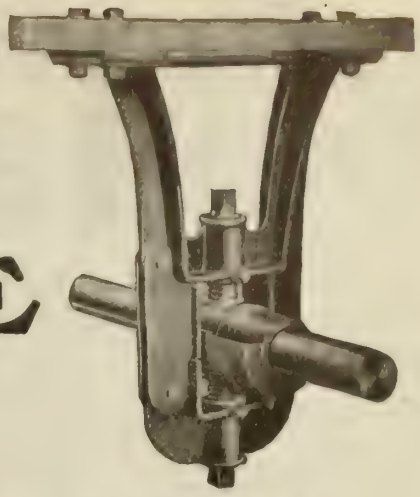
Dodge Hangers are the best obtainable everywhere in any type or size; specify them for line shaft service under any conditions.

Dodge will at any time give an unbiased opinion concerning the right hanger type for any job—an opinion based on and backed by the best engineering knowledge and practice.

But whether that opinion is accepted or disregarded for personal preference, the final selection should in every case be Dodge.

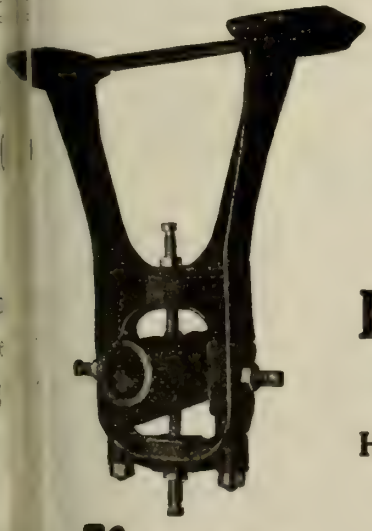
Dodge Manufacturing Co. of Canada, Ltd.

Head Office and Works: Toronto, Ont.
Eastern Branch: Montreal, Que.



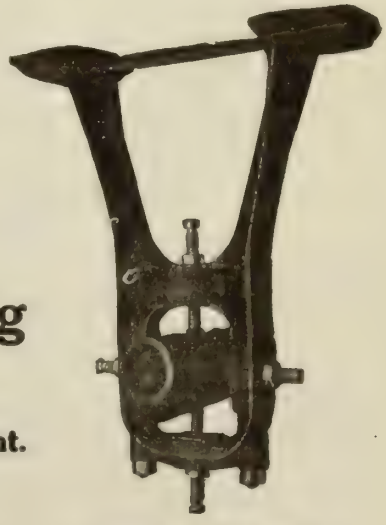
DODGE

Ball-and-Socket Hanger



Keystone

Four-Point Hanger



ONEIDA

Four-Point Hanger

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd , Mimico, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Independent Pneumatic Tool, Chicago, Ill.

Analyses, Chemical
Toronto Testing Laboratory, Toronto, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Columbia Hdwe. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Otn.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Iron
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd , Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

For list of Dealers see the last page of This Buyers' Directory

Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto,
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont
Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Montreal, Canada.
Bertram & Son Co., Ltd., The Dundas, Ont.
Canada Machinery Corp., Galt, On
Can. Fairbanks-Morse Co., Ltd., Mo
Garlock-Walker Mchy. Co., Toronto
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa
Boring, Drilling and Milling Machines, Vertical
Armstrong-Whitworth of Canada, Montreal, Canada.
Canada Machinery Corp., Galt, On
Can. Fairbanks-Morse Co., Ltd., Mo
Garlock-Walker Mchy. Co., Toronto
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, On
Oliver Machinery Co., Grand Rapids
Petrie, Ltd , H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto,

Boring Tools
Armstrong-Whitworth of Canada, Montreal, Canada.
Armstrong Bros. Tool Co., Chica
Gisholt Machine Co., Madison, Wis

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd. onto, Ont.

Brass Valves
Puro Sanitary Drinking Fountai Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountai Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., ton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd. ilton Ont.
MacKinnon Steel Co., Sherbrook

Broaching Machines
Bilton Machine Co., Bridgeport, C
Garlock-Walker Mchy. Co., Toront

Bronze
Brown's Copper & Brass Rolling Ltd., Toronto, Ont.
Walker & Sons Metal Products Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd onto, Ont.

Bronze, Phosphor
British Smelting & Refining Co Montreal, Que.
Canada Metal Co., Ltd., Toronto,
Ontario Metal Products Co., Lt onto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, On

Bufing or Polishing Machines (See Polishing and Buffing Ma
Blount Co., J. G., Everett, Mass
Can. Hanson & Van Winkle Co Toronto, Ont.
Ford-Smith Machine Co., Hamilt
Petrie, Ltd., H. W., Toronto, On
U.S. Electrical Tool Co., Cincin

Bulldozers
Bertram & Son Co., Ltd., Th Dundas, Ont.
Canada Machinery Corp., Galt,
Garlock-Walker Mchy. Co., Toro

Burners, Oil and Gas
General Combustion Co. of Ca Montreal, Que.
Rockwell Co., W. S., New York

Bushings
Fisher Motor Co., Ltd., Orillia,
Morrow Screw & Nut Co., Ltd Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toro

Calipers
Brown & Sharpe Mfg. Co., Provid
Starrett Co., L. S., Athol, Ma

Cams
Canada Foundries & Forgings land, Ont.

Can-Making Machinery (Se Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y
Brown, Boggs & Co., Ltd., Hamil
MacKinnon Steel Co., Sherbro

BUYERS' DIRECTORY

Ore
McKinnon Steel Co., Sherbrooke, Que.

...gs, Aluminum
...da Electric Castings Co., Ltd., Orillia.
...C Hanson & Van Winkle Co., Toronto, Ont.
...da Metal Co., Ltd., Toronto, Ont.

...gs, Brass and Bronze
...a Steel Corp., Ltd., Sault Ste. ...rie, Ont.
...da Electric Castings Co., Ltd., Orillia.
...C Hanson & Van Winkle Co., Toronto, Ont.
...da Metal Co., Ltd., Toronto, Ont.
...a Driver-Harris Co., Walkerville, Ont.

...gs, Copper
...da Metal Co., Ltd., Toronto, Ont.
...C Hanson & Van Winkle Co., Toronto, Ont.

...gs, Marine
...C Steel Foundries, Montreal, Que.
...Jonion Foundries & Steel, Ltd., Hamilton, Ont.

...gs, Die Molded
...ld & Sons, Ltd., W. H., Toronto.
...Motor Co., Ltd., Orillia, Ont.
...tin Die-Casting Corp., Syracuse, N.Y.
...Foundry Co., Galt, Ont.
...lan Brass & Metal, Ltd., Hamilton, Ont.

...gs, Ferro-Alloy
...Steel Foundries, Montreal, Que.

...gs, Iron
...a Steel Corp., Ltd., Sault Ste. ...ie, Ont.
...d Industrial Co., A., Fortierville, Q...
...Machine Co., Bridgeport, Conn.
...Boggs & Co., Ltd., Hamilton, Ont.
...Hanson & Van Winkle Co., Toronto, Ont.
...Electric Castings Co., Ltd., Orillia.
...& Co., M. A., Cleveland, Ohio.
...rn Ltd., John T., Toronto, Ont.
...Foundry Co., Galt, Ont.
...y & Sons, Wm., Owen Sound, Ont.
...gall Co., Ltd., R., Galt, Ont.
...a Foundry Co., Ltd., Ottawa, Ont.
...& Sons Metal Products, Ltd., ...n, Walkerville, Ont.
...n Engineering Works, Limited, ...real, Que.

..., Hyd. Press
...eel Foundries, Montreal, Que.

...s, Malleable Iron
...ional Malleable Iron Co., ...h, Ont.
...& Sons, Ltd., Wm., Owen ..., Ont.
...Falls Malleable Castings Co., ...'s Falls, Ont.

..., Monel Metal
...Driver-Harris Co., Ltd., Walkerville Ont.

..., Naval Bronze
... Brass & Metal, Ltd., Hamilton, ...

..., Nichrome
...river-Harris Co., Walkerville, Ont.

..., Nickel
...anson & Van Winkle Co., Toronto Ont.

..., Semi-Steel
... Mfg. Co., Thos., Montreal, Que.
...n & Steel Foundries, Hull, Que.
...oundry Co., Galt, Ont.
... Steel Foundries, Ltd., Winnipeg, Man.
... Engineering Works, Limited, ...real, Que.

... Steel
... Foundries & Steel, Ltd., Hamilton Ont.
...el Foundries, Montreal, Que.
...e & Sons, Wm., Owen Sound, Ont.
... Crucible Steel Co. of Can., Ltd., ...r, Ont.

... Iron
... Mfg. Co., Jersey City, N.J.

... Machines
... & Son Co., Ltd., The John, ... Ont.
... Walker Mchy. Co., Toronto, Ont.

...ee Sprockets and Chains)
...ane & Hoist Co., Ltd., Niagara ... Ont.
...ain Co., Ithaca, N.Y.
... Gear Works, Philadelphia, ...

... Hans) of Canada, Ltd., Montreal, Que.
...ht Mfg. Co., Lisbon, Ohio.

..., riving
... Belt Co., Toronto, Ont.
... Tap & Die Corp., Galt, Ont.
... Glassco, Montreal, Que.
...ain Co., Ithaca, N.Y.
... Hans) of Canada, Ltd., Montreal, Que.
...ht Mfg. Co., Lisbon, Ohio.

...& Son Co., Ltd., The John, ... Ont.
... Lamson Machine Co., Springfield, ...
...chine Co., Inc., Waynesboro, Pa.
... Whitney Co., of Canada, Ltd., ... Ont.

...esting Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I
Bilton Machine Co., Bridgeport, Conn
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont
Kearney & Trecker Co., Milwaukee, Wis
Madison Mfg. Co., Muskegon, Mich
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Cutters, Milling
Armstrong Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Banfield & Sons, Ltd., W. H., Toronto
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Toledo Machine & Tool Co., Toledo, Ohio

BUYERS' DIRECTORY

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd., W.H., Toronto

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis,
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto,

Flux, Galvanizing
British Smelting & Refining Co., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, O.
Bertram & Son Co., Ltd., The Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto
National Machinery Co., Tiffin, Ohio
Stewart & Co., Duncan, Glasgow,
Steel Co. of Canada, Ltd., Hamilton

Forgings, Drop
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Dominion Forge & Stamping Co., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine
Dom. Foundries & Steel, Hamilton
Hepburn Ltd., John T., Toronto,
N. S. Steel Co., Ltd., New Glasgow
Steel Co. of Canada, Ltd., Hamilton

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto,

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis
Rice Lewis & Son, Ltd., Toronto,
Sturtevant Co., B. F., Boston,

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal,

Fuel Oil Burning System
General Combustion Co. of Canada, Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., delphia, Pa.
General Combustion Co. of Canada, Montreal, Que
Rockwell Co., W. S., New York

Furnaces, Heat Treating Coal
General Combustion Co. of Canada, Montreal, Que.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York

Furnaces, Heat Treating Oil
Armstrong-Whitworth of Canada, Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd.,
General Combustion Co. of Canada, Montreal, Que.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York
Walker & Sons Metal Product Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., delphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Product Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence
Electric Furnace Construction Co., delphia, Pa.
Mechanical Engineering Co., Three Que.
Rockwell Co., W. S., New York
Walker & Sons Metal Product Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto

Gages, Comparator
Jones & Lamson Machine Co., field, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
Johansson Inc., C. E., Windsor,
Perdue, W. B., San Francisco,
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool)
Banfield & Sons, Ltd., W.H.,
Chesterman & Co., Ltd., J., Sheffield
Crescent Machine Co., Ltd., Montreal
Greenfield Tap & Die Corp., Greenfield
Johansson Inc., C. E., Windsor
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor
Taylor Instrument Co., Toronto,

BUYERS' DIRECTORY

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthle, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can Link Belt Co., Toronto, Ont
Canadian SKF Co., Toronto, Ont
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can Foamite Firefoam Co., Hamilton,

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd, Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que
Crescent Machine Co., Ltd Montreal Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co. Brantford, Ont.

BUYERS' DIRECTORY

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd., W.H., Toronto
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Lanurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Banfield & Sons, Ltd., W.H., Toronto
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashfil Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd., W.H., Toronto
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton,
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., To... Ont.
Williams Machinery & Supply Co., ... Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, ...
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, ...
Kempsmith Mfg. Co., Milwaukee, W...
Williams Machinery Co., A. R., To... Ont.

Monel Metal
International Nickel Co. of Can., ... Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianap...
Can. Fairbanks-Morse Co., Ltd., Mo...
Garlock-Walker Mchy Co., Toronto ...
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que...
Northern Electric Co., Montreal, ...
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., T... Ont.
Wisconsin Electric Co., Racine, W...

Moulded Rubber Goods
Can. Consolidated Rubber Co., ... Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, ...

Nails and Staples
Canada Metal Co., Ltd., Toronto, ...
Steel Co. of Canada, Ltd., Hamilto...

Nickel, Bars, Sheets, Wire, Et...
International Nickel Co. of Can. ... Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, ... Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling ... Ltd., Toronto, Ont.

Nitrogen
L'Air Liquide Society, Toronto, O...

Nut Tappers (See Bolt and N... chinery)
Acme Machinery Co., Cleveland, ...
Bertram & Son Co., Ltd., Th... Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., M...
Greenfield Tap & Die Corp., Galt, ...
National Acme Co., Cleveland, O...

Nuts, Finished and Semi-finish...
Galt Machine Screw Co., Galt, ...
National Acme Co., Montreal, ...

Nuts, Machine Screw
Torrington Company, Ltd., Upp... ford, Que.

Nuts, S.A.E., Plain and Castel...
Galt Machine Screw Co., Galt, ...
National Acme Co., Montreal, Q...

Oil Cocks and Burners
Puro Sanitary Drinking Founts... Haydenville, Mass.

Oil Filtering and Storage Syst...
Bowser, S. F., & Co., Ltd., Toron...

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toron...

Oils
Canadian Oil Companies, Ltd., ... Ont.
Cateract Refining Co., Toronto, O...

Oil Hole Covers
Can. Winkley Co., Ltd., Windso...

Oils, Soluble
Cateract Refining Co., Toronto, O...
Imperial Oil Ltd., Toronto, Ont...
Brantford Oven & Rack Co., B...

Oxygen
Carter Welding Co., Toronto, C...
Dominion Oxygen Co., Toronto, ...
L'Air Liquide Society, Toronto, ...

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, ...

Packing, Hydraulic
Can. Consolidated Rubber Co., ... Montreal, Que.
Graton & Knight Mfg. Co., ... Mass.
Guildford & Sons, L... Halifax, ...

Packing, Steam
Can. Consolidated Rubber Co., ... Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., ...
Graton & Knight Mfg. Co., ... Mass.
Guildford & Sons, Ltd., Halifax, ...

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotl...
Dominion Engineering Works ... Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, ...
Marion & Marion, Montreal, Que...

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See ... working Machinery)
Canada Machinery Corp., Galt, ...
Oliver Machinery Co., Grand Rap...

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Mo...
Victoria Foundry Co., Ltd., Ott...
Wraggis Pattern Works, Galt, ...

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke ...

BUYERS' DIRECTORY

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Piping or Tin
Brit Smelting & Refining Co., Ltd., Montreal, Que.
Can Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Hardwood Corp., H. B., Philadelphia,
Williams Machinery Co., A. R., Toronto,

Pipe Couplings
Canada of Canada, Ltd., Hamilton, Ont.

Pipe Cutting and Threading Machines
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Fairbanks, Ltd., Montreal, Que.
Fairbanks-Morse Co., Galt, Ont.
Gurney & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Machine & Tool Co., Detroit,
Mich.
Pratt & Whitney Co., Ltd., R., Galt, Ont.
Smith Ltd., H. W., Toronto, Ont.
Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Canada Hardware Ltd., Toronto, Ont.
Fairbanks, Ltd., Montreal, Que.
Jarvis & Son, Ltd., Toronto, Ont.

Pipe Reading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Planing Machines
Acme Co., Cleveland, Ohio.
Turret Machine Co., Madison, Wis.

Planimeters, Parallels
Mfg. Co., Niagara Falls, Ont.

Planing Machines
Jarvis & Son Co., Ltd., The John, Toronto, Ont.
Machinery Corp., Galt, Ont.
Fairbanks-Morse Co., Ltd., Montreal.
Machinery & Supply Co., Geo. F., Montreal, Que.
Walker Mchy. Co., Toronto, Ont.
Ltd., John T., Toronto, Ont.
Ltd., Alfred, Toronto, Ont.
Mfg. Co., Niagara Falls, Ont.
Mfg. Co., Muskegon, Mich.
Machinery Co., Grand Rapids, Mich.
Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Jarvis & Son Co., Ltd., The John, Toronto, Ont.
Machinery Corp., Galt, Ont.

Plug Gages
Jarvis & Son Co., Ltd., The John, Toronto, Ont.

Plumbers' Brass Goods
Sanitary Drinking Fountain Co., Taunton, Mass.

Pneumatic Tools
Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Pneumatic Tool Co., Toronto,
Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Pneumatic Tool Co., Grand Rapids, Mich.

Polishing and Buffing Machines
Acme, Ltd., John, Birmingham, Eng.
Bickle & Co., Chas. P., Montreal, Que.
Bliss, J. G., Everett, Mass.
Brown Sharpe Mfg. Co., Providence, R.I.
Gibson & Van Winkle Co., Ltd., Toronto, Ont.
Gurney Machine Co., Hamilton, Ont.
Mchy. Co., Toronto, Ont.
Ltd., John C., Birmingham, Eng.

Pulleys, Cast Iron
Crucible Steel Co. of Canada, Windsor, Ont.

Pulleys, Steel Parts
Acme, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Taylor Co., Ltd., Orillia, Ont.

Pulleys, Wood Rim
Arbor Co., Kalamazoo, Mich.
Fairbanks-Morse Co., Ltd., Montreal.
Manufacturing Company, Ltd., Galt, Ont.
Engineering Co., Sarnia, Ont.
H. W., Toronto, Ont.
Co. of Can., Ltd., Chas. A., Hamilton, Ont.

Punches and Forging
Briggs & Co., Ltd., Hamilton, Ont.
Foundries & Forgings Co., Welland, Ont.
Fairbanks-Morse Co., Ltd., Montreal.
Machine & Tool Co., Toledo, Ohio.

Punching Machines, Foot and Hand
Briggs & Co., Ltd., Hamilton, Ont.
Ltd., John C., Birmingham, Eng.

Punching Machines, Hydraulic
Machine Co., Kalamazoo, Mich.
Machine Co., Bridgeport, Conn.
Gibson & Son Co., Ltd., The John, Toronto, Ont.
Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Mfg. Co., Springfield, Ill.
Smith Ltd., W. R., Toronto, Ont.
Tool Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto,

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Alkenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto Ont
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Alkenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island Que
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co of Canada, Ltd., Hamilton, Ont
Torrington Company, Ltd., Upper Bedford, Que.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven, Mich
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven Mich

Saw Frames and Blades, Hack
Alkenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis I
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton, Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O

Screw Machine Work
Banfield & Sons, Ltd., W.H., Toronto
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont

BUYERS' DIRECTORY

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd., W.H., Toronto
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel Blooms and Billets
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel Wire Rods
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montr
Geometric Tool Co., New Haven, Con
Greenfield Tap & Die Corp., Galt, Ont

Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Con
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Det Mich.
National Acme Co., Cleveland, Ohio
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto,

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, On

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island,
Greenfield Tap & Die Corp., Galt,
Jones & Lamson Machine Co., Spring Vermont.
Murchey Machine & Tool Co., D Mich.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Spring Vermont.
Landis Machine Co., Inc., Waynesbor

Threaded Wires
Torrington Company, Ltd., Upper ford, Que.

Threading Machines
Acme Machinery Co., Cleveland, O
Geometric Tool Co., New Haven, C
Greenfield Tap & Die Corp., Galt,
Jones & Lamson Machine Co., S field, Vt.
Murchey Machine & Tool Co., D Mich.
National Acme Co., Cleveland, Ohi
National Machinery Co., Tiffin, Ohi
Williams Tool Corp. of Can., Ltd., ford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., S field, Vt.
Pratt & Whitney Co., of Canada, Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tongs
Hepburn Ltd., John T., Toronto,

Tool Cases
Rice Lewis & Son, Ltd., Toronto,

Tool Holders
Armstrong Bros. Tool Co., Chica
Bilton Machine Co., Bridgeport, C
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn,

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sher Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The Dundas, Ont.
Canada Machinery Corp., Galt, O
Williams & Co., J. H., Brooklyn,

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co Toronto, Ont.

Tools, Small (See Machinists' Tools)
Armstrong-Whitworth of Canada Montreal, Canada.
Armstrong Bros. Tool Co., Chica
Bertrams Ltd., Edinburgh, Scotla
Burgess & Marchand, Montreal,
Can. Fairbanks-Morse Co., Ltd.,
Chesterman & Co., Ltd., J., Eng.
Foss Machinery & Supply Co., Montreal, Que.
Geometric Tool Co., New Haven.
Greenfield T & Die Corp., Galt
Hamilton neering Service, Hamilton, t.
Keller Pneumatic Tool Co., Grand Mich.
Kimber & Hillier Mfg. Co., St. rines, Ont.
National Machine Tool Co., Raci
Rapid Tool & Machine Co., Lach
Rice Lewis & Son, Ltd., Toronto,
Rockford Milling Machine Co., Ill.
Starrett Co., L. S., Athol, Mas
Strelinger Co. of Can., Ltd., Windsor, Ont.
Wheel Trueing Tool Co., Detroit,
Williams Machinery Co., A. R., Ont.
Williams Machinery & Supply Co Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd.,
Crescent Machine Co., Ltd., Mon
Ford-Smith Machine Co., Hamil

BUYERS' DIRECTORY

Valves
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee. Wis.
Charles Parker Co., Meriden, Conn.

Vises, Metal Workers'
Aikenhead Hardware, Ltd., Toronto, Ont.
Columbia Hdwe. Division, Cleveland, O.
Charles Parker Co., Meriden, Conn.

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence, R.I.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kearney & Trecker Co., Milwaukee, Wis.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Barnes Co., Wallace, Bristol, Conn.
Diamond State Fibre Co., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrenches, Tap
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrought Iron Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co. Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada. Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Kempsmith Mfg. Co., Milwaukee. Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.

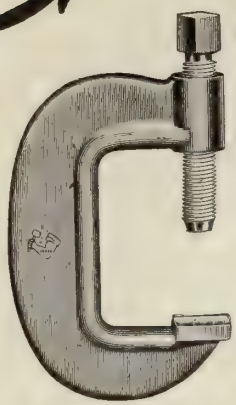
Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.

CANADIAN MACHINERY AND MANUFACTURING NEWS
143 UNIVERSITY AVE., TORONTO, CANADA

CANADA—Montreal, Southam Bldg., 128 Bleury St., Phone Plateau 946. Winnipeg, 901 Confederation Life Bldg., Phone Main 3449. Vancouver, 314 Carter-Cotton Bldg., 198 Hastings St. West. St. John, N.B., John S. Scott, General Delivery.
GREAT BRITAIN—London, The MacLean Publishing Company of Great Britain, Limited, 88 Fleet St., E. C., E. J. Dodd, Director, Telephone Central 12960. Cable Address: Atabek, London, Eng.
UNITED STATES—New York, J. J. Gillen, 1606 St. James Bldg., 1133 Broadway. Phone Watkins 5869. Boston, C. L. Morton, Room 734, Old South Bldg., Phone Main 1024. Chicago, A. H. Byrne, 405-6 Transportation Bldg., 608 S. Dearborn St., Phone Wabash 9430. Cleveland, W. L. Gifford, 1181 Allandale Ave.



ARMSTRONG
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DOGS DROP FORGED CLAMPS



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1862
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Known Everywhere

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Are for You

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Made in Canada

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We also manufacture and carry in stock all sizes and types of high speed and carbon milled drills.

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Is Your Tool-Kit Equipped for this Job?



A Starrett Micrometer Depth Gage, Universal Surface Gage, Solid Steel Square, One-Inch Micrometer, and a Two-Inch Micrometer.

Suppose the Van Dorn Electric Tool Company, of Cleveland, Ohio, turned over to *you* one of these tool housings to be finished up and checked.

Could you handle the job? Have you the Starrett Tools needed—tools such as the inspector is using in the illustration below?

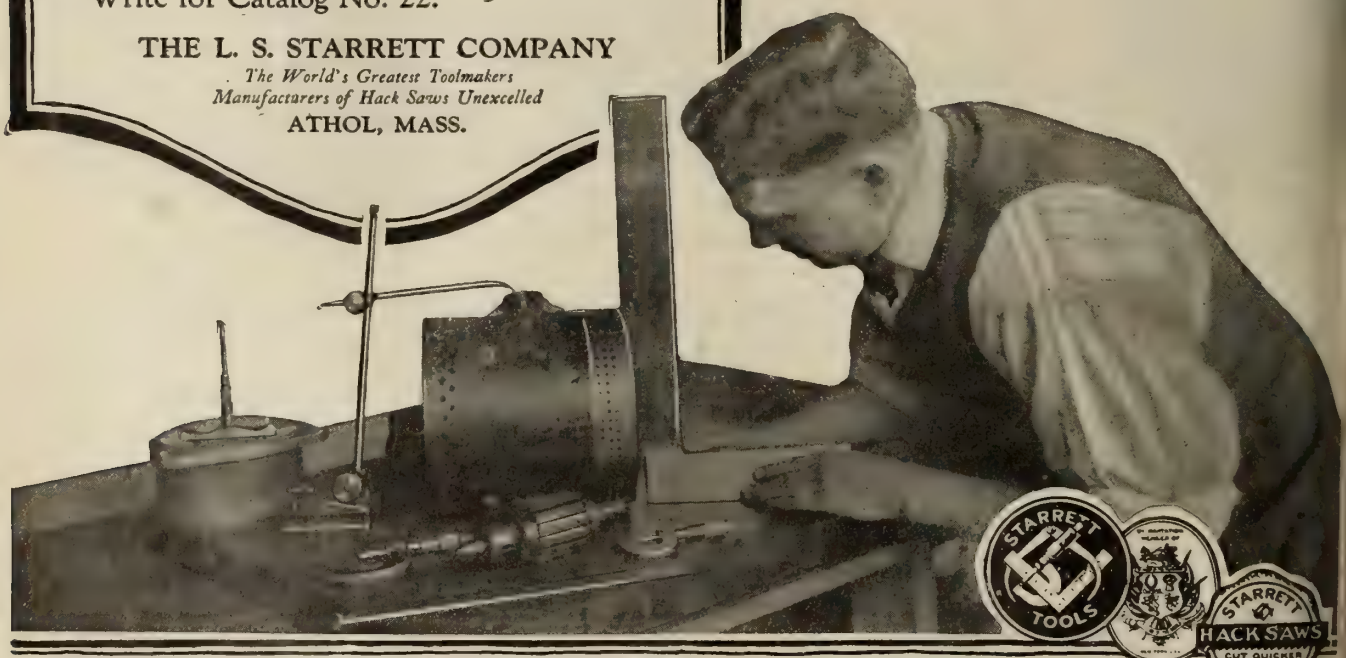
Make sure your kit is fully equipped with Starrett Tools.

Write for Catalog No. 22. "3"

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

Blueprint showing housing for electrically driven tool manufactured by the Van Dorn Electric Tool Company, Cleveland, Ohio. Illustration below shows inspector in Van Dorn shops checking up dimensions of this housing with Starrett Tools.



Use Starrett Tools

42r- 197

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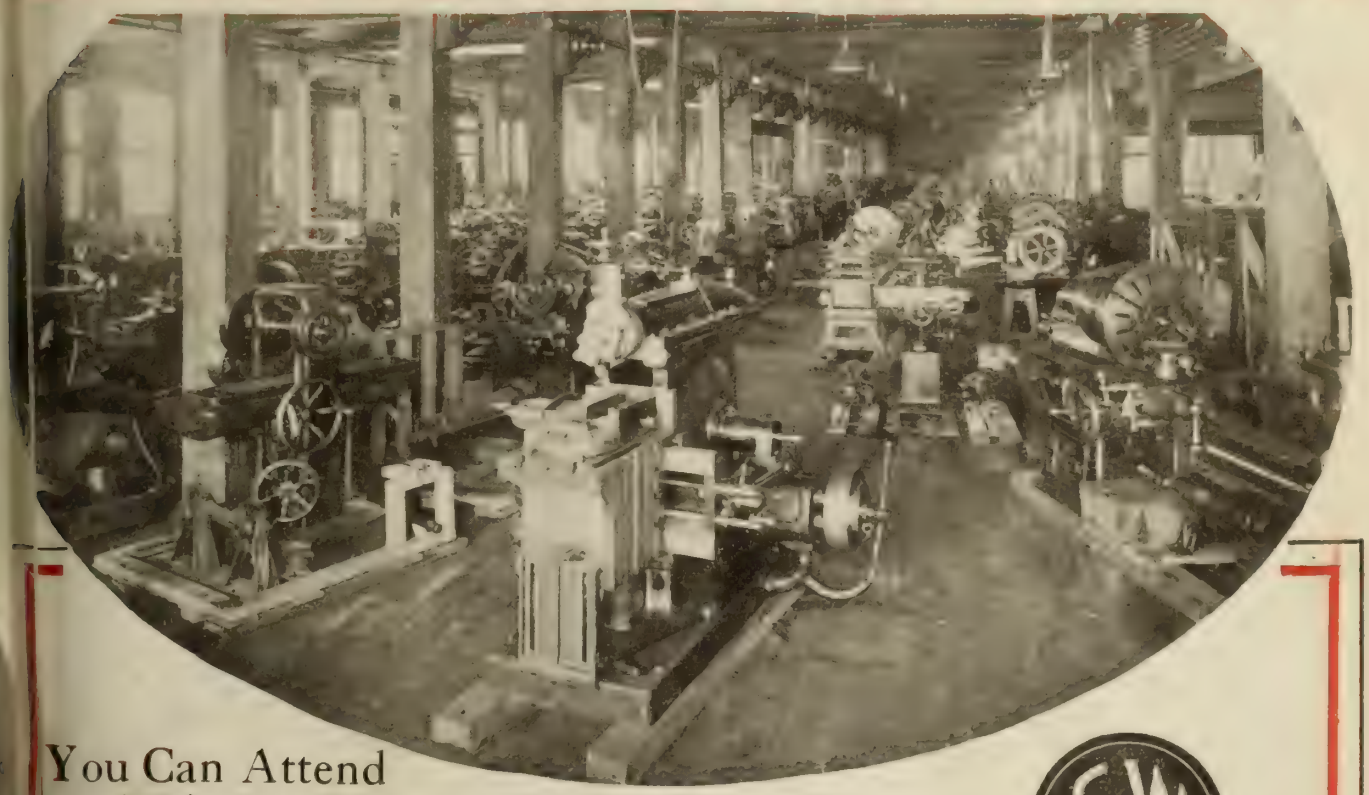
CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVI., No. 7 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Aug. 18, 1921 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

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HIGH GRADE MACHINE TOOLS



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At 163 Dufferin St., where this small corner of our warehouse was photographed, Canadian Machinery readers may come at will and inspect the latest in machine development. Our warehouse is but a few steps from the Exhibition grounds, main entrance, Dufferin Street. An inspection will repay you. You will be welcome.

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Everything for wood-working and metal-working purposes.

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These reamers have eccentric relief and can be set to size without regrinding. They are unexcelled for design and simplicity and ease of adjustment.

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Prompt service is assured at our nearest store, where P. & W. Small Tools are carried in stock for immediate delivery. Place your order there to-day.

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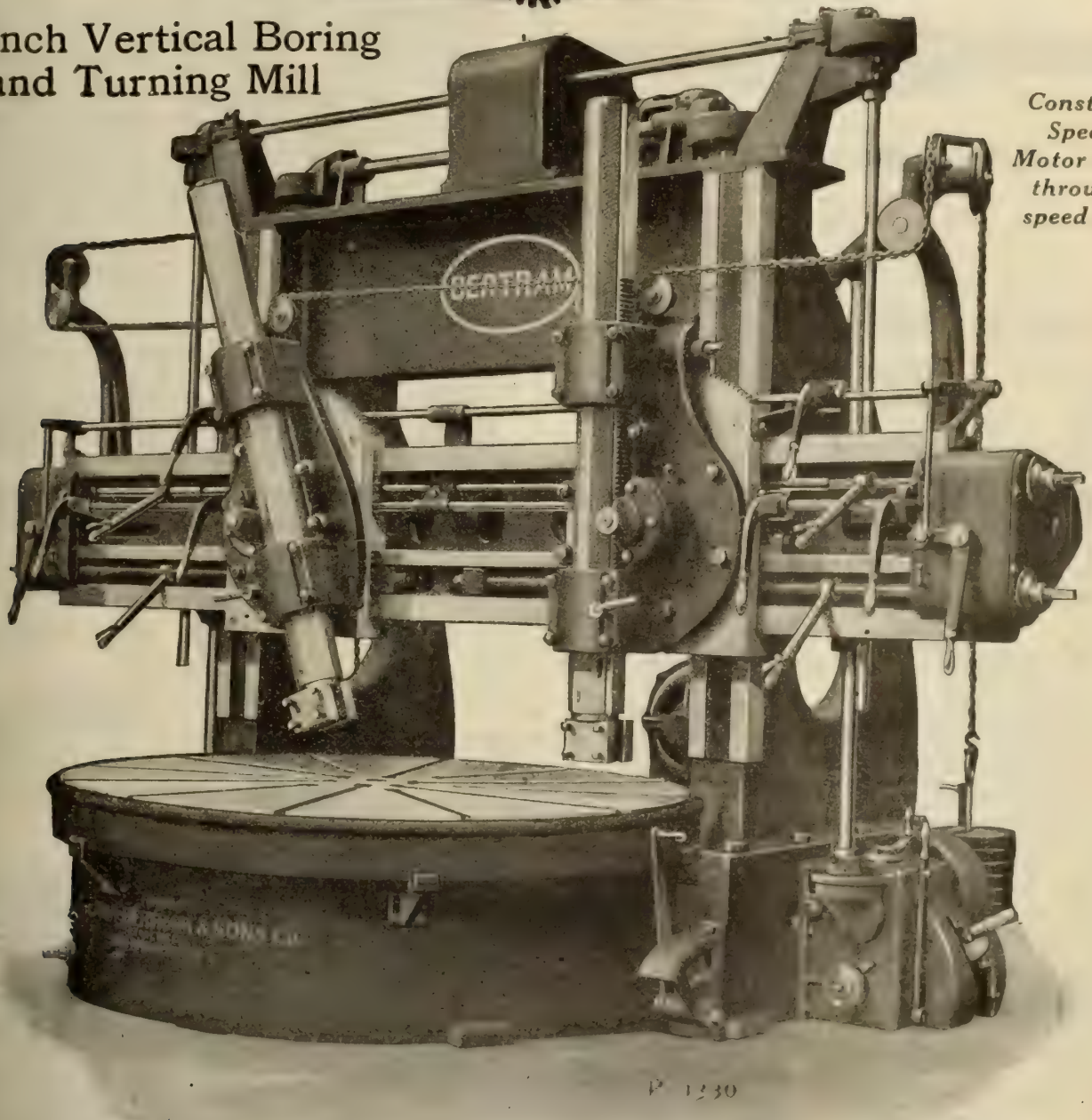
PRATT AND WHITNEY

The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



P 1230

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Our stock includes all the popular sizes of S.A.E. and U.S.S. Cap and Set Screws and Plain and Castellated Nuts.

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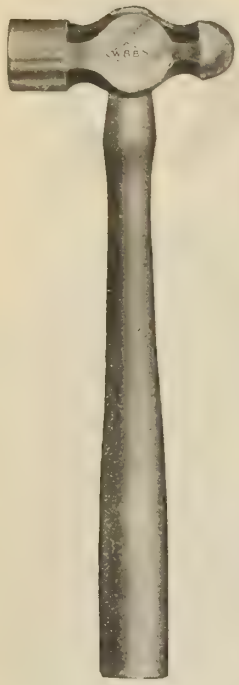
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Until the advent of the Audit Bureau of Circulations, advertisers sowed their business seed in a vast but fallow field. Some of it grew and returned a fair harvest—much of it was cast upon barren ground and was lost. There was no standardized method of determining the fertility of a publication's field. Experimenting was expensive.

The A. B. C. has eliminated the barren spots of circulation. Planting an advertising crop is no longer an experiment. Advertisers **Know** the field through audit reports. They know whether it is fertile ground and sow their seed accordingly.

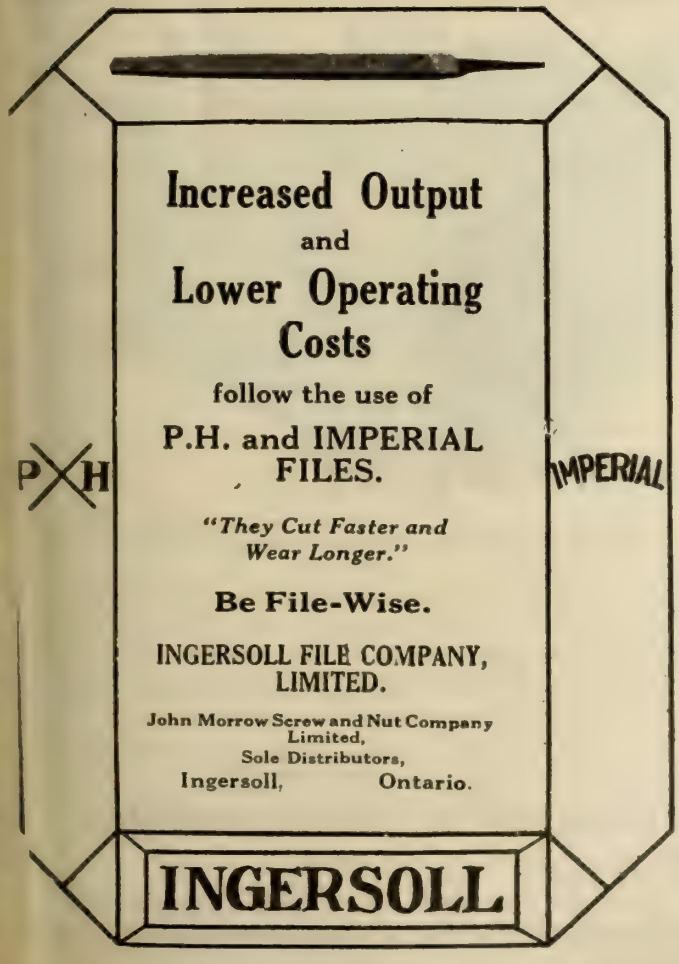
The Canadian Machinery circulation has been audited by the A. B. C. Advertisements placed in this publication are seeds well sown.

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Sheet metal work in all branches--Punching, Drawing, Forming, Finishing, Assembling. Whatever your problem we can solve it, whether it be Stamping or Small Machine Parts, such as Gears, Pinions, etc. Consult us.

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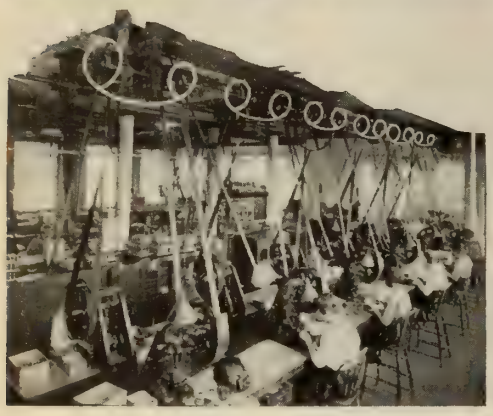
Your enquiries will have our careful attention

Dominion Engineering Works Ltd.

Montreal Quebec

If interested tear out this page and place with letters to be answered.

THE JOHNSON FRICTION CLUTCH



It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

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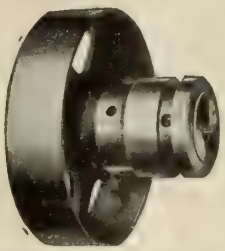
Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

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We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



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P.W.C. 537

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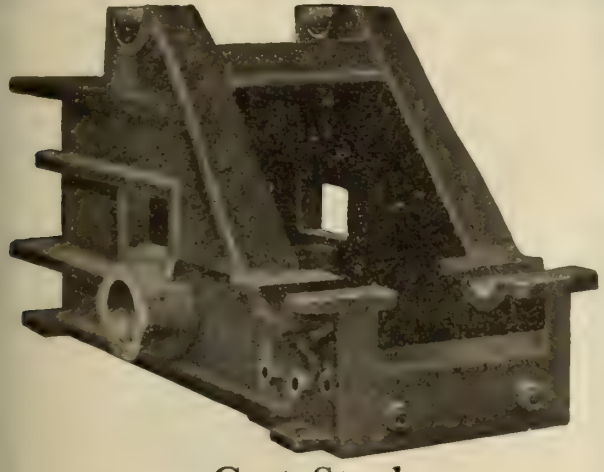
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Machinery Parts

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Chrome-Nickel

and other forged gear blanks

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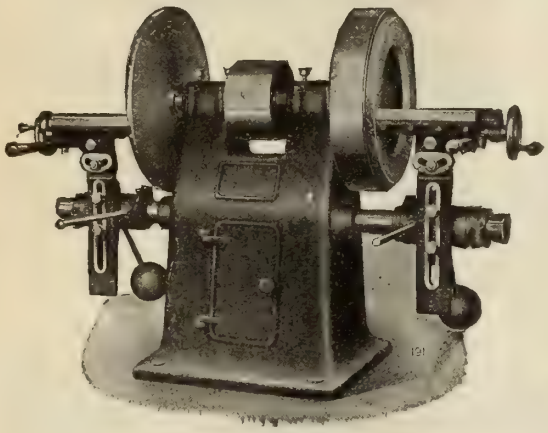
Hamilton, Canada

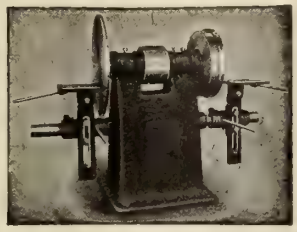
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When a file ceases to cut keenly, discard it and buy a new one. Otherwise you are wasting labor-time, which costs more than files.

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GREAT WESTERN
AMERICAN
ARCADE
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FILES AND RASPS

Made in Canada by

Nicholson File Company

PORT HOPE - ONTARIO

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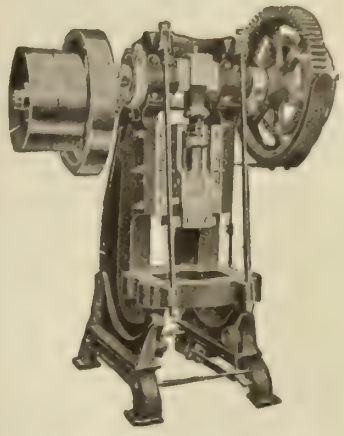
B B

TO be absolutely sure of the best tools to buy why not make a list of say a dozen leading users of sheet metal machinery. Then ask them all what kind they use. You'll find the majority standardize on

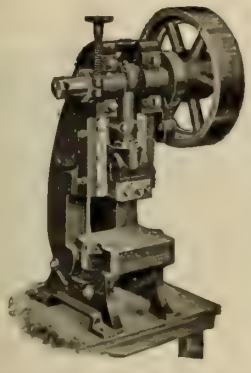
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They like "B-B" Tools because in all the years of Brown-Boggs existence there has never been a let down in quality. *They're dependable.*

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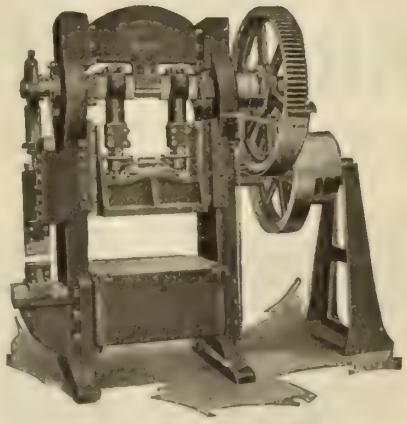


No. 215—Power Press



No. 10—Bench Press

Keep on the look out for new "B-B" designs. There are presses, dies, shears, punches, drop hammers, canners' processing machinery, evaporating machinery and special machinery. Get the "B-B" handy catalog.

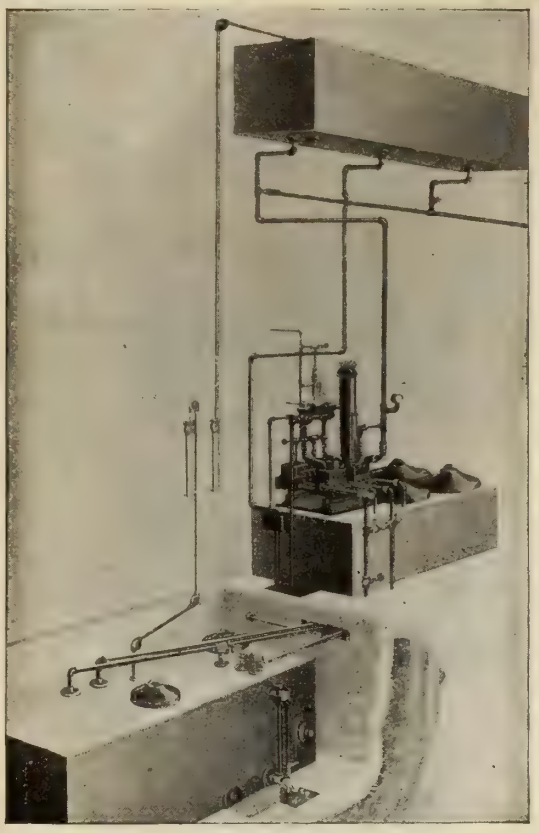


No. 140—Double Crank Trimming Press

B B

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HAMILTON, CANADA.



Bowser 6F Oil Filtering and Circulating System

When Clean Oil Flows Freely

Bowser Oil Filtering and Circulating Systems keep the clean oil flowing onto the bearings in a constant stream—insure efficient lubrication always.

At the same time Bowser Filtering Systems keep the oil bill down. They collect the used oil and filter it, making it ready for re-use—give several gallons of good clean oil for the price of one.

There is also a great reduction in labor. The Bowser System is so nearly automatic, it requires practically no attention.

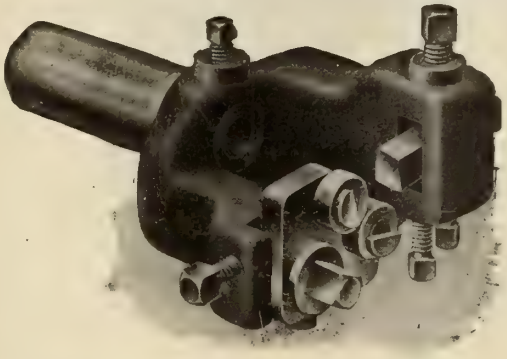
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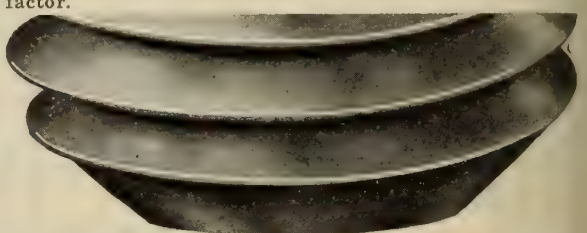
REG. U. S. PAT. OFFICE

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SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.



Get copy of new Bulletin I-810.

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Waterbury, Conn., U. S. A.

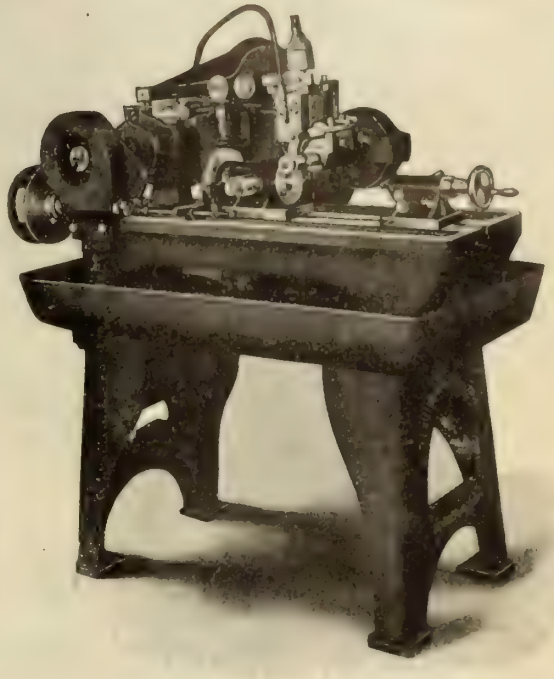
Bilton

MACHINE TOOLS Bilton BRIDGEPORT

Gives You the "Newest" in GEAR MILLER Practice

The "newest" in Gear Miller Practice as interpreted by Bilton, is *more* work, *faster* work, and *better* work per minute.

The Bilton is a compact, up-to-the-minute machine, that easily and accurately produces plain and form milling, as well as serrating, notching, slotting, fluting, etc.
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LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.
The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



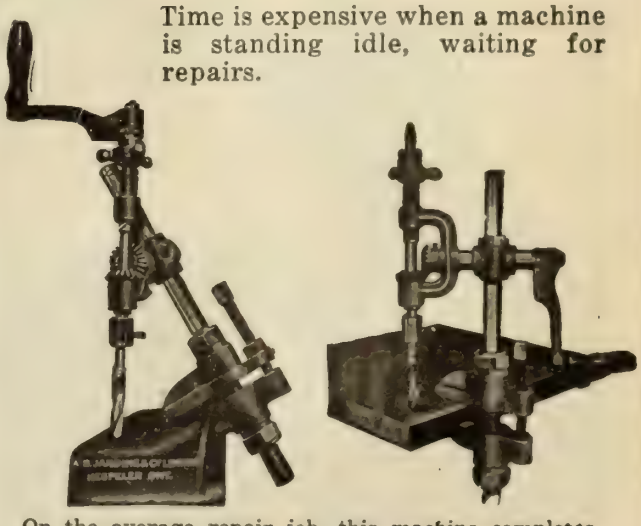
American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.
La Salle, Illinois, U.S.A.

Represented in Canada by
A. R. Williams Machinery Co., Ltd.
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Jardine Universal Ratchet Drill

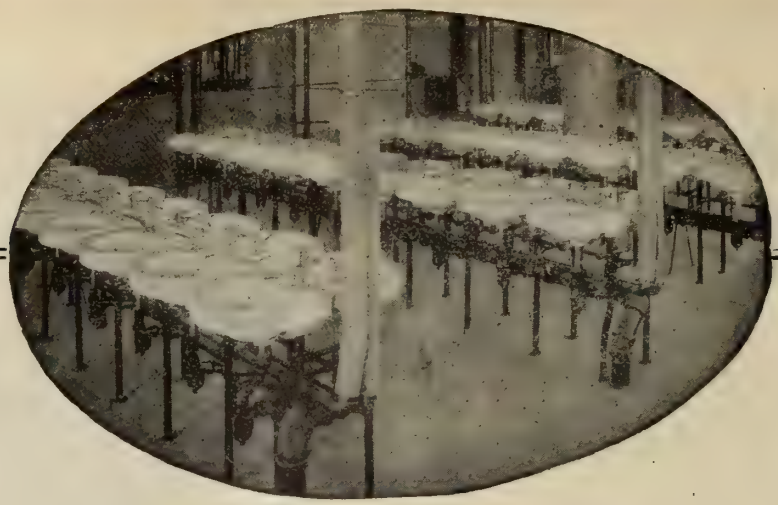
Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO



CRANE

Plumbing Fixtures For Industrial Plants

comprise a line so varied in pattern and design as to adequately meet all requirements; and of a quality capable of withstanding severe usage.

Manufacturers of Valves, Fittings and Piping Equipment and Distributors of Pipe, Plumbing and Heating Supplies.

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LONDON, ENGLAND.

Sales Offices:
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5



"The Men Preferred Starrett Tools—"

"Starrett Tools," says the Plant Superintendent of the Van Dorn Electric Tool Company, Cleveland, Ohio, "are used quite extensively in our plant.

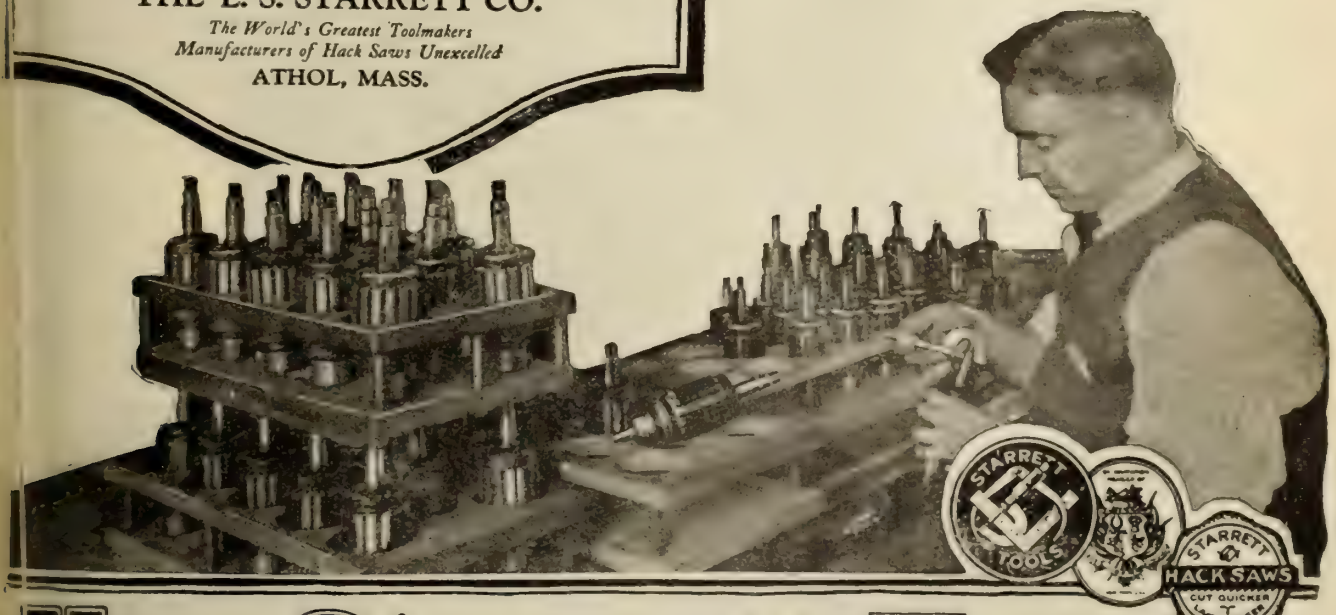
"Many of our men especially ask for Starrett Tools because of their great accuracy, their ability to stand up in service and the ease with which they can be read on account of the deep cutting of the calibrations."

Write for Catalog No. 22. -3''

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

Blueprint shows Armature Shaft for motor drive equipment of electrical tool manufactured by Van Dorn Electric Tool Company, Cleveland, Ohio. Picture below shows inspector checking up dimensions of these shafts with Starrett Micrometer.



Use Starrett Tools

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

SKF BALL BEARINGS

How to save power by reducing friction
—in transmission
—in machines

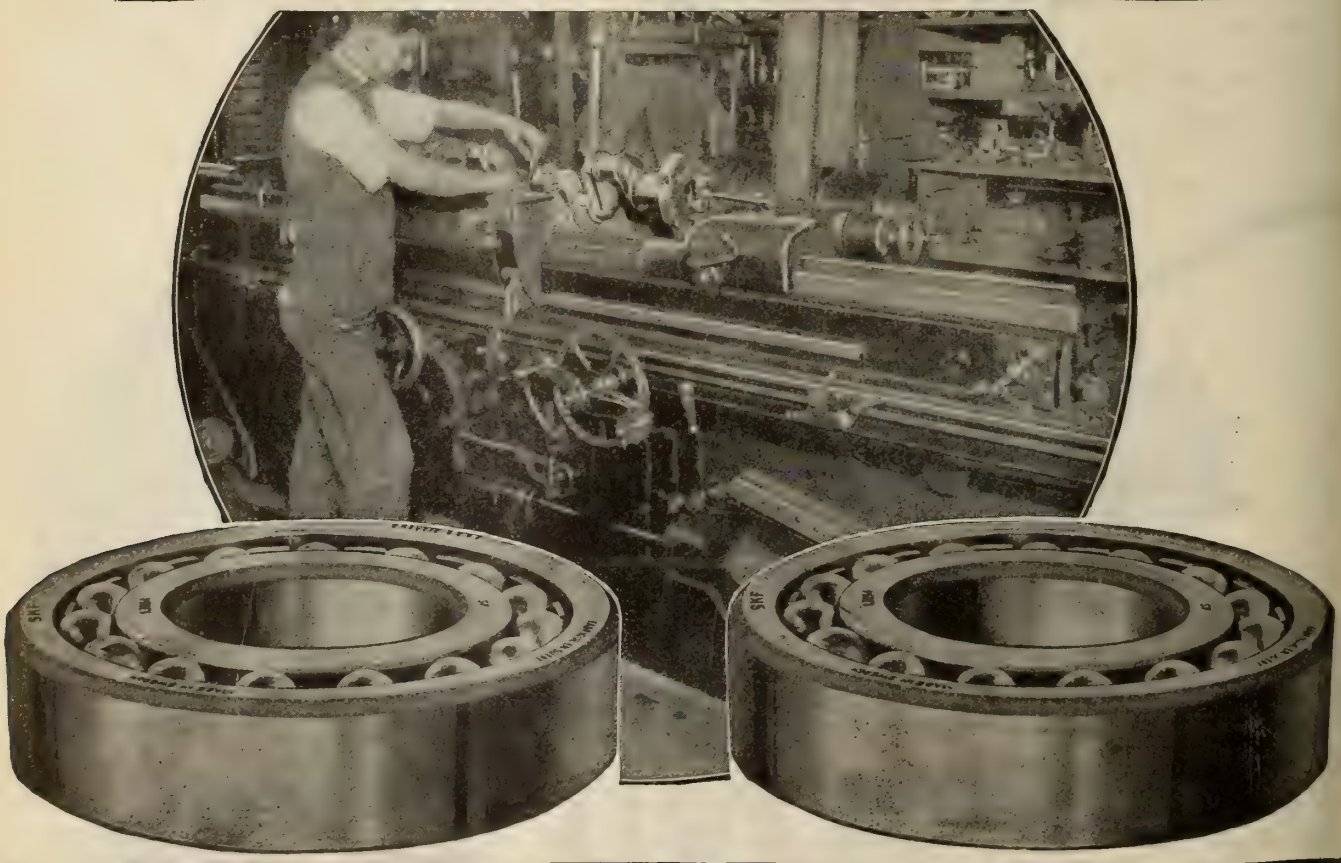
How to improve product by
—insuring accuracy and precision of machines
—increasing speed

How to reduce production costs by
—speeding up machines
—saving lubrication and overhauling of bearings
—reducing spoilage

SKF Engineers gather experience in these important questions from every civilized country of the world and place it at your disposal.

No charge nor obligation in consulting our engineers

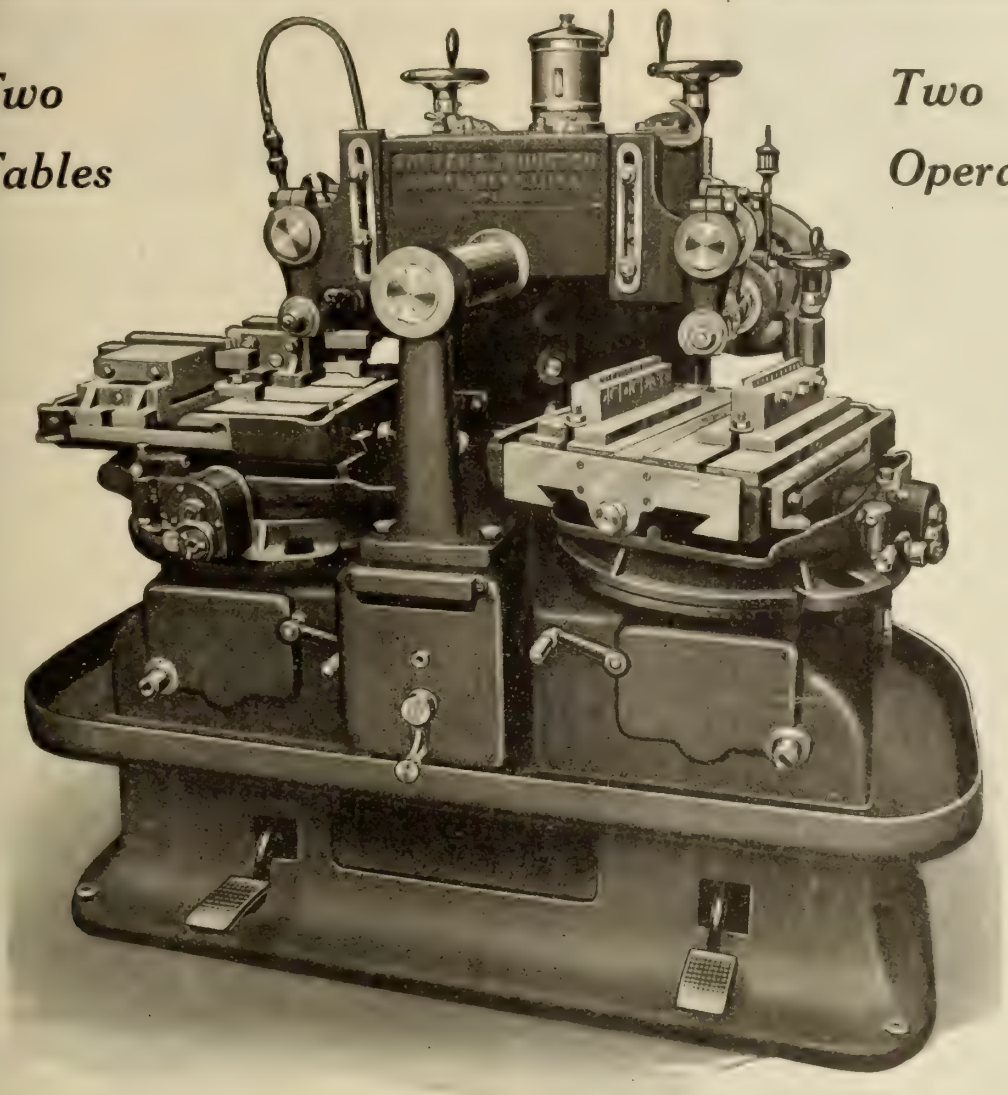
CANADIAN SKF COMPANY, LIMITED
TORONTO - - - MONTREAL



NO WASTE MOTION

Two Tables

Two Operations



P. & J. I-M Milling Machine

is turning out work every minute it is in operation. There are two tables enabling two operations to be performed without waiting for one operation to be completed. No power wasted—no time wasted. No marks from returning cutters. This machine has a history.

Write for Bulletin No. 53.

Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., Ltd.

Head Office and Show Rooms:

11 Wellington Street East -- TORONTO, CANADA.

If interested tear out this page and place with letters to be answered.



TESTED BY TIME

This Adjustable Snap is no experiment. Correctly designed to meet the severest tests, it has proven its value through years of service.

Easily set to exact sizes—rigid and dependable—economical to maintain—adaptable to different sizes and changed limits—this gage helps to reduce gaging costs.

Carried in stock for your convenience by all Johansson dealers.

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Williams & Wilson, Ltd., Montreal, Que.

C. E. Johansson, Inc.

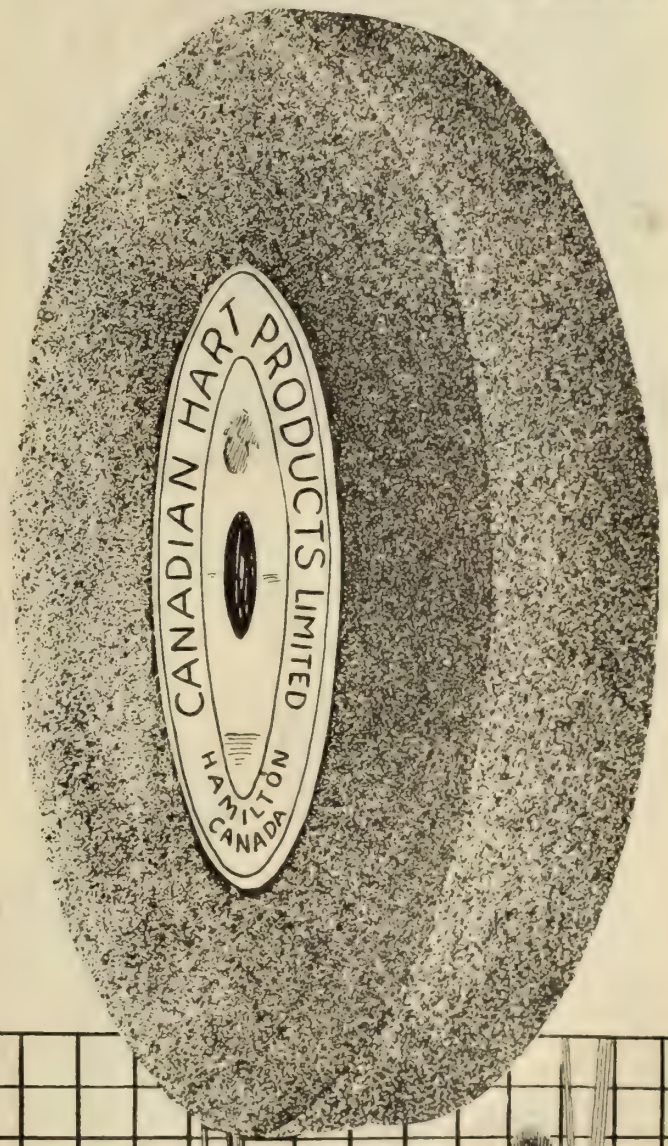
POUGHKEEPSIE, N.Y.

If interested tear out this page and place with letters to be answered.

CANADIAN HART GRINDING WHEELS

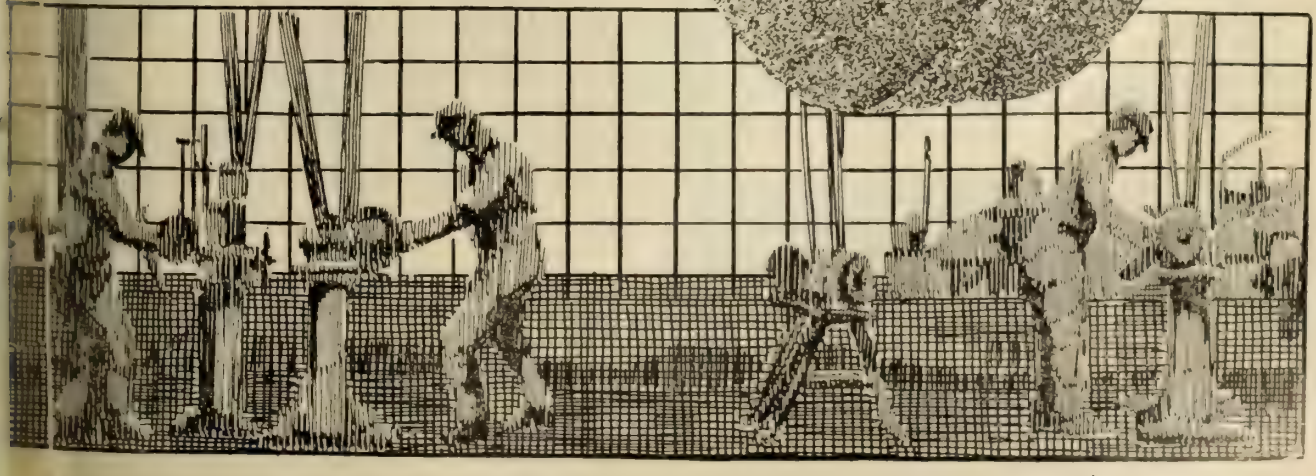
THE factory tests that all Canadian Hart Wheels are subjected to gives you an absolute guarantee that they are free from defects. Each wheel is also carefully inspected for size, grain and grade, so as to make certain that every wheel is in accordance with specifications on your order.

Canadian Hart Wheels are not inclined to "gum up" or "glaze," because they are made of proper abrasive grains of a suitable degree of hardness; especially is this true when the buyer secures the co-operation and advice of our engineering staff with a view of getting the right wheel for the job.



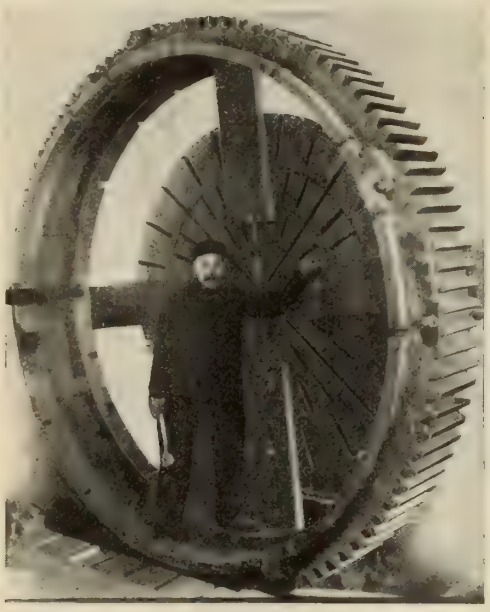
How can we serve you?

Canadian Hart Products
LIMITED
Manufacturers of Grinding Wheels and Machinery
Hamilton, Canada



Hull Iron and Steel Foundries, Limited

HULL, QUEBEC



Specify "HISCO" Regd. Products

Steel, Chrome, Manganese and Nickel

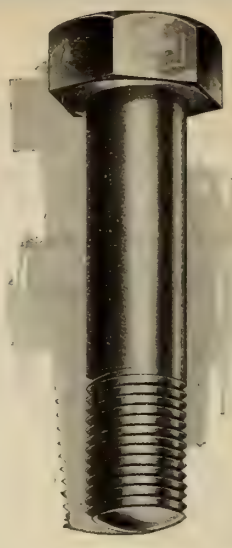
STEEL CASTINGS

Annealed and Unannealed

Cement Mill and Mining Machinery, Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

Machine-Moulded GEARS

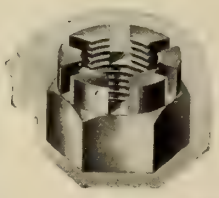
"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.



ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



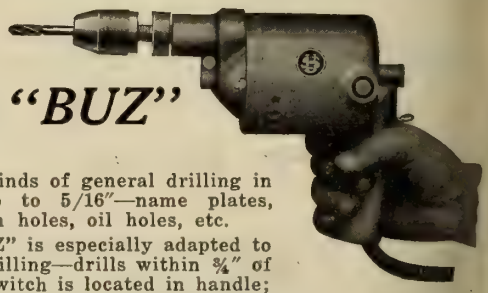
The Galt Machine Screw Co., Limited

GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.

Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

United States Electric Drills and Grinders



The "BUZ"

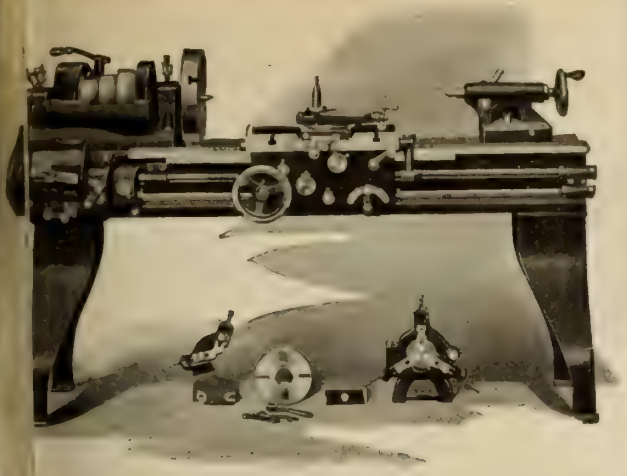
For all kinds of general drilling in metal up to 5/16"—name plates, cotter pin holes, oil holes, etc.

The "BUZ" is especially adapted to corner drilling—drills within ¾" of corner. Switch is located in handle; under absolute control at all times. Attaches to any lamp socket, alternating or direct current, 110 or 220 volts. Guaranteed the most powerful electric drill of its weight on the market.

Order a few to-day for trial. Their time and labor saving ability will convince you you need more!

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO



ufficient Weight and Power to Handle Modern Production

ough small in size, the "Economy" Double Back eared, Quick Change Engine Lathe is strong and werful. Its extreme accuracy makes it particularly apted to the tool room of the modern manufacturing ant. Made in 14 in., 18 in. and 22 in. swing.

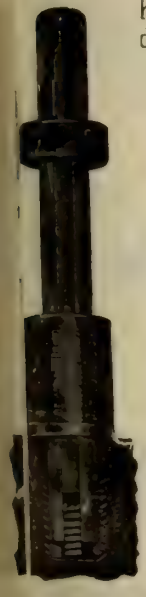
Write for complete information of this small, heavy duty lathe, without delay.

Rockford Lathe and Drill Co.
Rockford, Illinois, U.S.A.

Buried in the Work nd Broke!



ext time a tap breaks low the surface of a large sting, don't let some make-sift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

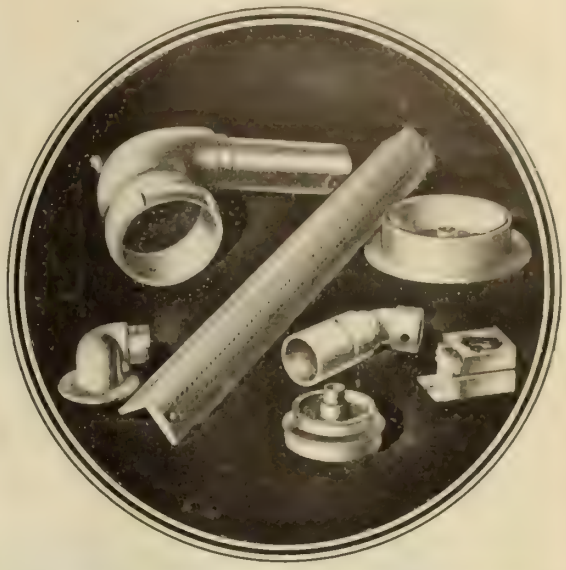
And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.
Hartford, Conn.



Franklin Die-Castings for Musical Instruments

Spreading a Great Educational Influence.

NOT so long ago good music was a treasure of the chosen few. Years of study were necessary to play an instrument. Today, irrespective of technical skill, the great educational influence of good music is at the command of everyone. Among other modern manufacturing methods the Die-Casting Process has been instrumental in enabling the general public to enjoy good music. Franklin Die-Castings, used in phonographs, player pianos and organs, have helped to reduce production costs in the manufacture of these instruments.

Franklin engineers, in 1892, originated the die-casting process. Franklin Die-Castings have helped manufacturers ever since to speed and simplify production in many fields of industry.

The addition of the standard No. 12 Aluminum to the Tin, Lead and Zinc base alloys already in use enables us to meet a still wider range of individual needs.

We quote from samples or blueprints. Write for booklet "Franklin Die-Castings in Many Fields."

FRANKLIN DIE-CASTING CORPORATION
Gifford and Magnolia Streets - Syracuse, N. Y.

FRANKLIN DIE-CASTINGS



NORTON

ALUNDUM CRYSTOLON

GRINDING WHEELS

We are in a position to supply from stock the standard shapes of grinding wheels in the common grains and grades for practically all the grinding jobs you have. In these days prompt delivery is essential and it is our aim to maintain a complete stock of grinding wheels.

Special wheels that we do not have on hand can easily be furnished made by the Silicate process, which will insure reasonably quick delivery.

Norton Alundum wheels for any work on steel or other materials of high tensile strength.

Norton Crystolon Wheels for any work on cast iron, brass, and other materials of low tensile strength.

NORTON COMPANY OF CANADA LIMITED

HAMILTON - - ONTARIO

Electric Furnace Plants: **NIAGARA FALLS, N.Y. CHIPPAWA, ONTARIO, CANADA**

CANADIAN AGENTS:

The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N. B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria F. H. Andrews & Son, Quebec, Que. Simonds Canada Saw Co., Vancouver, B. C.

Buying a Pig in a Poke

The buying of advertising space used
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uantity and quality of circulation was
irouded in mystery and often the bag
as tied against investigation.

That day has passed. The advertiser
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itied the strings to the sack and the
rculation of the better class of publi-
itions is thrown open for the most
arching scrutiny.

In buying advertising space in the
anadian Machinery you are not buy-
ig "a pig in a poke." Our A. B. C.
atements will stand the analysis of the
ost exacting investigator.

WHY EXPERIMENT ?
WE DID IT FOR YOU YEARS AGO



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

Write For Prices

THE CANADA METAL CO., LIMITED

TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

MADE IN CANADA

MADE IN CANADA



WILLIAMS' SUPERIOR
DROP-FORGED
WRENCHES
OVER 40 STANDARD PATTERNS
IN 1000 SIZES





J. H. WILLIAMS & CO Limited

"The Wrench People"

Formerly Canadian Division of
The Whitman & Barnes Mfg. Co.

45 Thorold Road

St. Catharines, Ontario

What We Do for Ourselves We Can Do for Others

The line of Bliss Presses and the high quality of workmanship which has always characterized them is sufficiently well-known to serve as an indication of the class of work we can do for you. We will undertake the building of complete machines, do any class of machine work on parts or manufacture complete parts. Our machine tool equipment is complete in every respect including sizes for very large pieces.

We are also prepared to do tool and die work including the manufacture of jigs and fixtures.

We can serve you at any of our plants.

BLISS 1857

E. W. Bliss Company

BLISS 1921

Main Offices: BROOKLYN, N. Y., U. S. A.

American Factories: BROOKLYN, N. Y.; HASTINGS, MICH.; CLEVELAND, O.; SALEM, O.

SALES OFFICES

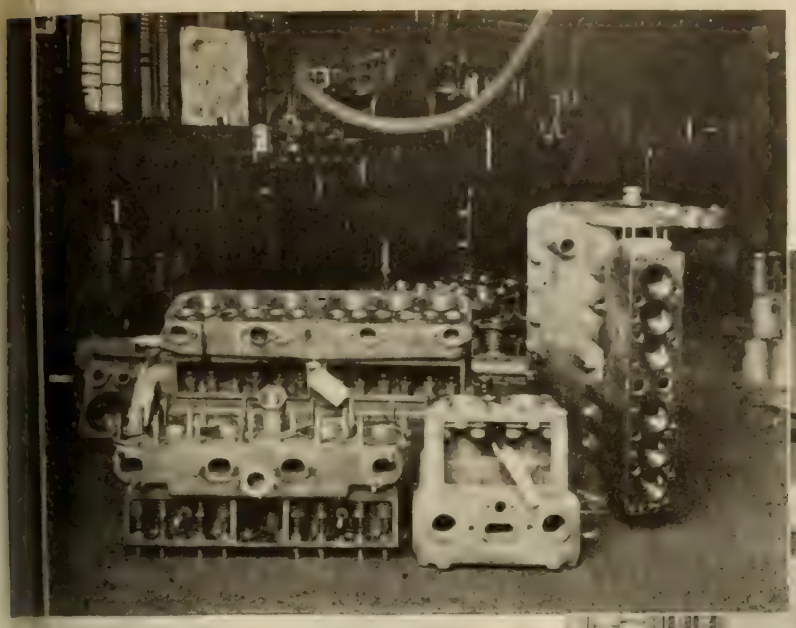
CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg.
CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURGH, Keenan Bldg.

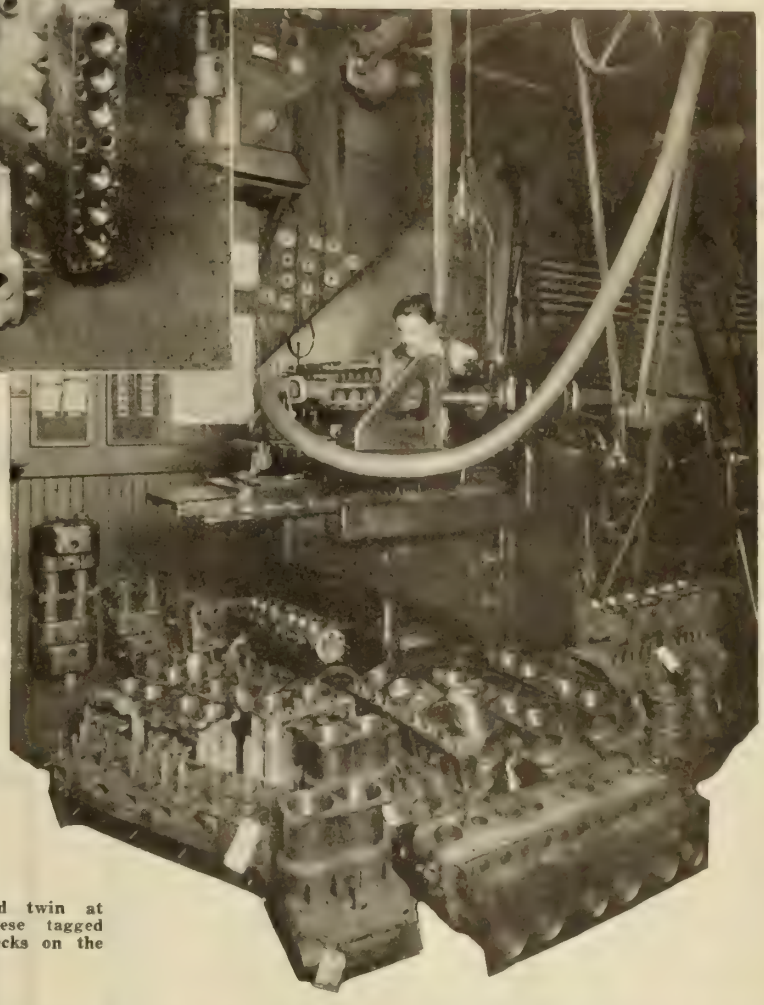
FOREIGN SALES OFFICES *and* FACTORIES

LONDON, ENGLAND, Pocock Street, Blackfriars Road, S. E. PARIS, FRANCE, 100 Boulevard Victor-Hugo, St. Ouen

159

Cylinder Regrinding





...ove group consists of a Mitchell six, ...a six, Continental twin, and Cunning-...ght that have just been ground on a ...which handles automobile, marine and ... cylinders equally well.

More Evidence In Favor of

HEALD

Regrinding the bores of a Packard twin at the Zumbach Machine Co. All these tagged cylinders will result in nice fat checks on the first of the month.

...e another Heald at work in the shop of the Zumbach Machine Co., 134 West 54th St., New York City. ...reare over 500 concerns using Heald in the United States that we could call on for photographs be-...te list would be exhausted.

...this is a large number they cannot begin to take care of the tremendous field and possibilities of ...inding. It proves definitely that the Heald is recognized as the logical machine to take care of ...ing worn and scored cylinders. In Canada there are **402,929** registered cars and only 11 Heald ...ped shops to handle these possibilities. It is an opportunity you should not pass up.

...Style No. 55 is built especially for regrinding work. It is nominal priced, self-contained and ...lewith a large range and capacity.

If you have a small machine shop, auto repair shop or welding outfit, look into the regrinding field. It is the most active business in the mechanical line today. Install a Heald and clear those cobwebs out of your cash box.

THE HEALD MACHINE COMPANY

51 New Bond Street, Worcester, Mass.

...NCH OFFICES:—New York, 839 Singer Bldg., Philadelphia, 1302 ...ard Bldg. Chicago, 26 South Jefferson Street. Detroit ... Marquette Bldg. Cincinnati, 311 Provident Bank Bldg. Cleve-...d, 72 Engineers Bldg. Buffalo, 331 Jewett Ave.

CANADIAN AGENTS:— H. W. Petrie, Ltd., Toronto, Ont. George F. Foss Machinery & Supply Co., Ltd., 305 St James St., Montreal

THE MORSE CHAIN CO.

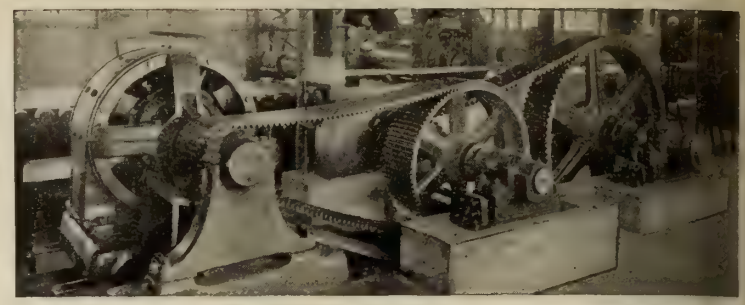
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

Why?

Morse Chain possesses the exclusive
Rocker Joint

Frictionless—Requires no Oilbath.

Jones & Glassco (Reg'd.)
Canadian Agents
Montreal - - Toronto



80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds

"Elkco," "Elkco Special," "Elk Steel"
"St. Marys," "Keystone,"
"M.D. Elk" "Rotex,"
"Elk Dust" "Keystone
Dust" "Rotex Dust"

ELK BRANDS FIRE BRICKS

A Brand for every purpose ensures the best results.

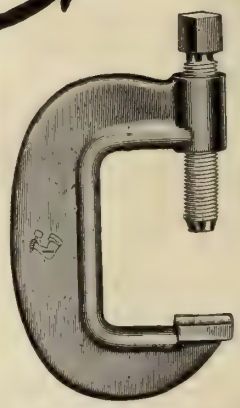
Each brand of Elk Fire Brick has some particular qualification which fits it to give better results in certain places than other brands we produce. It differs from the others either in grind, mixture of clays, or in method of manufacture, or possibly in chemical composition.

A trial will convince you that both our quality and service equal the best.

Large stocks of various shapes carried in warehouse in Hamilton.

Elk Fire Brick Company of Canada
Limited
Sun Life Building, HAMILTON, ONTARIO.





This extra heavy st
"C" Clamp has long h
and oversized screw ma
of chrome nickel al
steel—made to stand
under the most sev
conditions.
All sizes—¾ to 12-
Capacity. Screws ⅜ to
¼" diameter.
Write for free catalo

Armstrong Bros. Tool Co.
"The Tool Holder People"
306 N. Francisco Ave., Chicago, U. S. A.

HANNA

IRON ORE - PIG IRON

Sales Agents:

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"MORSE" TAPS & DIES





Every time you use a "MORSE" TAP or DIE you know that you will have accurate clean cut threads, and if you order another Tap or Die you can duplicate the threads cut by the first.

MORSE TWIST DRILL & MACHINE CO.
New Bedford, Mass.

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work

AUTOMATIC TURRET LATHES
For Chucking Work

VERTICAL BORING and TURNING MILLS

UNIVERSAL TOOL GRINDERS

HORIZONTAL BORING AND DRILLING MACHINES

TOOL-POST TOOL HOLDERS

REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking

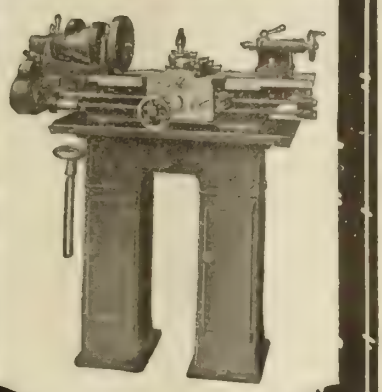
BORING BARS
With Adjustable Cutters

PERIODOGRAPH
For Time Recording in Factories

Separate Catalogs on each Product

Send for the ones you want

GISHOLT MACHINE CO
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.



"The Small Lathe for the Big Job"

Type B-6

Send for Catalog No. BC-10

For the tool room or experimental department the **"Dalton Six"** has no equal.

Actual Swing - -	8¼ inches
Between Centers -	18½ inches
Collet Capacity - -	¾ inch

Dalton Manufacturing Corp'n
Sound Beach, Connecticut, U. S. A.
Cable Address - - "Aledal Stamford"
Also Manufacturers of Type B-4 Lathe

"DALTON SIX"

3 FOR 1

Indianapolis, Ind.

The 6" blast gate furnished by you has proven entirely satisfactory. It is answering the purpose of an 8" gate valve, which would cost several times as much as a blast gate.

THE BAUR CARBONIC COMPANY
(Signed) Oscar Baur, Pres.



NEW AIR-TIGHT BLAST GATE
Light Strong, Compact, Inexpensive, Quick-Acting

You have the same opportunity to save practically two-thirds of what you now pay for gate valves.

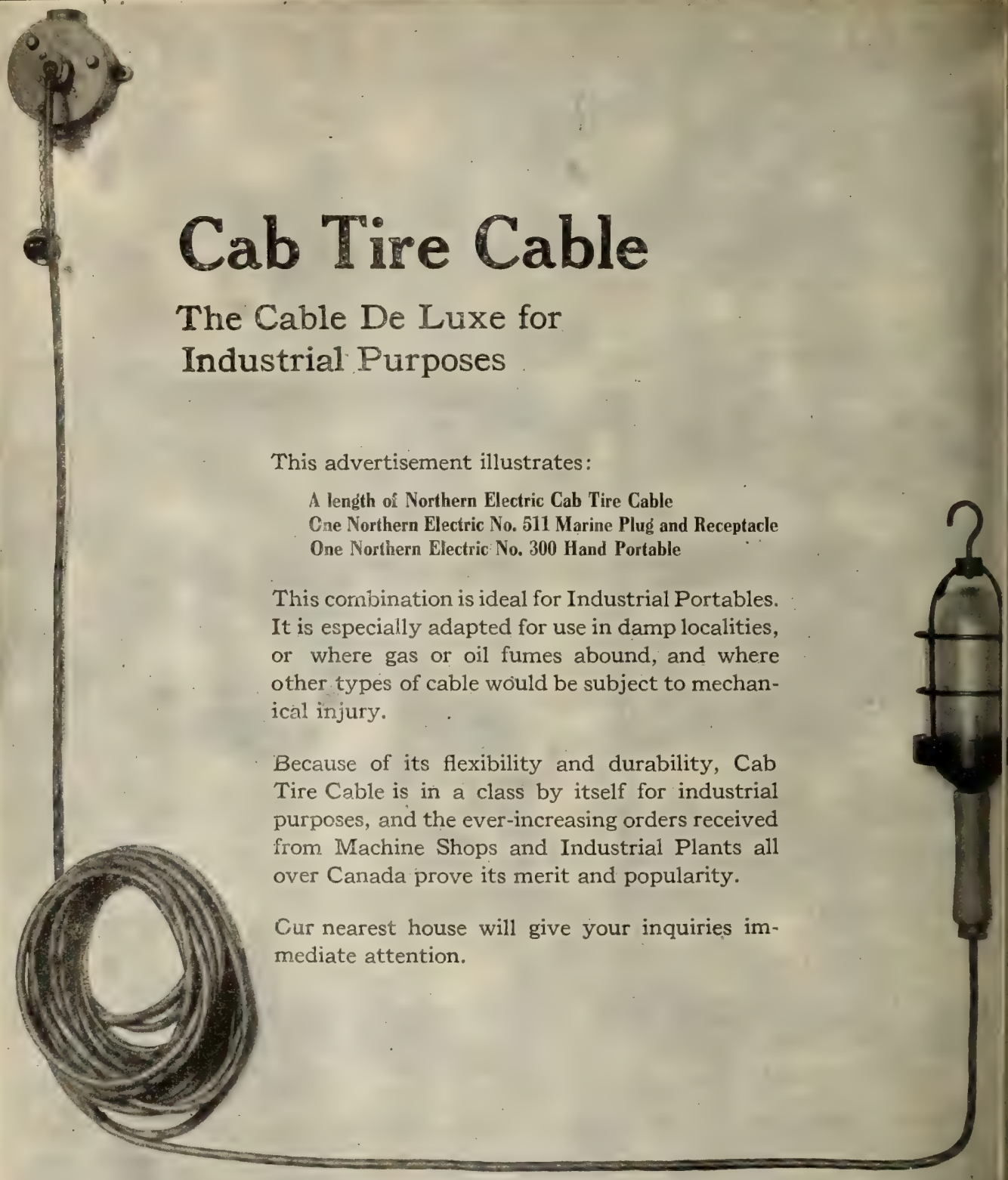
Low in first cost and upkeep, easily and quickly operated, affording the full area of the pipe, these and other advantages make our New Air-Tight Blast Gate an ideal substitute for heavy, cumbersome, expensive and slow-acting gate valves.

This new Air-Tight Blast Gate is made in sizes from 2" to 16" threaded and flanged. Descriptive circular 210-T gives detail dimensions of all sizes. Write for copy to Canadian branch.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
CHURCH ST. (Hudson Terminal Building), NEW YORK
Canadian Distributors: Drummond, McCall & Co., Limited, Montreal



GATE VALVE
Heavy, Cumbersome, Expensive, Slow-Acting



Cab Tire Cable

The Cable De Luxe for Industrial Purposes

This advertisement illustrates:

A length of Northern Electric Cab Tire Cable
One Northern Electric No. 511 Marine Plug and Receptacle
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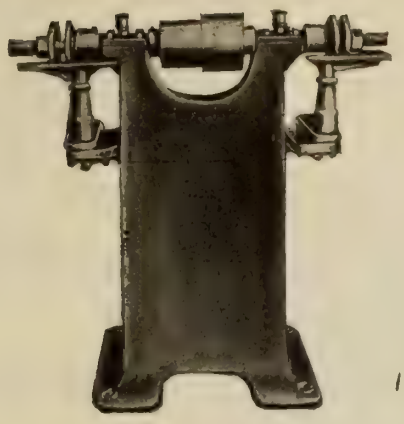
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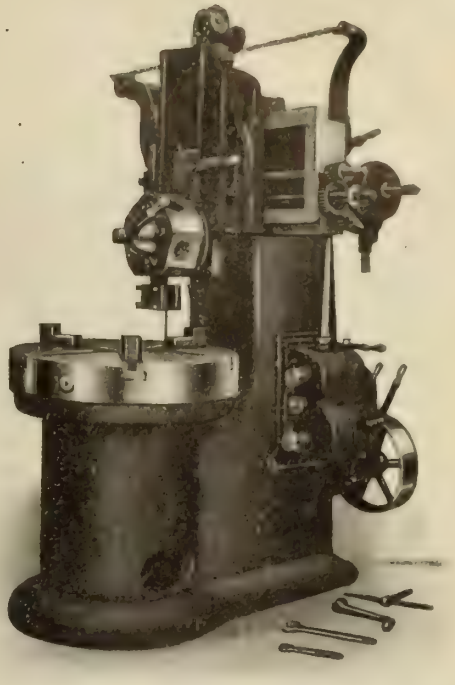
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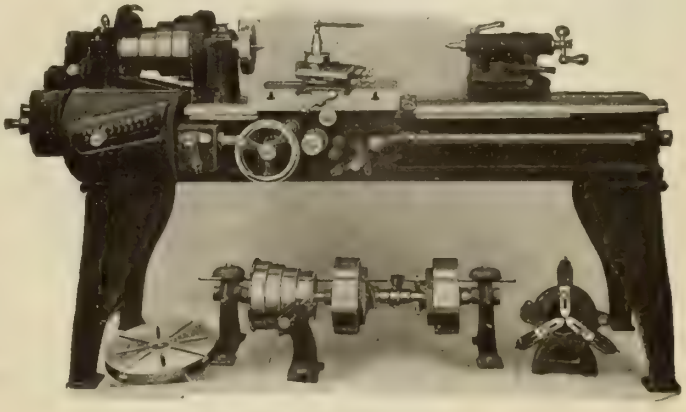


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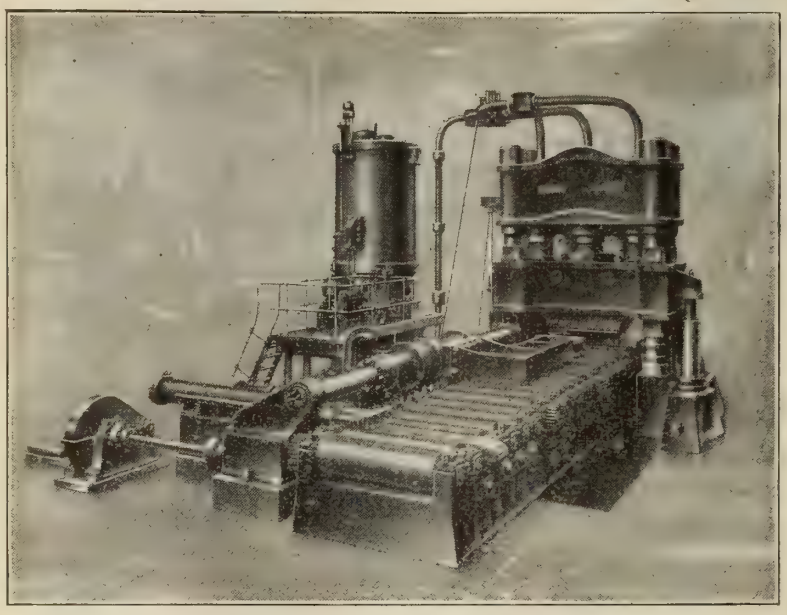
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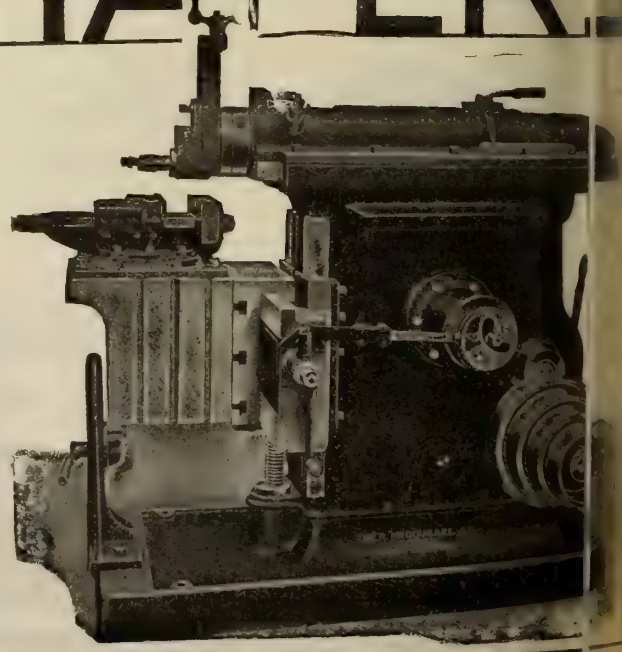
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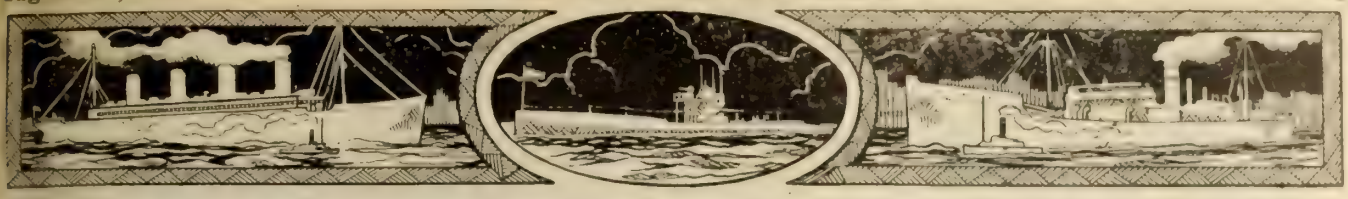
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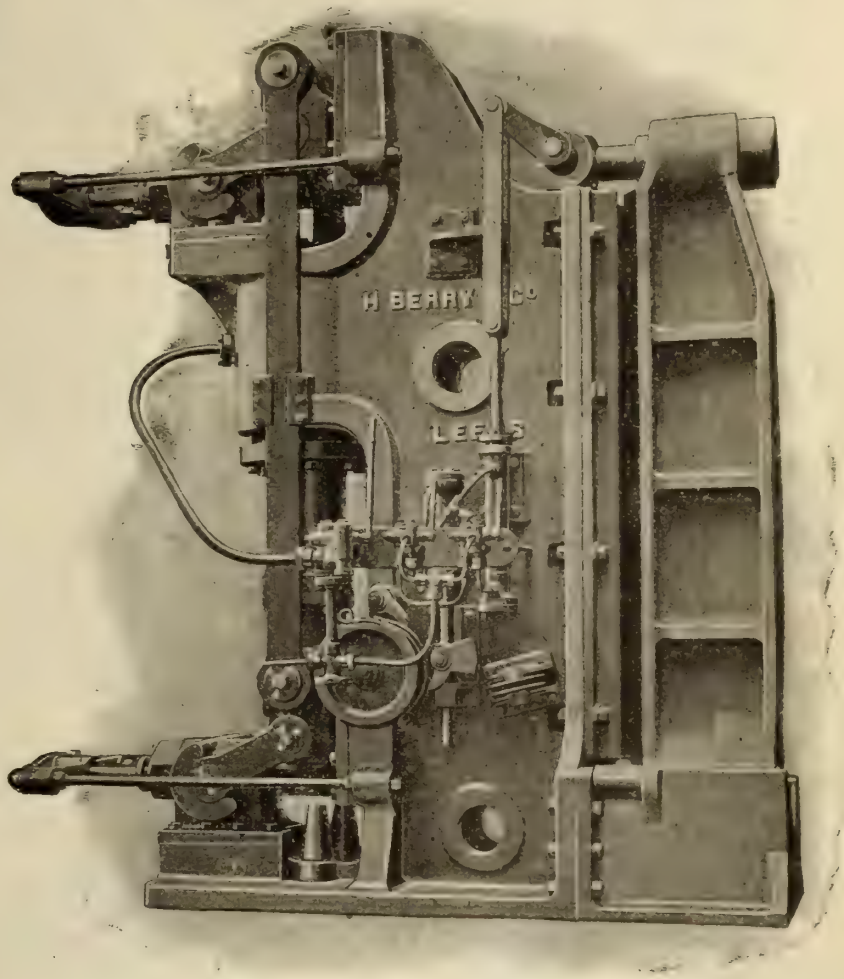
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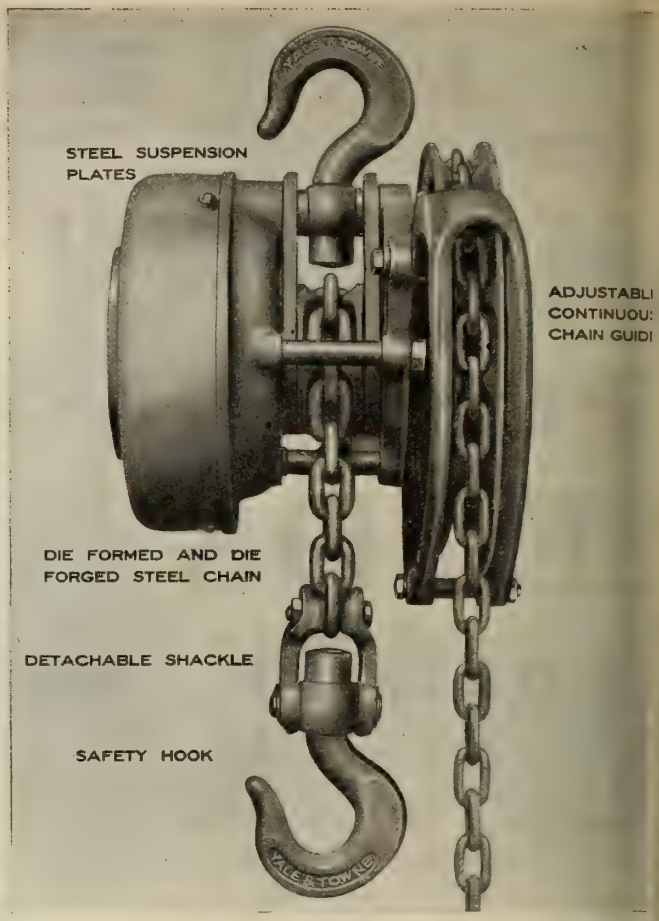


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If interested tear out this page and place with letters to be answered.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Volume XXVI, No. 6. August 18, 1921.

The Efficiency of Industrial Furnaces

Increase in Efficiency Due to Modern Design—High Cost of Fuel is Largely Responsible for Present Eagerness to Make Furnaces as Economical as Possible.

*By HUGH CHAMBERS

HIGH COST of fuels used in industrial furnaces during the past few years has resulted in considable study of the problem of increasg the thermal efficiency of furnaces. hen it is realized that a great many dustrial heating furnaces in use in ants to-day have a thermal efficiency 10 per cent. or less, the wonderful ssibilities along these lines can be apeciated.

A comparison between a forge furnace d a steam boiler will show the reader y the ordinary furnace has such a low ficiency. Fig. 1 shows a typical steam iler in which the temperature in the febox is 2500°F. It will be noted that e temperature of the gases resulting om combustion gradually decreases un- a temperature of 520° is reached, en the gases leave the heating surface the boiler. All heat contained in the ses after they leave the heating surfe of the boiler is lost.

For purposes of comparison it may assumed that the amount of heat contained in the gases varies in direct proportion with their temperature as the weight of gases passing through a furnace or boiler remains constant and the specific heat of the gases is practically constant.

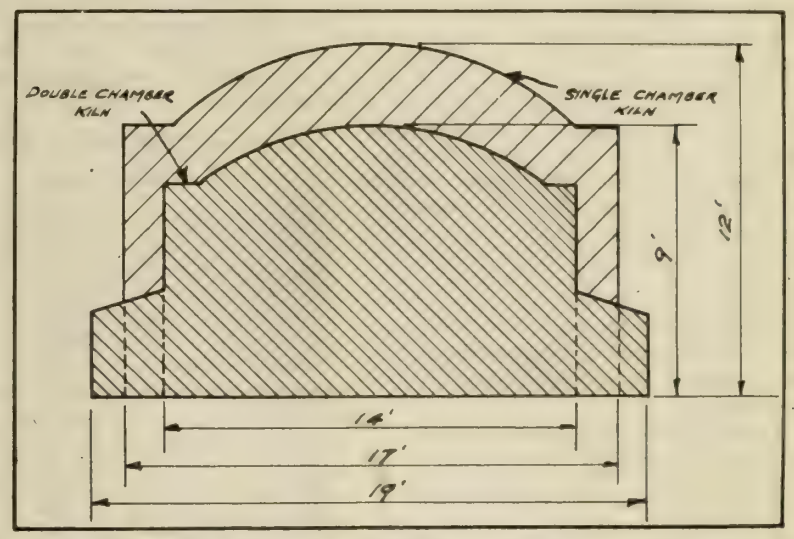


Fig. 5.—Section elevation showing relative size of single and double chamber kilns for a given output.

$$\text{Thermal efficiency of boiler} = \frac{\text{heat utilized}}{\text{heat supplied}} = \frac{\text{heat supplied} - \text{heat wasted}}{\text{heat supplied}}.$$

As the heat content of the gasses is in direct proportion to the gas temperature we have:

$$\text{Thermal efficiency of boiler} = \frac{\text{heat supplied} - \text{heat wasted}}{\text{heat supplied}} = \frac{2500 - 520}{2500} = .79 \text{ or } 79\%.$$

Fig. 2 shows diagrammatically a common type of furnace in which steel is heated to a temperature of 2200°F. for forging or rolling. The furnace gases reach a temperature of 2500°F and leave the furnace at a temperature about 100° lower than that to which the steel is being heated, or 2100°F. As the gases leave the furnace at 2100° all the heat which they contain at this temperature is wasted.

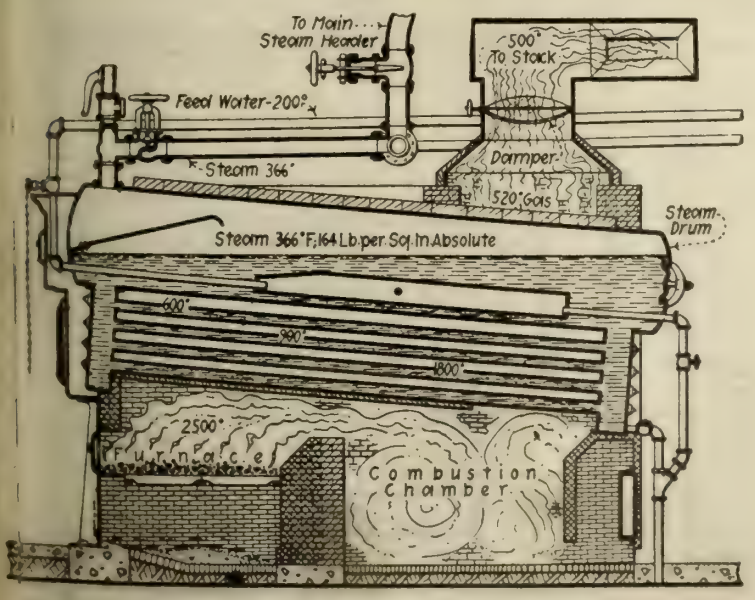


Fig. 1.—Section of a water tube boiler.

*Chief Engineer of the General Combustion Company of Canada, Ltd.

$$\text{Thermal efficiency of furnace} = \frac{\text{heat supplied} - \text{heat wasted}}{\text{heat supplied}} = \frac{2500 - 2100}{2500} = .16 \text{ or } 16\%.$$

Thus it is seen that in the case of the steam boiler it is possible to impart to the water 79% of the heat supplied in the fuel, whereas only 16% of the heat is utilized in heating the steel in the ordinary forging furnace. This great difference in efficiency is due to the fact that in one case water is heated to only 366°F., making possible a great drop in temperature of the gases, as against a small drop in temperature of the gases where steel is heated to a high temperature.

The above comparison does not account for the heat lost by radiation through the walls of the boiler setting or furnace. Had the radiation losses been taken into account, the furnace would show up still more unfavorably as compared with the boiler, as radiation losses are generally greater in furnaces than in boiler settings. Combustion of any fuel consists essentially in increasing the temperature of a given weight of air from that at which it enters the combustion chamber to whatever temperature is attained after combustion is complete. A chemical change takes place in which the oxygen of the air is replaced by an equivalent weight of CO_2. Let us consider what happens when 1 lb. of carbon is burned using cold air for combustion.

Equating the products before and after combustion theoretically, we have—

1 lb. carbon + 11.5 lbs. air) at 60°F. = 12.5lbs. furnace gases at 4915°F.

It may be noted that the temperature of the furnace gases as above indicated is not obtainable. In ordinary furnace work with coal which has approximately 85% of the B.T.U. of carbon the temperature obtainable in furnace or boilers is under ordinary conditions about ½ of the theoretical, or about 2500°.

The losses in temperature are due to—

1. Imperfect combustion.
2. Excess air.
3. Radiation.
4. Absorption of heat by the furnace and the materials heated.

Next, let us consider the theoretical combustion of fuel oil.

(1 lb. fuel oil + 14 lb. air) at 60°F. = 15 lb. furnace gases at 5420°F.

For the reasons as given above it is not possible to actually obtain temperatures higher than about 3000°F when burning fuel oil in furnaces using cold air for combustion. Since combustion is essentially a problem of heating air it follows that in order to attain a given temperature in a furnace the higher the temperature of the initial air for combustion the less fuel there will be consumed. Advantage of this fact is taken in the design of modern furnaces where the enormous amount of heat which was formerly wasted in the gases leaving the furnace is now used to preheat the incoming air for combustion of the fuel.

Effect of Recuperation on Thermal Efficiency.

Fig. 3 shows a diagram of a modern recuperative type of furnace in which the waste gases leaving the furnace are used to preheat the combustion air. Assume similar conditions to those obtaining in the furnace shown in figure 2, where the steel is heated to 2200°F. and the furnace gases attain a temperature of 2500°F. As before, the gases will leave the furnace and enter the recuperator at 2100°F. Cold air for combustion enters the recuperator at ordinary room temperature of 60° and is preheated to 800°F. while the temperature of the waste gases is reduced frbm 2100° to 1300° while passing through the recuperator.

As all the heat represented by the drop in temperature of the waste gases from 2100° to 1300° has been returned to the furnace.

$$\text{Thermal efficiency} = \frac{\text{heat supplied} - \text{heat wasted}}{\text{heat supplied}} = \frac{2500 - 1300}{2500} = .48 \text{ or } 48\%.$$

This efficiency of 48 per cent. is comparable with the efficiency of 16 per cent. obtained in a furnace working under similar conditions without recuperation. Furnaces of the recuperative type are in operation to-day showing thermal efficiencies as high as 60 per cent.

The heat loss through furnace walls is a considerable percentage of the total heat supplied in many types of industrial furnaces.

The amount of heat which is transmitted through a furnace wall varies directly as to time, surface area of wall, coefficient of heat transmission of wall material, and temperature difference between inside and outside of wall and inversely as to the wall thickness. This may be expressed in a formula as follows:

$$\text{B. T. U. transmitted through wall per hour} = \frac{A \times F \times (T_1 - T_2)}{B}$$

A = area of wall in square feet.
B = wall thickness in inches.
F = factor for wall material = 7 for firebrick.
T^1 = Temperature of inside of wall
T_2 = Temperature of outside of wall

Consider the case of two furnaces having similar chamber dimensions, one furnace, however, having a 9 in. wall of ordinary firebrick, while the other has a 13½ in. wall consisting of 9 in. firebrick plus 4½ in. of high heat insulating material having qualities which resist heat transmission 8 times that of firebrick. The heat loss per hour through each square foot of 9 in. firebrick wall assuming inside and outside wall temperatures of 2500° and 100° respectively will be:

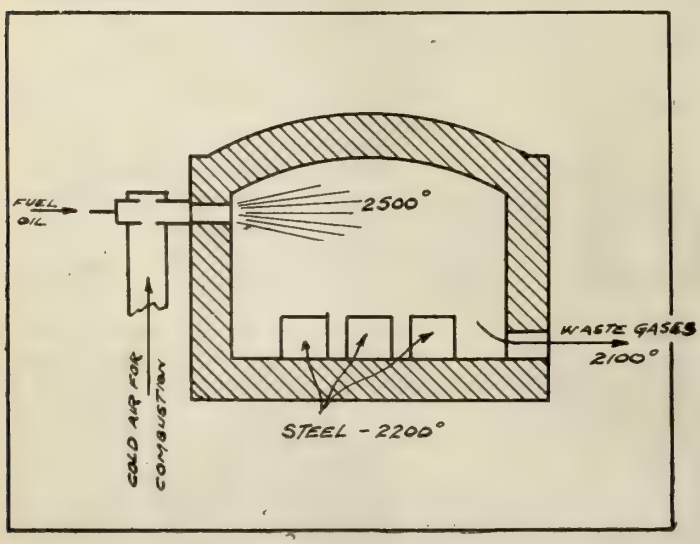


Fig. 2.—Diagram showing common type of forging furnace using cold air for combustion.

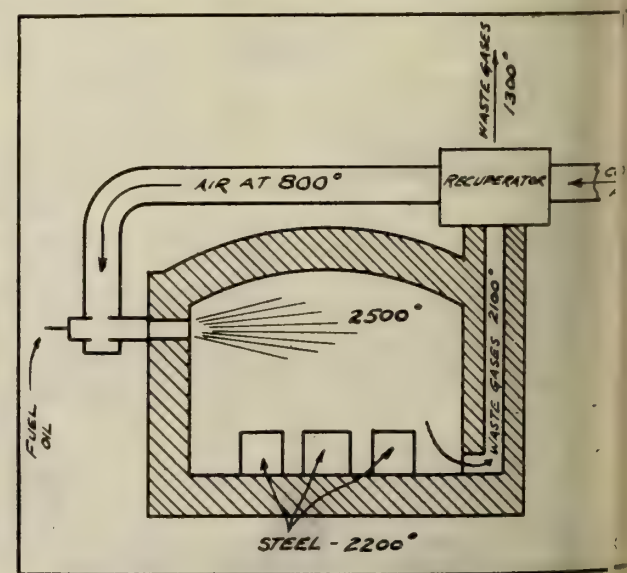


Fig. 3.—Diagram of recuperative type of forging furnace.

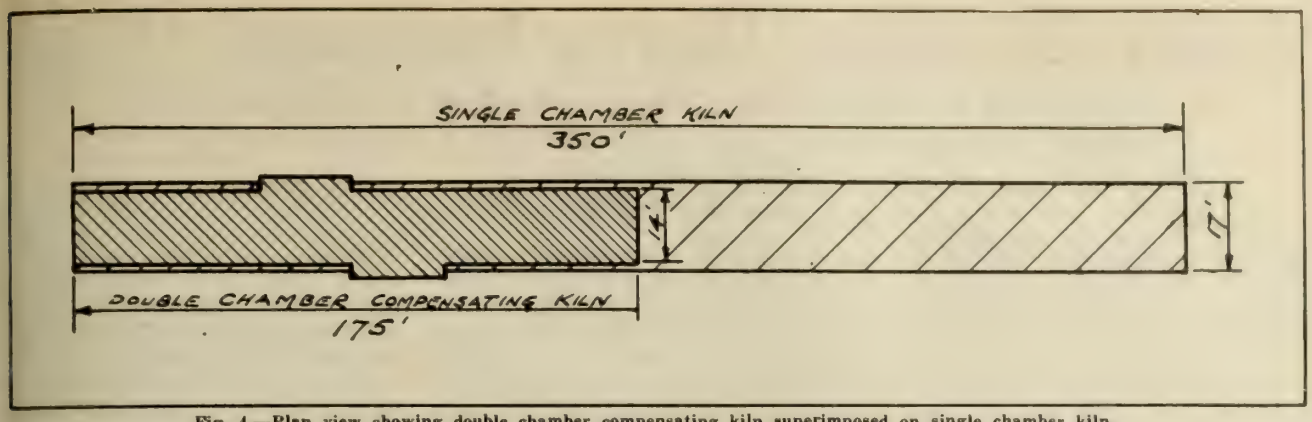


Fig. 4.—Plan view showing double chamber compensating kiln superimposed on single chamber kiln.

at loss per sq. foot of wall per hour

$$= \frac{A \times F (T_1 - T_2)}{B}$$

$$= \frac{1 \times 7 \times (2500 - 100}{9}$$

= 1870 B. T. U.

Next consider the heat loss when the vll consists of 9 in. firebrick × 4½ in. o heat insulating material having heat r isting qualities 8 times as great as f brick. This 13½ in. combination wall is equivalent to a firebrick wall 9 in. >4½ × 8 = 45 in. thick.

Heat loss per sq. ft. of wall per hour

$$= \frac{1 \times 7 \times (2500 - 100)}{45}$$

= 374 B. T. U.

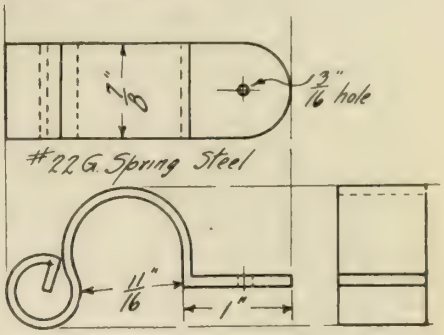
he above comparison shows that by pper design 4/5 of the radiation losses c be eliminated. A forging furnace wn heating chamber 5 ft. long, 3 ft. we and 2 ft. high, built with firebrick wls 9 ins. thick and having an oil con- mption of 20 gallons per ton of steel ted has a radiation loss of 8 per cent. of he total heat supplied. 4/5 of this loss mover 6 per cent. of the fuel can be ved by proper wall design. As radia- tn losses increase in direct proportion wn the total exposed wall surface of a rnace great fuel savings are possible by a design which will give a maximum output of material heated for a given size of furnace.

Figs. 4 and 5 illustrate what has been accomplished in the way of reducing wall surface for a given furnace output. These views show a double chamber compensating annealing kiln, of one design, superimposed on a single chamber continuous annealing kiln. Both kilns shown have a capacity of 50 tons of annealed malleable iron per 24-hour day. It will be noted that the exposed wall surface of the double chamber kiln is less than half of that of the single chamber kiln. The cost of fuel per year for many furnaces in use to-day, is several times the original cost of the furnace itself. This being the case, furnaces of modern design having high thermal efficiency quickly pay for themselves in fuel saved.

INFORMATION WANTED

A manufacturer in the Western part of Canada is anxious to procure a number of No. 22 gauge spring steel clips as shown in the illustration. He states that what he wants is prices on one thousand lots, and we take it from his correspondence, that he expects the cost of dies to be mentioned as a separate item.

Believing that manufacturers in the east might be interested, we show the clip with three of its chief dimensions. Anyone who feels that he is in a position to handle this work can write us stating prices, etc., when we in turn will pass the information to our correspondent.



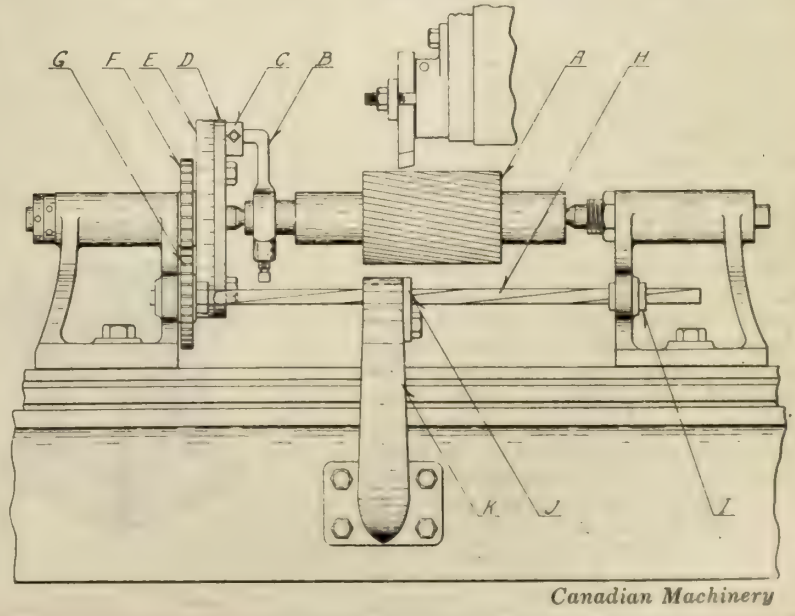
Showing the part under discussion.

HOW ABOUT THIS?

In the June 30 issue of Canadian Machinery M. C. Allen contributed an article. A check was forwarded to the address given us, but same was returned marked "Not at this address." If Mr. Allen will forward us his new address we will once more send out the check.

Planing Helical Grooves

The sketch illustrates a fixture used on a planer for cutting helical grooves on a crusher roll. The work "A" is supported on centers. On one end is the driving dog "B," the tail of which is located in the slot of the lug "C"—back lash being taken up by the small set screws. Plate "D" is independent from plate "E," and may be revolved by slackening two nuts, the bolt heads moving in T-slots in plate "E." Plate E and gear "F" are keyed to the spindle in the drive head. Gear "G," which meshes with gear "F," is secured to the square twisted (and milled) shaft "H," this shaft being supported in lugs extending out from either head, the bushing "I" in the right hand head providing a cylindrical bearing. "J" is a flanged bush fitted to shaft "H" and secured to bracket "K." This bracket is bolted to the planer bed. Movement of the planer table rotates roll while tool is cutting. Adjustment for different cuts is made by movement of plate "D" to the desired setting, graduations being provided for this purpose.



Canadian Machinery

Making Embossing Dies for Emblematic Work

Work Can Be Divided Into Three Classes from the Die Sinkers Angle — The Hub Method — The Cut in System, Also the Combination Method

By CHAS. E. HALL

THE making and use of embossing dies for emblematic work, and jewelery especially, seems to be confined almost exclusively to the jewelry trade. While several of the sheet metal stamping plants do a little embossed work, such as checks, key tags and work of a similar nature, the dies from which these articles are struck are necessarily in a cheaper class than their more exalted brothers of the jewelry trade.

Perhaps, in a description of some of the latter kind, it will be well to divide it into three classes, viewing the subject from the die-sinker's angle. They are: The "hub method," the "cut in" or engraved method, and lastly, a combination of the two, where the design is "hubbed" in part, and the balance cut by hand.

The hub method is used for all enamelled work, such as society buttons, emblematic goods, etc. The chief reason for this is on account of all parts of the die being of a uniform depth; the work struck from it for enamelling being also perfectly level; consequently when it is stoned off on the surface there are no low spots which would otherwise result if the die was cut by hand.

Another point in favor of the "hub" method is the fact that once the hub is made as many dies can be produced from it as may be required, and each will be the exact counterpart of the others.

To make the "hub" various means are adopted, according to the job itself, and also the equipment available. A good rule in the roughing out is to make use of any method, orthodox or otherwise, which makes for the rapid removal of the surplus stock.

Taking Fig. 1 as a simple example, the design being a shield enclosing a monogram, both being in relief, the background being removed by the most convenient method.

By using a die-sinker's hand-piece with a coarse "Revelation" dental burr of the wheel type, the outline can be milled out so that very little hand work with the graver will be necessary. Merely a touch-up here and there, particularly in the corners of the design. The surrounding metal can be turned off in the lathe as near to the outline of the shield as possible, and the small pieces remaining knocked off with a small chisel, the rags being removed by filing. The monogram and the inside outline of the shield (This is not Irish) are then outlined with the graver. The background is drilled away with the hand-piece, the remaining surplus metal being cut away with gravers of suitable shapes, the complete design being next trued up. The design now stands out in relief, and the surface, which was smooth to start with, is now stoned slightly with an Arkansas slip stone to remove any slight burrs which may possibly have been left. The hub should be bevelled back from the edges of the design, as shown at Fig. 2, to eliminate the risk of the thin, raised outline cracking in the hardening process; for if the edges rose abruptly from a flat background they would experience a sudden contraction on quenching, while the body of the "hub" would cool more slowly on account of its relative bulk. It is now ready to harden, after which the temper is drawn somewhat, and it is ready for use.

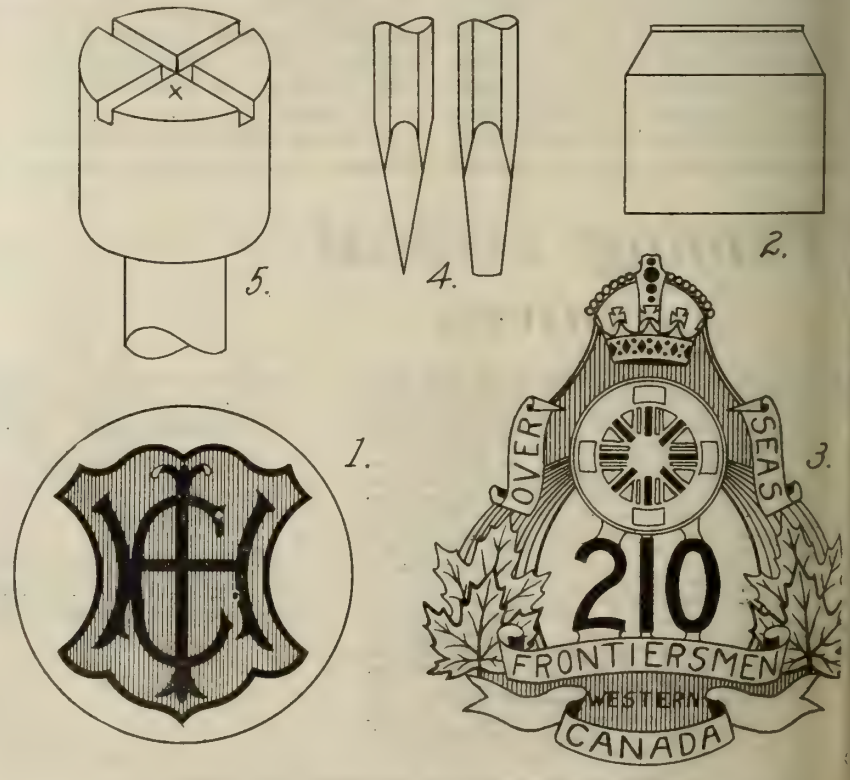
Die Block

A suitable die block of annealed steel is selected; faced up parallel with the back; and the front smoothed up on a fine emery paper lap. The hub is placed face downwards on the die block in a central position, and a light blow with the drop-hammer gives the impression. If the hub has any comparatively large flat areas in relation to the other parts of the design it is struck just hard enough to mark the impression and the lines on the die are cut away roughly by hand. The hub is replaced an struck again to the required depth. Th is to overcome the tendency of the large surfaces of the hub to carry down th surrounding background of the die ar also to prevent any undue strains bein established by the displacement of th steel.

When the desired impression has be obtained the die-block is placed in th lathe chuck and faced off to leave th required depth of impression. It is th polished on the face and is ready harden. Powdered boric acid is dust on the face of the die and the block heated in a semi-muffle gas furnac When at a low red heat it is remov and the boric acid is smoothed over t surface with a strip of brass to elim nate any air bubbles. It is then placed in the furnace and brought to t required temperature, varying in degr with different grades of steel, a quenched, face upwards, under runni water. It is then re-heated to abo 350 degrees F., slightly quenched, a allowed to cool off to relieve any strai It is next scratch-brushed. The bor acid leaves the surface perfectly cle which is most important in this cl of work, and the die is now ready use.

"Cut In" Method.

In regard to the "cut in" method, lit



Figs. 1 to 5, showing the dies made and the tools used.

ed be said here, as it is more or less die-engraver's job, and is one of artis- taste, skill of hand and the result of ng practice. If the die is of consider- le depth or area, the outline is traced the coppered surface of the block, d the surplus metal removed with all chisels of various shapes, also by all grinding wheels held in the hand- ce, while the balance is cut in with avers.

Impressions in plasticine, which has d some suitable dry color added to event it from sticking to the die, are ken from time to time as the work ogresses, to enable the die-sinker to l just where the metal needs to be moved. The plasticine is stuck on a all piece of steel, placed on the die, d struck a sharp, light blow with a mmer to embed it into all parts of e die. By breathing on the die sur- e, just enough moisture results to event sticking. When finished, the me procedure as in the foregoing case employed.

The Third Method

n the third method, where both "hub- " and "hand work" are resorted to, very wide field opens up, so that it will ot be possible to just "scratch the face" as it were and give one example atypical of the lot. Of course work nthis field is so varied in size and sign that no hard and fast rule can elaid down. Again, one die-sinker ay follow the "hub method," while an- ther would adopt the "cut in" way of ing the same job, and each get equally od results in about the same time ex- eeled. Numerous hand punches and ler stamps also enter into this class f work; and sometimes it is advisable o make a punch or hub for some par- icular part of a die which could be cut n y hand in less time. But if other ol are on hand or in prospect, where th particular detail is to be used, the in saved on the second die more than offsets the extra time taken in making a ub or punch. This applies to mili- tar cap badge dies, taking the crown as n example. In submitting a new desn, it is always advisable to use suc details as may be on hand in the wa of punches, hubs, etc. This also ena es one to make a much closer esti- ma of the cost of the dies than would oth wise be possible if every detail had to be made before starting the wo .

I Fig. 3, which was the cap badge for he 210th, Frontiersmen Battalion, we have an example embodying all three methods. This was made in two pieces on account of the way in which the badge was to be finished. The body of e badge was oxidized and brush- finished to a dark olive green tone, while the centre, enamelled in three colors, red, white and blue, was finished in gilt, afterwards being soft soldered on the badge. The die for the enamelled centre was made from a hub and the work trimmed after being struck in a round punching die of suitable size. The let- tering in the centre of this piece, which was "God Guard Thee," was punched in the hub with very small letter stamps. The wording had to go inside of a 5-32-inch circle, and as the letters were to be enamelled in blue, they had to be very distinct, and the small space they were to go in left no room for error.

Die For Badge

The die for the badge proper was made as follows. A hub was made for the circle which encloses the enamelled centre, and the figures "210" were sunk in the die block. The outline was then marked on, and the crown, which was a stock punch, sunk in its proper position. The maple leaves, also stock punches, were then sunk with a light drop-hammer by marking and relieving to prevent pulling down the background as before stated. The ribbons were then outlined and cut in, using small chisels for roughing out and shaping them up with the graver. The raised edges of the ribbons were punched in with a punch known as a tracer by tapping lightly with a hammer and moving it along at the same time. Tracers are made of various widths and curves and are left straight on one side, as shown at Fig. 4. The straight side enables the punch to follow curves of different radii and leaves a very smooth polished surface when carefully done. The background of the ribbons was next tapped all over with a matting tool, very small on the end, and having about seven small raised dots on it.

The lettering was then put in with die letter stamps which are the other way round to the ordinary variety, as they give a reversed impression.

Here it may be well to mention that hubs and detail punches are made the same as the finished work; while all work done on the die proper is reversed. The remaining background of the die was cut by hand and rounded out where needed, smoothed up, and the die hardened.

The background of this particular badge was cut away between the figures "210" and the maple leaf border with piercing dies and made a rather attractive-looking badge when completed.

This badge was struck from bronze plate .035 inch in thickness, and cut in squares with a shearing die. As the die was comparatively deep in the crown and ribbons, it is obvious that a full impression could not be brought up in one blow of the drop-hammer, if a flat face were used in the head, so that in work of this kind a male die is employed. When the female or die proper is completed, it is securely fastened in the bolster of th drop-hammer, and a "jack" die as shown at Fig. 5 inserted in the hammer head to carry the male die.

The jack die is about 3 inches in diameter with two slots planed across it at right angles to each other, both being about 1-4 inches wide and 3-16 inches deep. A small index mark is made in one corner near the centre, to insure re placing the male die the same way after each blow after starting to strike it up. The jack die is left dead hard.

Making the Male Die.

We are now ready to proceed with the male die. A round annealed block of tool steel about 2 inches in diameter and 2¼ inches long (in this case) and slightly domed on the face is now taken and the back end roughed out on the shaper to approximately fit the slots in the jack. It is then heated to a bright red and placed face downwards on the die with the roughed-out ridges so placed that they will enter the slots when the hammer descends. A top blow, in this case about 4 feet 6 inches with a 150 lb. hammer head is given. It is replaced—having regard to the index mark—as quickly as possible, and the blows repeated as long as the block remains red. Usually after a couple of blows at the most, the slots of the jack engage it, so that repeated blows can be rapidly given. It is then allowed to cool off and the background relieved by chiselling or etching. It is re-heated, and the same procedure continued until a full reversed impression of the die is obtained. The background surrounding the design, also the parts to be removed afterwards in the piercing operation, are etched away slightly to within about 1-32 inches of the outline of the design. This is to allow the whole of the blow to be struck directly over the impression in the die, part of the force of which would otherwise be expended in pounding out the surplus metal of the square blank used. The male die is now a perfect fit in the die proper, and it is obvious that a knife-edged impression would result after the trimming operation. To obviate this defect, the male die is trimmed with the graver, removing about 1-6 inch all around the outline, making it just that much smaller than the die itself.

When the articles are struck, the metal flows into the intervening space between the two dies, and gives a substantial edge when trimmed out. On account of the male die being hot when struck, a certain amount of shrinkage takes place on cooling, which causes a loose fit in the slots of the jack. This is overcome by peening out the raised ridges on the male die with a ball peen hammer. It is now hardened; the temper drawn to a dark purple color, when it is ready for use. By placing it on the die and giving it a slight tap with the drop hammer, it again fits snugly in its place in the jack, where it is securely held till the job is finished.

In regard to donning the face of the male die on starting, this particular shape will vary according to the shape and depth of the die itself, and often a sharp cone shape will be preferable. A little forethought and judgment as to the proper shape to start with, will greatly facilitate the striking up of a good impression.

Sometimes when hand cutting has been employed, the general effect is

often enhanced by lightly sand-blasting the die before hardening; but this depends largely on the finish the struck articles are to receive. Again, some dies, depending on the design, give very artistic results by sandblasting part and polishing the flat surfaces of the background to a mirrow finish.

When a sandblasting outfit is not available, a somewhat similar result is obtained by warming the die and pouring a little hydrochloric acid, for a few seconds only, over the surface, immediately washing it off. This has to be done very carefully, otherwise any fine lines may be destroyed. The sandblasting is preferable as the die can be examined at any time as to the result; and again, parts can be blocked off with plasticene if it is desirable to leave them smooth.

In regard to the spacing of letters, this is a matter of skill and practice. A good way is to take a plasticene impression of die to be lettered and select a stamp of suitable height for the space, and if say, 60 letters had to go in a given length, just tick off the impression with the stamps, allowing for space between words, and see if the stamp you are using will go 60 times into the space. If it will, you start and very lightly stamp them in the die, using the impression as an approximate guide, moving any letters a little where the spacing is faulty,. When properly spaced, sink them a little deeper, going over the lot gradually, taking impressions at frequent intervals to avoid stamping some deeper than others.

Impressions from an accurately lettered die look well when finished; while one letter out of alignment sticks out like a sore finger.

When the letters are all stamped in, the background will be found to have risen slightly. This is filed down level if the lettering is on a flat surface and stoned smooth or removed with the graver or riffle files; or sometimes with a small carborundum wheel held in the die-sinker's handpiece, according to the accessibility of the work. It is next stoned smooth or matter according to the requirements of the case. This also removes any doubled impressions which may have resulted in the first marking of the letters; hence the necessity of very light stamping until perfectly sure of the spacing.

It is hoped that this will give a general idea of the ordinary run of this class of work, and while volumes would be required to completely cover the field, enough has been given to show the nature of the problems on hand.

The Alfred Herbert Ltd., have sent to those whom they believe will be interested, a very attractive invitation to visit their machinery stands at the Toronto Exhibition. Canadian Machinery has received one of these invitations and cannot help but comment on the neatness and taste displayed in its preparation.

Reduce Accidents By Instruction In Efficient Safety Method

*By C. A. KUECHENMEISTER

I BELIEVE the one black mark against industry during the past few years is the fact that we all thought we could not enforce safety rules and safeguard our shops because we couldn't get men. Factory inspectors would console us with the information that of course we couldn't be expected to do much safety work, guard building, rule enforcing, etc., because labor was so scarce, and we used every excuse we could lay our hands on, with the result that it cost the industries of Ontario over $7,000,000, and we injured a man every three minutes of every working day of last year.

Scarcity of labor the cause of it? Lack of interest in safety was the cause of it all! Don't blame the workman for a lack of interest in guards, safety appliances and safety rules when we all sit back and admit—tacitly at least—that while we know how to prevent machine smashing that we are helpless in preventing the recking of human beings. And this year the excuse is that our shops are practically shut down and we are not busy enough to warrant doing safety work.

I do not believe that we can divide the word safety into classes and say that we are going to do industrial safety, public safety or school safety. Neither do I believe that any group of men can organize into an association and say they will do one class of work to the exclusion of any of the other, and succeed. And I will go a little farther and say that I do not believe you can organize your plant for safety and not do safety work outside of the plant if you hope to interest men in safety.

To the man who has kept up-to-date and has tried out all the safety suggestions; who has interested the manager, superintendent and foreman; who has organized committees and guarded machinery, and who feels that the desired results are still in the distant future I want to give a significant and far reaching statement recently made by the National Safety Council. A statement that I believe is the answer to our problem of interesting everybody in safety; the statement that over 75 per cent. of all accidents can be prevented, and that only by community effort can that be accomplished.

When you give serious thought to the last part of that statement a new vision comes to you and you wonder why on earth it wasn't thought of long ago. If you go at the problem of interesting everybody in safety as a community effort you immediately have access to every educational and civic agency in the community. While the word safety cannot be divided into definite class and be treated as such, you can, however, teach safety through the schoo in the home, by use of law making a law enforcing agencies and in the indu tries, and by doing so you get results.

Through the Schools

It seems to be generally agreed th teaching safety to the children in t schools is the logical and proper pla to begin. Many a workman who thoug he knew how to take care of himself the shop and refused to believe that could be taught how to be more care has been won to the cause by his ch coming home from school and talki safety to him.

Certain conclusions may be dra from the study I have made. They a

Accidents are not a necessary e They can be reduced. This reduct takes place as a result of continu educational campaign. This cannot obtained by spasmodic and unrela campaigns. The tendency for auto bile accidents to increase is proporti ate with the increase in automo registration. The departure from in 1920 was due to the safety campa Increase in population does not app to bear a very close relationship to number of accidents. The schools the logical places to begin this educa programme.

Teaching safety in the schools an the court room will not only stop m of our street tragedies but they will the safety man in the shop reduce a dents. If his work is nicely co-ordin with the work being carried on out he will quickly see results.

Another conclusion I have come t that safety is not, primarily, a pro for individual industrial plants to s When a man comes to us and asks f job and says he is a machinist, we k and he knows, what qualifications claims to possess. We know he im that he can start and stop machines up jobs, use calipers and read m meters. When he gets into the and is given a job he has never before he asks the foreman a few tions, the high points are explained he turns out the work.

This is true because years ago organized guilds and developed th prentice system. They set up stan and before a man was a journeym had to qualify. The guilds and ap tice system have almost disappeare the standards set up by them are in use. If working safely was pa the old standards, unfortunately i been lost and so we must find a w put the fundamentals of safe livin working into the training of the man.

(Continued on page 42)

*From an address delivered before Safety Convention at Toronto.

Machining Adjusting Nut in Eleven Minutes

By H. A. LOUDON

THE piece being machined is made from tool steel blanks cut from the bar. Two finished pieces are ade from one blank at one setting. he cutting off tool does not divide the ro pieces until they are both complete- finished. The advantages gained by achining the piece in this manner are, 1st, it is quicker, the boring and turn- g cuts are both taken at the same time. the pieces were machined one at a ne they would have to be gripped on e outside and bored and threaded in e first operation, and held on a thread- fixture while the outside was being ned on the second operation. Not only would the machining time longer if the piece were done in this nner, but more time would also have t be spent by the operator due to the f t that he would have to make two t l set-ups on the piece instead of one. nd, it is more accurate. The sur- f es all being machined at one setting. rd, and most important of all, i that the tendency to distort under t pressure of the jaws is greatly re- d ed due to the resistance of two pieces i ead of one, and to the fact that it is gripped on the other end from that w ked on.



The work to be done, showing stages of completion.

First Operation

he work is gripped in a three-jaw ck, and in the first position of the ret the blank is cored half way ough. It is then taken out, re- ed in the chuck, and the other half od. Coring in this manner has two antages over coring the piece ight through in one position, viz.: ter tools can be used, doing away with overhang, and narrower tools can be used which means a saving in stock. It is good practice to save the cores and use them for small gears.

In the second position of the turret, two tools of the inserted cutter type, simultaneously rough turn and rough bore.

In the third position the bevel is roughed and the 4 degree angle is butt-faced.

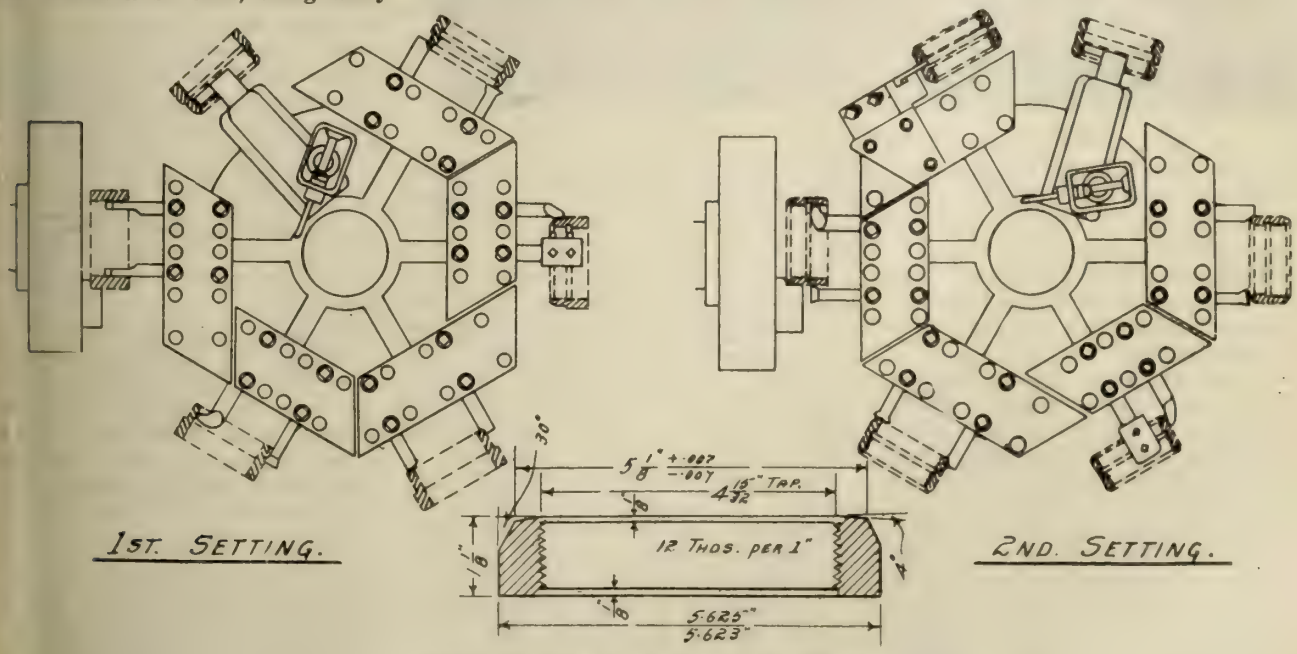
In the fourth position the outside diameter is finish turned. The cross feed is then thrown in, and the cross sliding head moves across on its broad-spread bearings, and the grooves are cut.

In the fifth position the bevel and 4 degree angle roughed in the third position are finished.

In the sixth and final position the piece is threaded by the Hartness screw thread chasing attachment. This attachment is automatic. The carriage is locked to the bed, and the attachment gets its positive drive from the work spindle. The threading tools feeds forward at cutting depth under lead screw control until the tool bar strikes the stop. The tool then automatically withdraws to clear the work and returns at high speed to the starting point, where it again feeds into cutting depth and engages the lead screw. The work spindle revolves continuously. The only motion required of the operator is that of adjusting the cross sliding head forward a slight amount during the return of the cutter to feed the tool in for the new cut.

Second Operation

In the second operation the piece is reversed and gripped on the finished outside diameter. The second operation is exactly the same as the first except that a cutting off tool is inserted in place of the coring tools in the first operation, to part the finished pieces. Production time, for the two finished pieces, is 23 minutes. This gives an average daily production time of one finished piece every 11½ minutes.



Showing the layout of the tools for both settings.

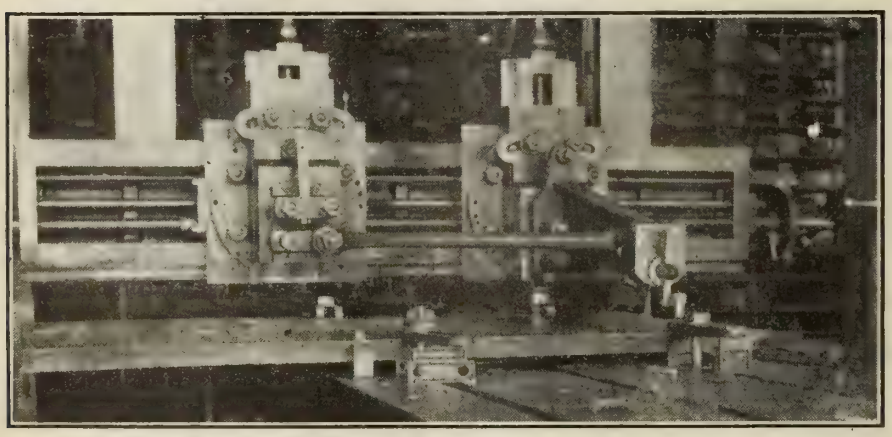
Efficient Planer Practice—Points to Watch

Setting of Work is Just Important—Flat Shims are Better Than Tapered Shims—The Cost of Belts—The Importance of Neatness —Painting Castings to Help The Planer Hand.

By DONALD A. HAMPSON

MOST planers have the rack screwed or bolted to the table. Smaller machines have filister head screws with the heads set in flush with the middle slot. We had some of the latter type, rather old, in our planer department but all running every day on work within their capacity. It was a daily task to get a big screw driver and tighten up these rack screws: the boys did that as religiously as they oiled up; no one seemed to think of the time so lost and none seemed to mind the "chug, chug" of the rack at reversals.

A new foreman came along. One of the first things he did was to take the planers out of service, one by one, and put a key in each piece of rack. These keys were of one-half inch square C. D. S. and were set half in the rack and half in the under side of the table. A piece of steel of this size, crosswise of the rack presented double the shearing area of the screws and it stopped for all time the noise and delay.



Showing how to make the extension head rigid.

Setting up work is the most important part of "running a planer." If a piece is improperly held, it may be sprung out of shape so much that no amount of careful machining can ever make it true, or it may come loose under pressure of the cut and have to be set all over again.

The angle of rake on planer tools is so slight that we may almost consider the effects as if the tool stood at right angles to the table. This latter would make all the stresses from cutting in the direction of the table's length. There is, however, a slight angle in two directions which divides the thrust of the cut into three components, the greatest of which is by far the longitudinal. Hence the cardinal rule for setting up is, first, place enough posts to resist all thrusts. Clamps are all right and very necessary, but two posts in front of a job are better than a dozen clamps; if the job is narrow, only one post is necessary. If it is wide, two are set in place and as far apart as the width of the job and the table spacing will permit.

After the posts are set, two clamps (or fingers) are added to keep the work in place. The fewer clamps used, the fewer bolts there will be in the way of the tool. One of the fundamentals taught in machine design is to make all parts subject to stress positively held, not depending on friction. This applies with equal force to planer setups. An incidental advantage of posts is that they do not distort the work.

Castings require more care in setting up than do steel parts like bars and forgings. Often the time required to properly pack up the work runs into hours. A good assortment of shim material is most essential. This should run in thickness from thin tin to nearly one-half inch; and it should be flat, and free from burrs or bends, and there should be a sufficient variety of sizes so that two or three pieces are the most that will be required to build up to any space.

Flat shims are better than taper ones. Even though clamps are securely tightened over taper pieces, the combination of reversal shocks and the angle of inclination frequently loosen up the shims. This will not occur with flat pieces. Except on the roughest work, taper shims should not be tolerated.

There should always be packing under clamps. If there is not, the work will be sprung when clamped and many guesses made afterwards as to why it is out. The writer has known cases where the accuracy of the cross rail was questioned; all the fits in the head joints came in for "knocking," and considerable time was spent in re-aligning when the sole trouble was that the packi was springy. No job will come out tr when it is held distorted for cutti There is an impression that looseni up for the finishing cut will insure accurate job—why loosen up? It simply an acknowledgment of impro clamping. Castings spring when outer skin is taken off. It is necess to re-pack to finish after that, but lo ening the clamps will not help out.

Leather belting reached its high price a couple of years ago. cause of their weave, the ma factured belts were not used much for mechanically shifted dri as for constant speed work, though r er forks eliminated fraying quite s cessfully. Our shop substituted wo belts wherever they could and, tho skeptical as to their standing up, tried them on planer shifting dri Several years of service have pro them satisfactory, if a belt with the per kind of edge binding is selected

We opened up all the shifting fo or loops, giving them a generous mouth top and bottom so there w be no sharp corners to catch. After belt had been cut to length, the were stuck in the glue pot and this allowed to dry before putting the bel service; by this means, a binder formed for the cut ends of the fibre

In the field of general work, it is dom possible to make full use of all "features" of a machine tool—mul heads and spindles, all gear feeds, q changes, flow of coolant, speeded movements. Generally you can re on about one of these per job. two or four heads on a planer, fo stance. Often it takes more time t the extra tools than is saved by use, while again, the work seem "run in bunches" of a class where can use but one head at a time. rare occasions, it is possible to re on the extra head, this holding esp ly true when two separate jobs ar up on one machine and running a same time.

On one occasion there happened a number of cross bars of the length for a series of special mac and only one machine available planing them. The planer hand a helper set up the two in the ord time of one, and from then on the ing time was cut in two.

Costs of Belts

The cost of maintenance of the shifting belts may be lessened little attention to the pulleys. countershaft should be parallel wit planer first shaft. in both direc

Make sure that the pulleys overhead line with those below, for if they do not, the forward belt will rub on the large countershaft pulley, resulting in torn edges and broken fastenings. On planers that have run a long time and without proper attention being paid to shifting, the pulleys actually get worn in size and shape. With a single driving pulley between the loose pulleys, the driving pulley gets worn down so much that the belt is loose when shifted on it. This affects the power, and the remedy is either to build up the center one, or turn down the outside ones; always preferably making the center pulley slightly larger than the others.

On the countershaft, the driving pulleys often have a flat face. This makes it possible for the belts to creep at will (within certain limits) with the result that the one on the smaller pulley rubs against the larger pulley. The remedy is to crown these pulleys. The writer received a motor-driven switch and frog planer from the makers with the two overhead pulleys flat face, with the result we were immediately troubled with frayed edges and stretched sides on the belts, and not until the pulleys had been crowned more than an eighth of an inch did we overcome the trouble.

Be Orderly

Neatness and orderliness are homely virtues but nowhere are they more acceptable than around a planer. Some men always have a mess about their machine; floor thick with chips, boxes and angle plates blocking the way, and the table piled high with bolts, dirt, and junk. They have to clear a spot before they can put on another job, and before they can do that, the whole collection has to be scraped off on the floor to allow bolts to be run in the proper slots.

The orderly man never has a littered table and his floor is always navigable. As soon as his cut is going, he puts away bolts and packing, takes a broom or brush and sweeps the chips into a neat pile under the machine, and arranges his accessories generally. Usually that man is keeping another machine going too. He always seems to do his work with little effort, even to the point of appearing lazy in his movements. One such man adopted the kink of catching the chips from side cuts in a keg placed under the tool; his work involved making a side cut on each side of an overhanging casting but, instead of the usual heap of chips, he caught them in the keg which was easily emptied.

Moving a Planer

A planer seems like an awkward machine to move but it is not difficult to do so if the matter is given a little forethought. It may be that the machine is a new one and has been delivered outside the door by truckmen, or there may be a rearranging of shop tools that necessitates removal to a new location. The first thing is to lay out the position full size of the floor. If the floor is concrete and the bull gear extends below the floor level, a pit must be dug. This pit ought to be several inches larger than the gear all around to allow clearance for dirt and chips that may get in the pit, as well as to compensate for any error in measurement. With some machines, it is absolutely necessary to bolt them down because of the shock of reversal or their lightness. With others there is ample weight to keep them in place. The best plan in any case is to include bolts or positive stops, though past experiences with the same tool will serve as a guide in this respect.

A foundation that is premanent must always be provided, whether the machine is light or heavy, especially if accurate work is to be done. To one who has never had experience with planers, the ease with which a heavy bed of deep girder type will spring or sag will come as a shock. Planer manufacturers supply a shoe with an inclined upper face upon which a wedge is moved, backed up by an adjusting screw; the shoe is set firmly in the concrete foundation or bolted to the floor. If the former, the machine is leveled up once and for all; if the latter, the accuracy of the ways should be tested at regular intervals to guard against floor changes. These wedge adjusters may be shop-made if desired, and one should go under each point of support.

A good spirit level is all that is needed to level up, or align, a planer. Tests should be made of the ways longitudinally and crosswise, making these tests every two feet throughout the length. The degree of accuracy attainable with a good level is probably not appreciated by mechanics generally, for a movement of one-sixteenth of the bubble, reflects an error of .009 in. at the end of an 18-inch level.

Returning to the subject of moving the machine. If the tool is a new one it arrives on skids and these ought to be left under until the planer is placed directly over its final location. It must then be blocked up while the skids are removed and following this it is carefully lowered by means of jacks, lowering but a little at a time so as to keep an approximate level during the process. To get the machine to the location from the shipping door, rollers must be kept under the skids, and the assembly moved either by blocks or crow bars. If bars are used, six men can move a 14-ton machine along a hard concrete floor.

An ordinary chain block such as found in all shops, or a rope tackle may be used to advantage. The fixed end is attached to a post or a heavier machine, or it may be necessary to run a rope to a distant doorway, placing a beam across this for a tie. In all cases, the effect upon the fixed member in the shop must be considered and its strength to bear the load. A portable shop crane or hoist may frequently be used to advantage for pulling, by blocking it between posts or at a doorway, detaching the chain overhead, and running this out horizontally; then the winch is used to do the hauling.

Where the distance to be moved is only a few feet, and it is undesirable to string tackle about, one man can move the average planer up to 24-in. size. It is neither desirable nor advantageous to re-skid a machine for a shift even for as long a distance as a hundred feet unless the floor is in very bad shape. In one instance the writer saw a 24-in. and an 18-in. machine moved six feet to the right of their old location. The man doing the work shifted them both, had them lined, (but not leveled) all in an hour, and his only tool was a six-foot bar—with a fulcrum set under the bar, and set within two inches of the machine. He worked one end, and then the other at a rapid rate, without undue exertion. Sometimes the location is so cramped that the bar is the only method that can be employed and the machine has to be worked along by a movement that resembles "tacking" in sail boat handling.

Painting Castings

Where iron castings are not tumbled or sand blasted all over, the jarring loose of particles of moulding sand is very annoying to men on the planer. The writer adopted a method of painting such castings with gratifying results. Exterior parts were of course cleaned before putting on the machine, but the under sides of beds and frames were not. It was for such places that the painting was helpful and the time saved the planer men more than paid the cost of a coat of cheap paint, the purpose of which was to hold any particles that would jar loose.

Chips from the planer are usually a dead loss; junk men will not take them, larger dealers in old metal will not bother with less than a carload lot, and local foundries do not have facilities for remelting. Where one or more machines run on cast iron exclusively, the chips may be collected and used about the yard. Mixed with ashes, they make a fine hard roadway, or drive, and the same is true of walks about the yard. The weight of the cast iron practically guarantees its "staying put" no matter how hard the rain may be and it soon rusts enough to become a binder with any material. The coarsest roughing chips will not injure rubber tires but this is not true of mixed cuttings with steel shavings mixed in them.

An open side planer is a most convenient tool in any shop, but when you do not have such a machine you have to get along with an extension head. The photo, Fig. 1, shows a method of making the extension more efficient because it is made stiffer. One head only is used on such a job, and if there is a second head on the machine its vertical feed can be engaged to travel in unison with the first head. The triangular brace, which is made of a piece of pipe flattened on the ends, is connected between the end of the extension and the second head. With such an arrange-

ment, it is possible to take good big cuts, and the extension becomes a production tool, not a nibbler to be avoided as long as possible.

Every planer slide should be provided with a lock. Of course, the heads and vertical slides have their gibs and gib screws and these screws ought to be set very carefully, so that the slide moves a little tight rather than loose. The screws should be sealed and any change in their setting absolutely forbidden. The fit thus created is free enough to permit hand and power feeds without undue strain, yet it is snug enough to maintain a setting throughout any ordinary period of cutting. One of the screws on the vertical (tool) slide, and one on the head (at the top of the rail) should be replaced with a binder, or locking screw, to lock the slide while the other slide is feeding. Thus, the lock on the head is tightened, while a side or facing cut is taken. It is sometimes argued that a properly fitted slide will keep itself in place,—and there is some truth in the remark— but locks all around will pay for themselves on any planer.

Watch Your Methods

An investigation made to determine why one man had no trouble with his tool holders while all the others asked for replacements at intervals led to an adoption of this man's method throughout the shop. The other planer hands broke set screws and chewed out the threads and ground away the ends of the holders. Armstrong holders for one-half inch and five-eighths in. bits were used. Without advertising it all, Steve always removed his bits for sharpening. He said when he ground them in place his set screws got rusty, the rust worked down inside, and the screws stuck, and then they had to use a big wrench to get them loose. Getting them loose, together with the big-wrench habit acquired, broke screws and stripped out threads. But though he did not get them rusty, Steve took his screws out occasionally and oiled them; and for grinding bits that were too short to hold in the hand, he used a cracked holder that one of the other boys had thrown away, this saving his good one.

Cast iron takes a beautiful finish when a broad tool is used. This may be either a "scoop" tool, or a spring tool. Feeds as high as ½in are possible when the flat face of the tool is machine ground & the tool is correctly set. The end of any such finishing tool should be .001 in. or .002 in. convex & the corners rounded. Such a shape will not scratch, and if set so that the leading side is the higher while the other side removes the merest powder, then the finish will be first class and the accuracy in line with the best work.

The finishing tool should not remove too much metal at a cut. Different grades of work call for different standards; rough work would be finished with a flat scoop tool that removed perhaps 1-32 in., while the final cut on an accurate piece of relatively light section would be made with a goose-neck tool that was removing not over .005 in. and had been preceded by a semi-finishing cut. Before the finishing cuts are made on a casting, the cross rail should be wiped off underneath to remove drops of oil which might fall on the work and form a glazed spot over which the tool would jump, or "skate." Greasy fingers will form the same kind of a spot. Sometimes a casting that has been oiled once has to be planed again to a nice finish; in such a case, a round nose tool is better than a flat one for the latter will not take a light cut over a glassy surface.

REDUCE ACCIDENTS

(Continued from page 38)

We must find a way to so thoroughly impress safety upon future workmen that when they come to the plant they will exercise care in all things.

Guarding Machines

Then there is the matter of guarding dangerous machines. The first thing everybody thinks of when you talk about safety in a shop is guarding machinery. The pioneers in the work began with guard building and we must do the same thing. Not only will guards prevent the serious accidents in a plant but they are the only visible part of the safety work. Guards on all machines in a plant will convince workmen that the owners are serious in their efforts to make the shop safe. Guards on only a few machines—the guards that the Government inspector has ordered or forced on to machines —are only glaring, hideous, telltales of the insincerity of the management. If workmen are citizens, haven't they the right to demand safe working conditions? They have, and the sooner it is recognized the better it will be for all of us.

We are assessed "collectively" for the cost of accidents. Why should we not do "collective" accident prevention? Plant managers must submit, without notice, a statement of the annual payroll. Why not have these same managers submit, with due notice, a statement showing what guarded and unguarded machinery they are operating. The result would surprise us and would certainly tend to create interest in safety in the employee who is paid to manage the plant.

TELEPHONIC INSTRUMENTS

Some interesting points on telephone measurements were brought out in a recent paper presented before the Institution of Electrical Engineers in England. Sir William Noble, who was the author, named his paper "The Long-Distance Telephone System of the United Kingdom." Among other things he pointed out that the developments of recent years have extended the practical limits of telephonic science. Thus measurements and adjustments of the capacity and resistance of cable conductors are now made to an extreme degree of accuracy at frequencies of 800 cycles per second and higher. The amplifiers used are exhausted to a pressure of 0.00001 mm. of mercury, probably the highest vacuum employed in commercial apparatus. These methods and devices, the employment of which a few years ago was possible only in the best-equipped laboratories, now form part of the standard construction and operation of a long-distance telephone plant, and are the every-day concern of the telephone engineer.

NON-GLARE LAMPS

A new apparatus has been invented in England which is said to abolish the usual diffused glare from motor car lamps, and enables drivers in the opposite direction to see whether the road is clear. It consists of a grid composed of thin aluminum plates crossing at right angles and forming a network of square tunnels about ⅜-inch wide and 2 inches long. These are held in a frame which fits on to the lamp. The result is that the beam is concentrated about four feet or five feet in front of the lamp, whence it widens out to give sufficient light laterally, while at the same time an increased range directly ahead of some 20 yards compared with bare lamps is obtained.

INTERNAL THREAD GAUGE

John Bath & Co., Worcester, Mass. have developed a micrometer internal thread gauge which enables the measurement of internally threaded parts to be easily accomplished in increments of .0001 in. The gauge enables the determination of the exact amount that a tap cuts over size. Four measuring jaws are held in alignment by closely fitting dovetailed slots in a slide which is operated by a micrometer screw. The moving parts are lapped and fitted so carefully according to the makers, that the gauge is as rigid as a solid plug, and this rigidity causes different persons to obtain the same reading on a given piece.

Three distinct steps are taken in the manufacture to secure a measuring contact that will be as nearly perfect as possible. The jaws are first ground and lapped when set to the nominal size. They are again ground when set to the smallest size, and, finally, when set to the largest dimension. The subsequent grinding relieves the threads on each side of the centre of the measuring jaws. In this way, the threads on the jaws are freed from interference due to the difference between the helix angles obtained at the largest and smallest settings of the gage.

When wear occurs on the measuring jaws, the gage may be referred to a master ring gage and the wear taken up by means of the graduated collar which is provided with serrations that enable adjustments of 0.0001 inch to be made. The gage can be furnished with any number of threads per inch and in nominal sizes of from 1 to 5 inches in diameter.

Electric Furnaces—Points in Operating

Various Reasons Advanced Regarding Type of Furnaces That Should be Used—In Making Small Steel Castings Three Important Points Must be Kept in View

"SHOULD we install acid or basic lined furnaces?" According to F. W. Brooke, vice-president of he Electric Furnace Construction Co., Philadelphia, this query has been asked is company on numerous occasions dur- ng the past six months, and he believes hat the matter to follow will be of in- erest to electric furnace users generally.

"To my mind," comments Mr. Brooke, acid operation should be adopted when:

1. The sulphur in the scrap is and al- ways will be less than the sulphur re- uired in any castings you will be re- uired to make.

2. The phosphorus in the scrap is and lways will be less than the phosphorus equired in any castings you will be re- uired to make.

3. When the range of carbon and sili- on contents will always be wide.

4. When close physical tests have not be met.

5. When power consumption and rate operation are of prime importance.

6. When very small castings are the le output..

Basic operation on the other hand ould be adopted when:—

1. The sulphur in the scrap now, or in ture may go above the limits required chemical or physical tests or re- irements.

3. When the steel has to be made (for emical or physical reasons) to a close rbon, silicon or manganese analysis.

4. When close or good physical tests ve to be met.

5. When alloy steels are ever to be de in the furnace.

6. When steady load is essential.

7. When refining of cast iron is being c sidered.

Reasons 1 and 2 Acid and Basic

A prospective purchaser of an electric f nace, in looking over his available s ap supply, often feels he can obtain a the scrap he requires of a sulphur a phosphorus content low enough (say b w .04 per cent. sulphur and phos- p rus) to meet his requirements. The s ap market and the freight situation, it as been our experience, only too o n upset his calculations, and he is confronted with the problem of having a igh sulphur and phosphorus scrap a a furnace which cannot eliminate h e all important injurious elements. It as often meant one of three things: a paying an excessive price for low su hur and phosphorus scrap; (b) a sh -down until proper scrap can be ob- ta ed; or (c) bad castings and a dis- sa sfied customer.

Let us assume that the above situa- tic can be satisfactorily met. There is st the subject of requiring a low sul- phur for special occasions, as for in- stance, the making of a specially difficult casting where the foundry has its own particular difficulties and where a low sulphur steel would be of particular value in helping out the foundry. This can only be done in basic furnace.

Reasons 3 and 4 Acid and Basic

It is much easier to control the car- bon, silicon and manganese in the basic furnace, which means that where speci- fications have to be met the rejections are much less, particularly on physical tests, such as a good relation between the maximum stress and yield point, and a good elongation with a relatively high maximum stress. This is because of the inherent value of an electric furnace for making refined steels of a quality better than the converter steel, the open hearth steel and at least equal to crucible qual- ity, which is only present in the basic operation. Refining can be done in the acid furnace to a limited extent, but calls for skilful operation and is not re- liable.

Reason 5 Acid

The acid operation gives a better power consumption in the relation of about 100 to 112, because there is prac- tically no refining in the acid operation. It also gives a less refractory cost, as the cost of raw material is less and the repairs are less frequent.

"If alloy steels are ever contemplated a basic furnace is required. Manganese steels, for instance, so often required in the steel foundry industry, can only be economically made in the basic furnace. The use of other elements, particularly chromium, vanadium, etc., can only be handled in the basic furnace, and while the making of alloy steel castings may not be of immediate consideration their use is becoming more general every day, especially for parts requiring uniform wearing qualities, resistance to shock and resistance to alternating stresses.

Reason 6 Basic

A basic furnace invariably has a steadier load than an acid furnace, for two reasons: (a) Higher secondary voltages are used in the acid to bring about more rapid melting. (b) The re- sistance of an acid slag is higher than the resistance of a basic slag, and there- fore also requires a higher voltage.

Both of these calling for a higher sec- ondary voltage causes in practice longer arcs and higher surges because the elec- trode travel cannot pick up as rapidly.

Reason 6 Acid

In making all small steel castings three important points must be kept in view: (a) Do not have the furnace of too large a capacity—instal smaller units and more of them; for instance, when the castings do not exceed 10 to 15 lbs. a 1-ton furnace should be the maximum. (b) "Hot metal is essen- tial," because of the necessity of pour- ing into shank ladles where the transfer losses and the ladle losses are high and because of the number of "pours" re- quired. (c) It must be easy to hold back the slag and acid slag will keep back and separate more readily than basic slag.

This does not mean that small cast- ings cannot be made in the basic fur- nace, but means that in foundries where castings weighing ounces and a maxi- mum of say 25 lbs. are to be made, the acid operation is easier and more econ- omical.

Reason 7 Basic

Probably the latest field which is making very rapid strides for the elec- tric furnace in the foundry is for the refining of cast iron. This is particu- larly applicable to the making of engine cylinders, high pressure valves, piston rings and parts requiring uniform wear- ing qualities, etc., and the practice now being adopted is to pass the molten pig- iron from the cupola through the electric furnace for a refining period of 20 to 40 minutes, which gives: (a) a rapid desulphurization; (a) elimination of oc- cluded gases; (c) an accurate pouring temperature.

These causes will speak for them- selves to the progressive foundryman, who in the past on particular work had gone through periods of worry in his: Sulphur in the coke; blowholes, and "hot" metal and "cold" metal. Only the basic furnace can be considered for this purpose.

In looking over the number of fur- naces recently installed in foundries it must be surprising to the prospective buyer to find the large percentage of acid installations. This should not be taken as a criterion. These furnaces were only too often installed by foun- dries that used electricity as a "fuel" and the electric furnace as the melting pot, thereby hurting the electric steel field. They sold their product during a time when there was a loud cry for steel castings and when inspection was either entirely missing or at least lenient. The sulphur and phosphorus specifications were eased off and physical requirements were seldom met. This does not mean that the acid furnace had not its own field, as there are many cases where the correct "business" decision should be for the acid furnace, but this decision should be reached after a careful study of all the existing conditions and as many of the future conditions as possible.



WHAT OUR READERS THINK AND DO



BORING HORIZONTAL HOLES ON A VERTICAL BORING MILL.

By F. A. McLEAN.

It sometimes happens in shops doing a wide variety of repair work, that a piece will come in for drilling that is too large to be handled on any post or radial drill in the plant. Such jobs are always a problem the successful solution of which, usually depends on the ingenuity and skill of the foreman in rigging up or adapting such tools and odds and ends as may happen to be at hand.

A case in point, which clearly illustrates the value of pneumatic tools for such work, is shown in the photograph. The brake ring on a large Corliss driven coal mine hoist was broken in service so badly that a new one was required. The casting for this ring or spider was between 9 and 10 ft. in diameter and had to be bored and turned all over. This was done on a 14 ft. boring mill and the next step was to drill 96 13/16" holes through the rim (which was about 1½" thick) to permit the bolting on, of wooden friction pads or shoes.

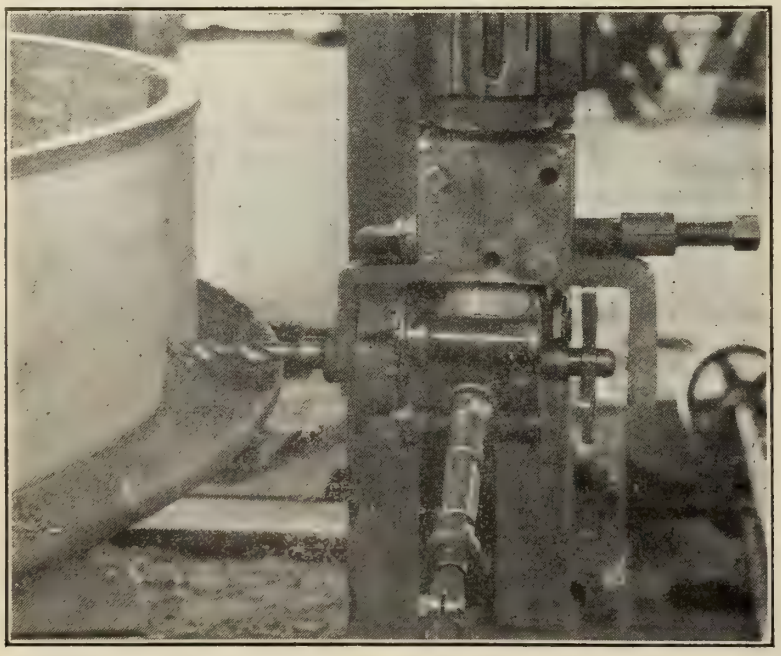
Owing to the large size and awkward shape of the ring casting, it was impossible to drill it on an ordinary drill press so that it became necessary to seek some other way of doing the work. The old method of doing a job of this kind would have been to use hand rachet drills, and figuring on about twenty minutes per hole and adding the time lost in shifting the drill, setting up the "old man," etc., would have probably required the services of two men for about 32 hours.

Drilling the casting on the floor with a pneumatic drill would require the services of two men for 8 hours and in addition some time would have been lost in shifting the casting from the mill to the floor and vice versa. After the friction pads were bolted in place they had to be turned to form a good seat for the brake band and it was finally decided that the best way of doing the job was to drill it on the boring mill, thus saving the time which would otherwise be lost in moving the piece to and from the mill and resetting.

A small pneumatic drill was clamped to one of the tool heads of the boring mill by a simple yoke as shown. The cross and vertical movements of the tool head were used for feeding and adjusting the drill up and down, while the table was revolved from time to time, as required thus acting as a sort of indexing device ensuring the proper location and alignment of the holes.

The actual drilling time, using the equipment illustrated, was eight hours for one man. The holes were all drilled true, very little time was consumed in shifting the drill. One and one-half hours was saved in moving the casting to and from the mill and half an hour for resetting piece to turn brake pads after they were bolted on, thus saving approximately twelve hours over the estimated time required for two men to drill this piece on the floor with a pneumatic drill.

It is obvious that the equipment shown could be adopted to boring large horizontal holes by using a portable boring bar suitably geared to the pneumatic drill chuck instead of an ordinary twist drill. Such an arrangement would be of value in repair shops not equipped with a horizontal boring mill or where it is desirable to have both vertical and horizontal holes bored in large pieces at one setting.



Method of clamping the drill to the boring mill so as to take advantage of vertical and cross feeds.

EMERGENCY HINTS

In the April 21 issue of Canadian Machinery we published an article on "Emergency Hints" by A. L. Marshall. The manner in which we published the material was rather confusing and as Mr. Marshall has pointed out to us the man we described had a lathe with large number of change gears, the meaning of course, that if he was a real mechanic he should be able to compound and cut almost any desired thread.

The meaning we intended to convey for Mr. Marshall was that the more modern lathe with its gear box arrangement with sliding gears and shift levers with the one having a tendency to stick the man on the job as there is no chance to change anything in an emergency.

We said in this article "Suppose the lathe you are using has a feed screw 5 inch pitch," this is wrong. It should read, "Suppose the lathe you are using has a feed which is gear driven with a ratio of 1 to 5 of the lead screw; when your lead screw is cutting leads for 1 inch your feed rod is giving one thirtieth inch feed per spindle revolution." There are plenty of modern lathes marked feed 5 times threads per inch or 3½ times threads per inch, etc.



Personality In Industry

IN the opinion of Professor Walter J. Matherly "Personality is the centre of all industrial values." While discussing the matter in a recent issue of Industrial Management he brings out many points of decided value, a few of which we reproduce. In his opinion Personality, whether within or without industry, is the "ego" in man. It is that which makes him different from other men. It is not that which he pretends to be but that which he is. It is the outward expression of his inward self. It is the man himself.

Personality, as found in industrial plants, is of many types. These are the weak personalities. These are the ones that are vacillating, who possess no ambition, no desire to climb up, no enthusiasm. There are the strong personalities. These are the men who are energetic, forceful, efficient, intensely interested; the men who hold responsible positions; the men who do things. There are disagreeable personalities. These are the individuals who rub us the wrong way. They are the obnoxious folk whom we may classify as the egotists, the autocrats, the wheedlers, and the distrusters.

Personality of the strong and forceful variety is the greatest asset in industry. While it may not be shown in annual balance sheet, yet it is certainly reflected in company earnings and in the efficiency with which products are put on the market. Personality is the energizing power in industrial organization. It enables executives to permeate every departmental activity and to get others to respect and carry out their program of activity.

Personality is a pre-eminent factor in salesmanship. Success cannot be attained in vending goods unless a man has force of character. A sales representative can not convince his customers of the superior qualities of his wares, and get orders wherever he goes unless he possesses an abundance of personal magnetism. Personality helps an individual to secure a job. It helps him to hold it. It gives him power to outgrow it and to reach up for higher jobs. It, coupled with brains and hard work, endows him with the capacity to scale the utmost business heights.

To develop personality, several qualities are necessary. The foundation is a resolute and disciplined will. Without will-power a man is crippled from the very beginning. Closely associated with will power is self-control. That is the second essential. Without the mastery of self, the mastery of industrial enterprise is an empty dream. The next element is self-confidence. An individual might be able to control himself, and even have the will to do, yet lack faith in his ability to carry out his plans. Another quality which is imperative is a mind eager to know and understand. It is impossible to get very far without knowledge. Unless human beings understand what they learn, they flounder about in darkness.

As a crown to personality, courtesy is needed. That means interest in others, thoughtfulness as to the welfare of others. It means looking at things through the other fellow's eyes. It means agreeableness, affability.

Personality, made up of such qualities, plays the leading rôle in present-day business. Without large-caliber men with personal force, warmth and ability, the whole industrial structure would crumble and fall.

Selecting New Equipment

SPEAKING on the subject of "The Selection of New Equipment" a writer in "Factory" tells of a plan whereby new equipment and machinery is purchased on the recommendation of committees, instead of relying upon the opinions of a single individual, or the buyer alone.

In using this plan, the factory manager appoints a committee from among the superintendents and foremen in whose departments the new equipment is to be used, and, in many cases, the workmen who will use the machines are included on the committee.

It is not the function of the committee to make final decision on the particular machine or equipment to be purchased. They merely investigate and consider the merits and disadvantages of the various machines that may be used, and recommend to the management the machine which seems most adaptable to the particular requirements of the factory as a whole.

This may seem like overriding the responsibility of the purchasing agent, but such is not the case. Actual experience with the plan proves that the plant using such a plan is more likely to be equipped with the most efficient machinery, at an ultimate saving in dollars and cents.

The following incident will show the advantage of the system:

A large factory in New York had found, by trying out various material-handling devices, that the lift truck with its interchangeable platforms was best adapted to one part of its work which was handled through several departments. A large number of these trucks would be required to handle this work, and as it was the policy of the firm to standardize on a single make of equipment, where possible, to cut down the number of different repair parts to be held in stock and also to facilitate the handling of the repair work, the question to be decided was which make of lift truck to use.

The factory manager selected a committee from among the superintendents and foremen who would use the trucks in their departments. The purchasing agent was at the same time instructed to invite each lift truck manufacturer to send one of his standard trucks for a trial period and to submit his prices on the quality which would be needed.

The manufacturers were glad to submit trucks for trial. The salesmen were informed that they were not to interview members of the committee during the trial period, and that they were to call only on the purchasing agent. Each truck in turn, was to be used in each department for a certain period, and the members of the committee were to study the trucks in service. Each foreman was to make a report on every truck.

At the conclusion of the trial period a meeting was held, and the committee discussed in detail the performance of each truck. Some of the points which seemed advantageous to one department were not so acceptable to another department and the committee had to trash out which points were most advantageous to the factory as a whole. In some cases a slight change in conditions in a department turned disadvantage into an advantage. Since that time experience has proved the committee's choice of truck an ideal one.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Elmore L. May, 2117 Dime Bank Bldg., Detroit, Michigan, was the only reader to submit a correct list in the July 28th contest. A scale has been forwarded to him. Again we request that any reader who does not receive his scale one week from publication of his name as winner, write us so that we may trace the matter up.

CONTEST FOR AUGUST 18TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1 What to do if you want the "newest."
2 - A case where there is a size for every purpose.
3 What a superintendent said.
4 An opportunity that should not be passed up.
5.—Something that somebody is willing to undertake.
6. How to keep a certain kind of bill down.
7 Something said to have set a new standard.
8 -A case where only one thing is made.
9—A product that is shipped promptly.
10 How to effect big economies.
11 --Something gathered from all civilized countries.
12—The value of a continuous hand chain guide.

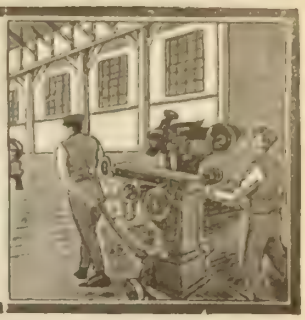
These are Correct Answers for List from July 28th Issue:

1—Pratt & Whitney Co. of Canada, Ltd.
2—L. S. Starrett Co.
3—Dodge Mfg. Co.
4—John T. Hepburn, Ltd.
5—Canadian Blower & Forge Co.
6—Rockford Lathe & Drill Co.
7—Cleveland Pneumatic Tool Co. of Canada.
8—The Carlyle Johnson Machine Co.
9—National Electro Products, Ltd.
10—Northern Electric Co., Ltd.
11—Roelofson Machine & Tool Co., Ltd.
12—Canadian Fairbanks Morse Co., Ltd.

Closing Date for This Contest is Sept. 8th



DEVELOPMENTS IN SHOP EQUIPMENT



LARGE BORING MILL.

William Sellers & Co., Inc., Philadelphia, Pa., have recently produced a boring mill for machining castings used in large hydro-electric power units. This mill measures 35 ft. between the uprights, and 18 ft. between the table top and the tool when the cross rail is in its highest position.

The bed of the machine alone weighs about 50 tons. To enable shipping, it is made in two pieces, one piece extending from one upright to the other, and the other piece being bolted and doweled to it and extending forward so as to provide a portion of the bearing for the table. The over-all dimensions of the assembled bed are 19 ft. 9 in. in width, 9 ft. in length and 2 ft. 8½ in. in depth.

The table is supported on two annular bearings on which it slides when the machine is running. These bearings are supplied with oil under pressure, a pump being provided for this purpose. The table, complete with the driving-gear ring and the center spindle, weighs about 40 tons, and is 19 ft. 10 in. in diameter and 2 ft. 3 in. thick. It is provided with radial T-slots for clamping bolts. It is made in two semicircular sections, securely bolted and keyed together. The driving-gear ring is a separate casting 16 ft. 2½ in. in diameter, centered and bolted on the table. The table is provided with a large taper spindle 20 in. in diameter and extending vertically through the bed. A split bushing fits into the central hole in the bed, and is used for adjustment.

The spindle bearing is lubricated by the return oil from the inside annular bearing. The uprights are very heavy box castings 24 ft. 8 in. high and 12 ft. deep, the faces being 24 in. wide. They are bolted and doweled to the upper portion of the bed and the upper ends are tied together by a cast-iron cross-girt of heavy box construction. The cross-girt carries the lifting and traverse machinery drives and is accessible to the operator by a ladder carried on the inside of one of the uprights. A wooden platform with safety guard rails is provided to enable the operator to pass safely from one side of the machine to the other at the top.

The machine is driven through a 5 h.p. adjustable-speed motor with a variation of 3 to 1, and a speed regulating mechanism with four gear changes, giving a total range of 0.19 to 6 revolutions of the table per minute. The gears are all of large proportion with cut teeth. One feature of the drive which is worthy of mention is the short length of the shafts which are used throughout, in order to eliminate, as far as possible, the shaft deflections which may cause chatter.

The feed mechanism for the power feed of the saddles along the crossrail, and for the tool bars in the saddles is located on the sides of machine, and a total feed range from 1/64 to 1½ in. per revolution of table is provided for.

DOUBLE SPINDLE GRINDER

The Chas. H. Besby & Co., Chicago, Ill., have developed and marketed a new heavy pattern motor driven double spindle grinder. This machine is to be known as type I, and is suitable for wet or dry grinding. It is equipped with two 7½ h.p. a.c. special grinder type fully enclosed motors, and the starting apparatus is of the push button control type. The starters are attached direct to motor frame and are mounted in a sheet metal dust-proof case equipped with a hinged door. The motors are fitted with specially designed end casings and extra large and long ring oiling bearings. These motors are mounted on a bed plate and the two inner end casings or bearing supports have a footing on same which is machined on a perfect plane with the motor feet thus insuring rigidity right up to the nose of the spindle.

Motors can be moved along the bed of machine base to accommodate different widths of work to be ground. This movement is accomplished by means of racks and pinions. The motors are only moved on bed when it is necessary to change the machine from one width of work to another as both spindles themselves slide endwise through the bearings, feeding the wheels to the work being ground. This spindle movement is obtained through racks and pinions to which both hand and foot lever are attached. The movement is actuated on both spindles through a connecting rod attached to lever at the rear of machine. When desired, the connecting rod can be disconnected and the right hand spindle locked in a stationary position while the left hand spindle can be operated to and from the work through foot lever movement.

A pull spring is attached to a lever at the rear of machine, which is drawn out when spindles are moved forward to the work so that when the foot or hand lever is released this spring returns the spindles to their original starting position. Endwise movement is controlled by micrometer stop screws attached to each of the outer bearings. When the wheels are brought up to the work and a piece has been ground to the required depth the micrometer screws are set so that they come in contact with the bearing head casing, making a positive stop to the endwise movement of spindle.

The bearings are extra heavy phosphor bronze castings, the thrust being taken on a flange of large area. This flange is equipped with a hardened steel thrust collar and the thrust bearing is automatically oiled from the ring oiling bearings themselves. The oil reservoirs are extra large and the oil rings are of large diameter, which practically makes a flood of lubrication to all bearing parts. All bearings are dust-proof.

CYLINDER GRINDING MACHINE.

The Landis Tool Co., Waynesboro, Pa., have marketed a cylinder grinding machine especially designed for regrinding automobile cylinders. The range of work capacity includes all makes and types of automobile cylinders cast en bloc as well as a miscellaneous variety of irregular castings.

The grinding wheel spindle center of rotation is 10" above the top of the work carriage so that large castings may be easily handled with no extra or special fixtures. The grinding wheel spindle regularly furnished, will grind 15" deep and two wheels 2½ and 3½ inches in diameter are included as regular equipment. Eccentric adjustment of the spindle range from 1/16" to 1-1/16" which permits grinding holes as large as 5⅝" with standard 3½ diameter wheels. Two spindle driving pulleys are furnished to give correct peripheral speed of approximately 6,500 feet per minute with 3½" and 4½" diameter grinding wheels. Extra wheel spindles and sleeves for grinding 20" and 22" deep or for diameters larger than 6" can be furnished if necessary. These sleeves are interchangeable on the regular machine.

The work carrying fixture is an open angle plate design with two adjustable

work clamping bars. The work to be ground is securely clamped to the bars by two heavy machine clamps of ample capacity. A distinctive feature of this fixture is the arrangement for quickly and accurately aligning the work in vertical position to the center of spindle rotation. The entering bar fits into two slots milled in the frame of the work carrying fixture and carries two adjustable bearing brackets. Before clamping the work on to the machine these centering brackets are inserted into the hole to be ground to ascertain the exact size. They are set to this dimension and work is then lifted to the machine and fitted over the brackets of the aligning bar, where it is securely clamped to the work carrying fixture. After it is securely clamped in position this aligning bar is removed. If work is not absolutely aligned, minor adjustment can be made by a screw in front of the fixture which permits it to be raised or lowered as required.

The machine is arranged for either direct motor drive or for lineshaft drive through a small overhead counter. If motor drive is used a three horse-power motor operating at 1,150 R.P.M. furnishes ample power. If driving from counter a 3½" belt is used. Floor space occupied is 88 inches by 88 inches and net weight of the machine is approximately 2,900 pounds.

TRUS-FORM SNAP GAUGES

The Pratt and Whitney Co. Hartford, Conn., have recently added to their line of adjustable limit gauges, known by the name "Trus-Form." These gauges are constructed along the same general lines as a roof truss with the metal placed where it affords maximum rigidity. This frame of triangular cells has the flanges and ribs in tension or compression, forming a light and stiff construction. The outer rib with its broken lines affords a sure grip for the fingers, even when they are oily. A unique adjustment is provided for the anvils in the following manner:

Two opposed screws pull in opposite directions like the screws of an independent lathe chuck, and by pulling one against the other the finest adjustment is easily made, this adjustment being positive in either direction. When both screws are tight, the anvil is securely locked against shake in any direction. It cannot be jarred loose and may readily be sealed. The holes in which the anvils work are accurately line-reamed, and the anvil faces are lapped square before assembling.

New anvils can be substituted at any time, these being interchangeable. In all sizes over ½ inch, the anvils have heads which permit of gauging to within 1/32 inch of a shoulder. In the smallest size, as an extra, two special anvils with offset heads may be used in the "Go" position, where it is necessary to work close to a shoulder. These are not needed in the "Not Go" positions.

When necessary to mark sizes, tool numbers, operation numbers, etc., two pairs of brass buttons are secured by special screws. They are readily removed to a bench plate for stamping, and they may be filed off and re-marked. One pair may be used for any permanent marking and secured by riveting over or soldering the point of the screw. These gauges are made to cover a range from 0 to 12 inches in fifteen different sizes, as follows: 0 to ½, ½ to 1, 1 to 1½, 1½ to 2, 2 to 2¾, 2¾ to 3½, 3½ to 4¼, 4¼ to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9, 9 to 10, 10 to 11, and 11 to 12 inches.

GEARED HEAD LATHES

The Morris Machine Tool Co., Cincinnati, Ohio, have placed on the market a line of geared head engine lathes, these being in 16 in., 18 in., and 22 in. sizes. These machines have a single pulley drive, are geared in the head, and provide twelve spindle speeds. With a double friction countershaft twenty-four speeds or twelve forward and twelve reverse are obtained. All the gears are of steel, heat treated and hardened. The headstock is filled with oil up to a certain level, permitting the gears to dip enough to thoroughly lubricate them.

All speeds are secured through one front gear and one positive back gear clutch, friction clutches or any parts requiring adjustment having been eliminated. The only friction clutch is in the pulley at the initial drive, which is of a large diameter and is controlled by a shifter rod running the full length of the lathe. This permits the operator to start and stop the lathe from any working position. Speed changes are secured through the levers in front of the head, the two levers at the back end controlling a set of sliding gears giving six speeds. This lever, when engaging the direct drive clutch, slides the back gear pinion out of mesh, preventing the back gears running idle at high speed and from absorbing unnecessary power. Pulley is protected by a guard which can be swiveled to suit the angle of the belt.

The geared heads are interchangeable with the cone head. All geared heads are arranged to receive the motor drive unit at any time. The motor is mounted on a plate, bolted to the head and drives the clutch pulley by an endless belt which is furnished with the motor drive details. An idler pulley adjusts the tension of the belt by means of the sta handle at the front of the motor plate The idler pulley and bracket are mounted on the motor plate, making the moto drive unit self-contained.

When releasing the friction clutch i the pulley, a brake can be applied b the same pull which stops the idle rota tion of the spindle. This is a grea convenience both when shifting gear and when turning work partly around fo inspection at different points on th diameter.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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B. G. NEWTON, Manager
A. R.. KENNEDY, Managing Editor
J. H. MOORE, Technical Editor
T. H. FENNER, Associate Editor
J. H. RODGERS, Montreal Editor



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JOHN BAYNE MACLEAN, President
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It Pays to Give Service

"CONSIDERABLE improvement is necessary in the quality of work coming from the foundry." Such an article as Mr. Hampson wrote in the July 21st issue of Canadian Machinery would be unnecessary if foundry owners would try to get the manufacturers' viewpoint, and there is no reason why this should not be easy of accomplishment. When a person goes into a store for an article, they do not like to pay out their hard-earned cash until they have been shown something of good quality. In other words they get what they want before purchase. The same condition should hold good in the foundry.

Why should a manufacturer pay for castings which are too hard to machine; too full of holes to be worth using; or as often happens, too warped to be of the slightest use? These conditions may seem far-fetched, but they are happening every day. A case came to our notice recently that is well worth repeating. It seems that this concern gave all their work to one particular foundry. This arrangement dated back to 1914, so that the foundry in question had no competition so far as this firm was concerned. A considerable volume of work yearly was turned out, and in this case the grade of castings received was very satisfactory—or rather was—until the recent war broke out.

Extensions were made to the foundry to handle extra work, for in those days one was lucky to even get work into a foundry. Imagine the surprise of the manufacturer when the foundry began sending very poor castings, so poor that they were unfit for use. Believing it to be an accident, he called the owner's attention to the bad batch, getting in return, a load of abuse. The manufacturer, realizing the scarcity of foundries which could handle his work swallowed his pride and disappeared. Thus, the first victory went to the foundry owner.

The second battle was short lived. Without warning, the manufacturer received all his patterns having intricate cores, with a note saying that from now on only simple core work would be handled. This left him strictly up against it, for without these castings his product could not be turned out. To make it worse the patterns were in very bad shape, thanks to rough treatment, and it took over a week to put them in good condition.

During this time a wild hunt was in progress to find a foundry that would handle his work. "Are the pieces solid or cored," used to be a favorite query of the foundry owners all on receiving his reply, the plea of rushed business, lack of good coremakers. etc., was given. Eventually a foundry was found which would handle the work and from all reports they did so at a lower rate than the first foundry making the castings, yet turned over a handsome profit, as the volume of work was considerable.

And now comes the punch of the story, as the author would put it. Today, the foundry owner that gave the manufacturer such shabby treatment is running wildly to and fro for business, when just a stonethrow from him is the concern whose work he turned down. Naturally he has tried to get the work again, but the manufacturer is luckily blessed with a good memory.

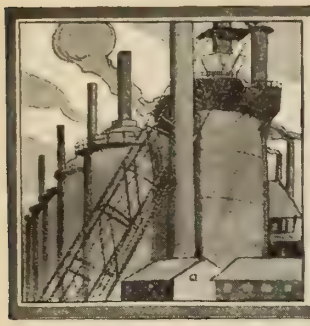
Of course this tale may be an extreme case, but in a milder form the same conditions existed all over the country during war time. Old customers were forgotten, new friends were made at high prices, but today the old reliables are in business while the new firms are a thing of the past. Foundry owners can still make good by showing they are anxious to serve the manufacturer. There are quite a few foundries in existence today which know the meaning of real service. Let them be an example to those who merely think of the tonnage passing through their shops. When foundry owners co-operate with factory executives, giving them castings to suit their particular requirements, the biggest step in the right direction will have been taken.

Preparing Goods For Export

SOME good advice for exporters is given in an article appearing in another portion of the present issue. The author, who is trade commissioner at Melbourne, says that new cases should always be used for export, also that tongue and grooved lumber is especially desirable for the packing of high class and expensive goods. He points out that the cases should not be too large; that the parts should be so packed that they do not shift; and that the cases should be lined with some sort of paper or cloth to exclude the effects of the sea air and other moisture in transit.

Canadian Machinery has always been a staunch supporter of careful packing, both for home and export shipping. From time to time articles have been published showing methods which have been found successful, and these stories, together with similar articles published by other technical journals have had their effect. At the present time the larger firms having export business have set aside a separate staff of men whose duty it is to prepare export boxes. One large concern in the United States has everything reduced to such a point that the boxes for their various products are cut according to blue print. Several Canadian concerns that we know of also follow out the same practice, although on a somewhat smaller scale.

There is no question about the rough handling such packages receive. Anyone who has watched the loading of a ship knows how the dock hands reverence the sign "Handle With Care." While it does no harm to mark boxes in this way the safest form of protection is to make them in such a manner that they cannot help but be handled properly. Wherever possible, embody as part of the box, the eye through which the slinging hook will go. This will ensure the box being lifted and kept right side up. Rules for marking should be carefully observed, for many a box has been delayed through this cause. Consider every step of the journey; place yourself in the position of the package, then put on it the protection you would ask for in order to arrive in good condition yourself, always provided of course you were made of similar material to the goods being shipped. Place your best men in the export shipping department, men with visionary power, and above all see that your checkers are fully alive to the responsibility of their position. Let them understand that a satisfied buyer means not only repeat orders, but possibly an established trading connection.



MARKET DEVELOPMENTS



So Far This Month Market Shows Improvement

July was a Poor Month for the Steel Mills—Output Has Since Improved and by November it is Expected that Further Gains Will Be Made—Pig Iron Moves Slowly.

THE July market was a poor one for steel mills and it is questionable if any other will show such a low average. About the middle of the month an improvement was noted. Since that time the market has improved slowly but surely, and a further improvement is looked for as time goes on.

The steel ingot output in July was about 11,000,000 gross tons a year, or about equal to 21 per cent. of capacity. The low point in output fell at about the middle of the month. So far this present month a little gain has been reported. A 35 to 40 per cent. rate is looked for by November. This would mean more than double what the mills were producing a month ago.

The increased demand upon the mills is said not to be a reflection of business being more active generally, but of people buying more in relation to the general volume of industrial activity. Business in the United States is more active than it is given credit for. The improvement shown is not only likely to be held but should improve week by week.

The bottom seems to have been reached so far as steel price are concerned. Practically all the decline has occurred, an until freight rates, wages, and such important determinin factors drop, prices in steel are fairly sure to hold. Pig iro shows some signs of activity although the movement is ver slight.

Machine tools are not much in demand these days. Produc tion tools are not moving at all, and even re-built tools are nc being enquired after. Manufacturers seem to be holding tigh spending as little as they possibly can.

Small tools are not moving very rapidly, although in som lines the prices are said to be down to 1913 levels. There are n changes in price from last week.

No. 28 gauge galvanized sheets are selling at $7; No. 2 black at $6; while No. 10 gauge blue annealed is selling a $4.50. Bar and bar mill material shows no change, selling a the old price of $3.75 base.

BUSINESS IN UNITED STATES IS MORE ACTIVE THAN IT IS GIVEN CREDIT FOR

Special to CANADIAN MACHINERY.

PITTSBURGH, August 18.——The monthly report of the American Iron and Steel Company, giving the steel ingot production of 30 leading companies, permits an accurate estimate to be made of the production by the whole industry in July, a month that will probably never be equaled in future for lowness of production. As indicated by these market letters in recent weeks, it was the month in which the turning point occurred as to the volume of demand upon the steel mills.

The steel ingot output in July was at the average rate of about 11,000,000 gross tons a year, equal to about 21 per cent of capacity, this being made up of an operation of about 5 per cent by the United States Steel Corporation, and about 18 per cent. by the independents, taking the independents as a whole. The low point in output fell at about the middle of the month, when the industry probably operated at between 18 and 19 per cent. At both the beginning and end of the month the operation was heavier, and there has been a little gain thus far this month, so that the rate now is probably about 25 per cent. of capacity. A 35 or 40 per cent. rate may easily be reached by November. While a 40 per cent. rate might not seem like much it would mean more than double the mills were producing a month ago.

In some uninformed quarters reference has been made to the Steel Corporation's showing of unfilled tonnage decreasing 287,544 tons during July as being a favorable indication, because in preceding months the decreases had been larger, tapering off from the 649,102-ton decrease reported for last March. It may be well to state specifically that the smallness of the decrease, in the circumstances, is unfavorable, although the facts were already so well known that it does not make any difference. In the five months March to July inclusive, the Steel Corporation was engaged almost wholly in filling shipping orders or specifications furnished by customers against their contracts, made long ago. The "unfilled tonnage" reported monthly includes all such contract tonnage. The more the customers specified, the more the corporation shipped, the more money it made and the more the unfilled tonnage decreased. Shipments in March were at about 51 per cent. of capacity, the decrease in unfilled obligations for the month being 649,102 tons. Shipments in July were at about 25 per cent of capacity and the u filled obligations decreased by 287,5 tons. In each of the five months the co poration booked a little new tonnage, a eraging about 100,000 tons a month. Th when there is a little new buying a lar decrease is favorable, showing that cu tomers are willing to take steel. Of cour it would be still beter if they took all steel ordered and bought more still, which case there would be an increa in the unfilled obligations. The corpor tion does not need to make new sales this time, its interest being in having i customers take tonnage already contrac ed for. The independents are in a di ferent position. Having had prices 1920 much above those of the Steel Co poration, they have little contract tonna now, and their business is chiefly in ma ing fresh sales.

Demand Increasing

Week by week for five successi weeks there has been basis for repo ing an improvement in the demand u on the steel mills, and it might thought that by this time there is qu a demand or, if there is not, that t improvement has been just talk. Nei er has been the case. There has be continuous improvement, but it has be at a very slow pace, and there is a lo road to travel because at one time th was hardly any demand, or the m would not have been operating at l

than 20 per cent. of capacity. It is undoubtedly. a case of "slow but sure" The increased buying and specifying is not attributable to "sentiment" or "an improved tone" or "more optimism" the hackneyed expressions that are so often used, or misused, in market reporting. There is no sentiment at all about this market. People are buying because their stocks have run out or become ragged, when previously they had been drawing upon stocks or had been distributing machinery, implements, tools, etc., previously manufactured.

The demand upon the steel mills had been far below the actual ultimate consumption for many weeks and with the gradual reduction in stocks the demand is working up towards a normal relation. The increased demand upon the mills is not a reflection of business being more active generally, but of people buying more in relation to the general volume of industrial activity. The fact is that general business in the United States is much more active than it is being given credit for. There has been talk about several million people being out of employment, but there are about 45,000,000 altogether who are either working or want to work. The freight ton-mileage on the railroads was at a greater rate in May than in April, and was at a rate slightly greater than the rate in the best railroad year before the war, the year ended June 30. 1913. Debits to individual accounts at banks, reported by the Federal Reserve Board as an indicator of the volume of the nation's business, have been lagging only 14 to 17 per cent. behind those of a year ago. Demand upon the steel mills has been below a normal relation , and as that could not continue for any length of time the improvement now being experienced is certain to be held, while further improvement in future is certain.

Steel Prices Steadier

For months buyers have been looking for lower and lower steel prices, and properly, but the point now is to know when to stop looking. Very nearly all, and perhaps all, of the decline has now occurred. Prices cannot of course return to the pre-war level, with freights involved in iron and steel making up 75 to 100 per cent. and wages up 50 per cent. or more, taxes perhaps doubled, and various other things all higher. Should freight rates come down 20 per cent. a few months hence, and that is about all that could be expected, they would still be up about 50 per cent. Wages are likely to average about 50 per cent. advance for some time if not for years. There is to plain showing by comparisons that steel prices are now relatively low, and there is the showing of the actual market, that in the past week there has not been a single definite decline. Prices are more or less irregular, some mills quoting a little lower than others, and slightly lower prices being quoted on the more desirable orders than on the less desirable orders, but the shading on the whole is little greater than a week or two ago, and in bars, shapes and plates there is some question whether concessions from regular prices, on especially desirable orders, are altogether as great as two weeks ago. The "regular" prices are $.75 on bars and $1.85 on shapes and plates.

Pig Iron

Pig iron in the past week has been showing possibilities of there being a turn. While there remain ample stocks of basic on this market, stocks of foundry and Bessemer seem to be small, and two or three sellers of foundry iron state they have withdrawn from the market. This means that what little stock they have left they wish to keep to feed out to regular customers. In the Cleveland and Buffalo districts there are still fairly large stocks. Prices in the valley market are unchanged, at $20 for Bessemer, $18 for basic and $19.50 for foundry.

POINTS IN WEEK'S MARKETING NOTES

The month of July will probably never be equalled in future for lowness of production. However it proved to be the month in which the turning point occurred, for the demand on the steel mills has slightly increased since the middle of July.

For the past five weeks an improvement has been noted in the steel market. This movement has been continuous, but very slow which accounts for some doubting even its very existence. It seems to be a case of "Slow But Sure."

Sentiment does not exist on the market. Where buying occurs it is because the stocks have run out entirely, or at least become very ragged.

General business in the United States is not so poor as some would have us believe, according to reports received from our Pittsburgh correspondent.

It would seem that the point is being reached where people must stop looking for lower prices. Dealers feel that nearly all the decline has occurred. They say that prices cannot possibly return to pre-war level so long as freight charges remain as high as they are at present high wages, taxes, etc. being other considerations.

Pig iron during the past week has been showing possibilities of an increase in demand. There still remains ample stocks of basic on the market while stocks of foundry and Bessemer seem to be small. Prices remain unchanged.

The machine tool market remains in a sort of comatose condition. Nobody seems to be wanting anything. Enquiries do come in occasionally, but at present they go no further than enquiries. A spirit of optimism is making itself felt however and improvement is looked for although the process will be gradual. The same can be said about small tools.

Scrap iron remains in exactly the same position as last week. The demand is very light, the prices quoted are as low as they are expected to go and on top of that nobody is hurrying to buy.

Pig Iron Output

In the Dominion Bureau of Statistics report, it is stated that the advance in the output of pig iron ferro-alloys in Canada, noted in the May report, was fairly well maintained during the month of June. Pig Iron production declined slightly from 56,091 long tons to 54, 812 tion, but the amount of basic iron made rose from 44,002 long tons to 48,870 tons, all of which was used by the makers. The output of foundry iron made for direct sale dropped slightly from 4,709 tons in May to 4,389 tons in the month under review. Foundry iron produced by makers for their own further use, showed a considerable decrease from 5,206 tons in May to only 825 tons in June, so that the total output of foundry iron declined from 9,915 tons in May to 5,214 tons in June. Malleable iron was also lower, dropping from 2,162 tons in May to 661 tons in the current month. Sixty-seven tons of iron castings was made from electrical furnaces. No other electric iron was produced during the month. A total of 717 tons of ferro-alloys was made during June, as compared with 944 tons during the preceding month.

Six blast furnaces were active at the end of June, one additional furnace having been blown in during the month, by the Dominion Steel Corporation at Sydney. At the close of the month, three furnaces were being operated at Sault Ste. Marie, one at Hamilton, and two at Sydney. During the six months ending June 309,206 long tons of pig iron was made in Canada, as compared with a total of 449,810 long tons during the same period in 1920. The output for the first six months of this year was, therefore, only about 69% of the amount made during the corresponding period of 1920. Of the pig iron made, 249,008 long tons was produced from blast furnaces by firms for their own use in further process of manufacture; 59, 897 tons made in blast furnaces was produced for direct sale. Of the 301 tons of electric iron made during the period, 222 tons was made for use and 79 tons of iron castings was made for sale as such. An analysis of the pig iron output for the six months ending June shows that 71% of the total was basic iron; 21% foundry iron, and 8% malleable iron. Coke was the only fuel used in the manufacture of pig iron in Canada during the period. The production of ferro-alloys, including the several grades of ferro-silicon, and also spiegeleisen, amounted to 10,781 tons during the half year.

DEMAND IS VERY LIGHT AT PRESENT IN TORONTO—MACHINE TOOLS DULL

Special to CANADIAN MACHINERY.

TORONTO—The summer season is still making itself felt on the Toronto market. The various dealers spoken to by Canadian Machinery say that little change has occurred since last week. No large sales are being made, and although a few enquiries come in here and there, they seldom develop into real orders. When an order does arrive it is for a very small amount. One dealer stated that he had not sold a "Production" machine for a long time. By such a term he of course means to cover any type of machine tool that is specially adapted to speeding up production.

Re-built tools are also moving very slowly. It would seem as if manufacturers had decided to do absolutely nothing for the present. If they are waiting for still lower prices, they are waiting in vain, said one dealer, because prices have dropped as low as they can. When one compares present prices with the high freight rates, high wages, etc., he continued, they can readily see why we can't drop further until the various factors controlling these prices drop accordingly.

One dealer claims that in some lines the prices are down almost to 1913 levels. This is said to be especially true in some lines of small tools. The latter commodity moves, but very slowly. There does not seem to be much demand for new tools, manufacturers using their old ones rather than spend money. The prices on small tools remain the same as last week. Speaking on future possibilities, one dealer said that he could see no reason why this section of the business should not pick up very shortly. Of course such a change would not be sudden, he continued, but would take the form of a gradual improvement.

The Steel Market

The steel market merely moves along these days, neither up nor down. Prices seem to have reached bottom, and while the demand at present is light, improvement is looked for shortly. No. 28 gauge galvanized sheets are now selling at $7 per 100 lbs. No. 26 gauge, black is at $6, while No. 10 gauge blue annealed sheets are selling at $4.50. Bars and bar mill material show no change, this material still selling at $3.75 base. The demand for boiler tubes remains light, and the prices on these are the same as last week.

Scrap metal is still the black sheep of the market. There is hardly any business at all and according to one dealer, not much improvement can be looked for at present. The market situation can readily be summed up in the words of one dealer who remarked that he had stopped guessing what was going to happen. One thing sure however, is that everyone feels the worst has been passed through, and from now on things must get better instead of worse.

Steel Ingots and Castings

The output of steel ingots and castings in Canada during the month of June was the highest for any month during the present calendar year, the output rising to 64,103 long tons, an increase of more than twelve thousand tons over the production for the previous month, which was 52,001 tons. Direct steel ingots accounted for 62,339 tons as compared with 50,068 tons during the preceding month, and of this quantity, 62,190 tons was basic open hearth steel produced by the makers for their own use. A total of 144 tons of electrical steel ingots was made, of which 139 tons was made for further use by the firms reporting. Basic open hearth steel castings were also a little higher for the month, the production being 389 tons, consisting of 100 tons made for further use and 289 tons made for sale. Steel castings made from electrical furnaces showed a slight decline from 1,738 tons in May to 1,278 tons in June, of which 1,164 tons was made for sale, and the balance was used by the producing firms.

The total production of steel ingots and direct steel castings during the six months ending June amounted to 295,140 long tons, of which 284,197 tons was produced for use in further processes of manufacturing by the makers; the balance, or 10,943 tons was made for sale. By far the greater amount of steel made was produced by the basic open hearth process, the total for this item amounting to 282,648 long tons, of which 280,839 tons was in the form of steel ingots and was used by the makers, and the balance, or 1,809 tons, in direct steel castings. Of this latter amount, 1,423 tons was made for sale, and 386 tons for the use of the producers. Electric steel production amounted to 10,938 tons of which 9,585 tons was produced as direct steel castings and 1,353 tons was in the form of ingots. Nearly eight thousand tons of the direct steel castings made from electric furnaces was marketed directly as finished product. Very little open hearth steel was made during the six months' period, the amounts recorded being 239 tons of ingots made for use, and 256 tons of direct steel castings, practically all of which was sold as such making a total of 495 tons in all. Converter steel production amounted to 1,059 tons, most of which was made for direct sale as steel castings.

The average monthly production of steel ingots and direct steel castings for the half-year ending June 30, 1921, amounted to slightly more than forty-nine thousand long tons, the total output for the period being 295,000 tons. During the same months in 1920, the average production was ninety-one thousand tons, and the total, 574,000 tons. The monthly average for the eight-year period, 1907 to 1914, inclusive, was sixty-two-and-one-half thousand tons, so that the June production this year is somewhat higher than the pre-war average.

FIRMS WANT GOODS

3245. **Agricultural Supplies.**—A London firm dealing with the Near East would like to be put in touch with Canadian suppliers of agricultural implements and machinery and other agricultural goods suitable for the Near Eastern markets.

3231. **Lanterns, Axes, Hammers, and Builders' Hardware.**—A London company who are buyers of hurricane lanterns, axes, hammers, and other tools, and general builders' hardware, are open to consider offers from Canadian manufacturers.

3232. **Hardware and Tools.**—A commission agent in London buying for clients in South Africa would be interested to receive regular quotations from Canadian exporters of picks, shovels iron and steel materials, and other Canadian requirements of the mining districts of South Africa.

3233. **Chemicals.**—A commission agent in London, England, buying for clients in South Africa, would be interested to receive quotations from Canadian exporters of caustic soda, cyanide of sodium, and other chemicals required for the mining districts of South Africa.

3229. **Cement.**—A Liverpool firm desire prices of the above, in casks of 40 pounds gross, for export to the Gold Coast, West Africa.

A SERIOUS ERROR

The advertising department have asked us to call readers' attention to a serious error which occurred on page 63 of the August 4 issue. On this page was an advertisement of the Norton Co. of Canada. Ltd. In italics it was stated that Norton Crystolon wheels were suitable for any work on steel or any other materials of high tensile strength. At the opposite side it was claimed that Norton Alundum wheels were good for any work on cast iron, brass, and other material of low tensile strength.

Of course to mechanical readers the error is self evident, viz, that the reverse is true. The Crystolon wheels are specially adapted for iron, brass, etc., while the Alundum wheels are best suited for steel work, and such high tensile materials. Considering the fact we are working with a staff of men who are not familiar with our work, we are having very few typographical errors.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



IT PAYS TO CONSIDER INTERESTS OF OVERSEAS BUYERS—RULES OF EXPORT

CANADIAN exporters should consider the interests of overseas buyers as their own." Trade commissioner D. H. Ross at Melbourne, is responsible for this truthful remark, and he goes on to say that a satisfied buyer means repeat orders and, probably, an established trading connection which may endure for a long period of years.

In many instances, he continues Australian buyers—especially of new lines—attach a packing sheet to their indent on which is clearly set out the contents of each case, besides requesting that iron hooping or wiring should be used in a specified manner. In ordinary lines of merchandise, the usual trade package to which the trade has become accustomed is implied as a matter of course, hence no specific packing instruction may be given. When oversea buyers give packing instructions, founded upon their long experience of their special requirements, it is absolutely essential, for the reputation of the Canadian suppliers, that careful compliance should be given to every detail outlined. Credit must be given to distant buyers as to their knowledge of what packing their particular trade requires, however inconsequuous the instructions may appear to the shippers. It it obvious that want of consideration in essential packing—and minor shipping details—reflects not only upon the delinquent manufacturers but also upon the methods of Canadian exporters as a whole.

Improvement in Packing

In recent years the packing of Canadian goods shipped to Australian markets has greatly improved, as manufacturers have taken an intelligent interest in following the instructions of overseas buyers in order that their goods should arrive in good condition. It is now the exception to receive complaints regarding Canadian packing.

In concluding his talk on packing for export, Mr. Ross says that certain factors enter into good practice. Following are the suggestions he makes:—

New cases should always be used for export.

The timber to be used depends on the contents of the package, hence no fixed recommendation can be made, for this is a matter to which the manufacturer's intelligence and desire to give satisfaction are commended. Tongued and grooved timber is desirable especially for high-class and expensive goods.

3. Cases should not be too large and should be closely packed to prevent the contents shifting en route. Waste space means additional expense to the oversea buyer besides adding to the landed cost of the goods.

4. Cases should be well lined with strong waterproof paper to avoid the effects of the sea air and other moisture in transit. The necessity of this essential lining of cases is more frequently ignored than followed by Canadian exporters. To the waterproof paper is recommended an additional inside lining of strong kraft or cartridge paper.

5. Zinc or tin-lined cases are often used by British and Continental shippers for special goods, and for this extra expenditure the buyer is charged. Buyers frequently stipulate such packing, but without a definate instruction shippers must use their own discretion always with the object in view of landing their goods in perfect condition.

6. Carefully check contents of cases before packing; two persons are recommended for this purpose.

7. In packing machines every part (screws, bolts, etc.) should be checked beyond the possibility of an error, for commissions are often unobtainable where the parts are unpacked.

8. Avoid straw or hay which absorbs moisture in packing fragile or light and bulky goods. The packing depends on the nature of the goods, but, generally, excelsior or wood wool and waste paper are preferable to vegetable materials.

9. Cases should be clearly stencilled with the marks of the oversea buyers, numbered, and the port of destination must be clearly indicated. Preferably, the marks on cases should be stencilled in indelible ink and in prominent characters. In some countries stencil marking is obligatory.

10. The cubic measurement (extreme outside dimensions) should be stencilled on each case (e.g. 30 inches by 20 inches by 18 inches) and noted on the invoice to facilitate landed costs being computed. The cases should be weighed, particularly after packing, and the gross weight stencilled thereon as a check (to a limited extent) against pilfering. The number and contents of each case should be clearly shown on the invoice.

11. Unless otherwise instructed, cases are always preferable to crates or bales. In loading or discharging ships, stevedores use cargo hooks (despite marks of warning) and the contents of bales are frequently damaged thereby.

12. An endeavour should be made to pack only one class of goods in each case.

13. Should catalogues, price lists, or advertising show cards, be enclosed in a case, it is necessary to state the weight of all such printed matter which is dutiable in Australia at the rate of 20 cents per pound. Failure to disclose such particulars on the invoice may, on examination by the customs, cause the importer to be substantially fined. Unless requested by buyers, it is inadvisable to enclose any extra printed matter.

RAILWAY IS NOW A PAYING PROPOSITION

Wonderful Results Since Henry Ford Has Taken Over The Railroad Between Detroit And Irontown

A short time ago Canadian Machinery acquainted its readers with the fact that Henry Ford, had taken over the Detroit, Toledo, and Irontown railway, and that he had decided to pay over the union scale, making the minimum rate $6.00 per day. The aftermath of the above reading notice is told by the Wall St. Journal which says that if every railroad had a shipper of Ford's capacity as godfather or owner, operating problems would become simple. They go on to say that he has sent over his rails sufficient traffic to turn a consistent deficit into an operating profit of more than $500,000 in the first six months of 1921.

He has also been able to cut two hours off the running time between Detroit and Bambridge, a distance of 280 miles, and the trip is now made in 10 hours with 28 scheduled stops. Most of the freight is moved at night, and by speeding up shipments Ford says he has cut the time when raw material leaves the manufacturer until finished automobiles reach the dealer from an average of 22 to 14 days. This in turn freed $22,000,000 in inventory for other purposes. Instead of a former record of 200 cars moved in 24 hours, the new road, or at least the new management have moved as many as 1,200 cars in the same period.

BRIDGE TO BE BUILT WILL JOIN PHILADELPHIA AND CAMDEN SOON

IN THE August 4 issue of Canadian Machinery we give some interesting figures on the proposed Hudson river bridge. Believing readers will be further interested in the new bridge which is to be built across the Delaware river, we append some of the interesting features in connection with it.

At the time of writing, work will no doubt have been started on this bridge which is of the two-cable suspension type. The bridge will span the Delaware between Philadelphia and Camden, a distance of 1,750 feet. The main span will be 1,750 feet. between towers with a clearance of 135 feet above high water. The two cables on which it will be hung are to be 30 inch diameter, being made up of 16,531 wires, .192 inch diameter. All parts of the bridge will be designed to safely withstand a live load of 11,990 pounds per lineal foot.

The span of the bridge will be 50 feet shorter than our own Quebec bridge, so that Canada still has the second largest bridge of its type in the world, the new Hudson of course, being the largest. It is estimated that about 33,000 tons of metal will be used, and the cost will be somewhere around $28,871,000.

Ralph Modjeski of Chicago, George S. Webster and Laurence A. Ball comprise the board of engineers which recommended the bridge, and six months was taken considering sites, etc., before the definite plans now arranged were settled.

In their report the engineers stated that they selected the suspension type of bridge because it involved less risk in construction, and would be considerably cheaper and quicker to build. They also touched upon the possibility of increasing the capacity of such a bridge as against the cantilever type, and also stated that there would be less exposed surface to paint on a suspension style bridge.

Traffic Arrangements

Six lines of traffic have been arranged, each line being 9 ft. 6 inches wide to take care of the largest trucks. The width from curb to curb on the main structure has been set at 57 feet. Room is also provided for two lines of tracks for a bridge shuttle service, and two more for an extension of the city's high speed transit lines over the bridge when such is desired.

The main piers are to be 380 feet high and 60 feet wide, and the wire used for the cables have an ultimate strength of 215,000 lbs. per square inch, and an elastic limit of over 144,000 lbs. per square inch.

Owing to local conditions it has been found advisable to carry the cables to an anchorage a considerable distance back of the towers. For economic reasons the side spans are suspended from them. The cables and towers necessary for the main span sustain the fixed load of the side spans with a very small increase in size and cost.

By placing the walkways on the upper lateral, and bracing and grouping the vehicle and car roadways on the lower levels, the designers have reduced considerably the width of deck space. The roadway is inside the carlines.

Rock suitable for foundations of the bridge was found at 86.7 ft. on the Philadelphia side and 91.6 ft. on the Camden side below mean high water at the side recommended by the engineers, while at other sites considered the rock level was near the practicable limit of pneumatic foundation work, exceeding on one side of the river or the other 110 ft., below which depth men could only work in half hour shifts. Although not of such huge proportions as the Hudson River bridge, this structure is a much needed one, and will relieve the present congested ferry service between these two points.

TONNAGE INCREASED DURING WAR PERIOD

Total is 11,000,000 Greater Than at First of July 1914

During the three years ending Dec. 31 1920, the tonnage of sea going merchant vessels comprised more than 25 per cent. of all similar tonnage launched in the twenty-nine years beginning with 1892, for which the compilations of Lloyd's Register of Shipping are available.

Prior to the European War, the largest amount of shipping launched in any year was 3,332,882 gross tons, in 1913. Ship construction decreased during the earlier phase of the war, falling to 1,201,630 tons in 1915. In the following years, however, urgent demand for tonnage stimulated construction, but it was not until 1918 that total launchings exceeded those of 1913. In that year, thanks very largely to the construction of more than 3,000,000 tons in the United States, the world's shipyards launched 5,447,444 tons, while in 1919 the total was 7,144,549, of which more than 4,000,000 were the product of American yards. In 1920 shipbuilding activity was reduced somewhat, but launchings were still in excess of any previous year except 1919.

In spite of the destruction by enemy action of over 13,000,000 gross tons of seagoing merchant vessels, between August 1, 1914 and November 11, 1918, and the loss through marine hazards of an additional 2,390,000 tons during the same period, the world's mercantile tonnage afloat is to-day greater than it would be had the average rate of increase for the ten years prior to 1914 continued in the years since that date. Estimates of tonnage now afloat indicate a total in excess of 60,000,000 gross tons, approximately 11,000,000 gross tons above the figure for June 30, 1914.

TRADE MARKS SHOULD BE REGISTERED

Procedure Which Should Be Adopted. Fees and Other Particulars.

Canadian firms who are now exporting, or intend to export to the West Indies, and who are proprietors of trade marks, are strongly recommended to have them registered in each of the colonies. According to Trade Commissioner E. H. S. Flood, the procedure is very simple, and the fees charged are not excessive. He says that applications for the registration of a large number of foreign trade marks have been advertised in the Official Gazettes of the various islands during the last few years, but not many Canadian have appeared. In some countries a trade mark once registered, though it may be fraudulent, can be held against the owner, but in the British West Indies the courts afford relief, and fraudlent trade marks may be cancelled. The method of procedure to obtain registration of trade marks in Barbados, is as follows:—

The registrar states that the laws governing trade marks and merchandise marks, and the procedure in obtaining registration for them, are the same in both cases. A form of application is required, which can be obtained from the registrar, and is to be accompanied by a representation of the trade mark either on a printed label, an impression from a steel engraving, or an engraved block. On receipt of these an acknowledgment, enclosing with it a memorandum of the registration fees and cost of advertising, is made by the registrar on payment of which a notice of the application is inserted in the Official Gazette and one other newspaper for one month. A certificate of registration is then issued which does not require renewal. The fees are: application, 1 s. registration, 5 s.; certificate, 5 s.—with an additional charge for preparing a block for the printer, and about $5 for the advertising. Should a certificate of registration be obtained that is fraudulent, it may be set aside by an action in the Court of Common Pleas. Applications from foreign firms for information concening trade marks may be addressed to the Colonial Secretary or the registrar. It is quite possible that the above fees may be increased by the legislature now in session.

Information on Trinidad; The Windward Islands; St. Vincent and St. Lucia can be obtained by writing Mr. Flood at Barbados.

An Exhibition under the auspices of the Hungarian iron and machinery industries is to be held in Budapest from Aug. 15th to Sept. 30th.

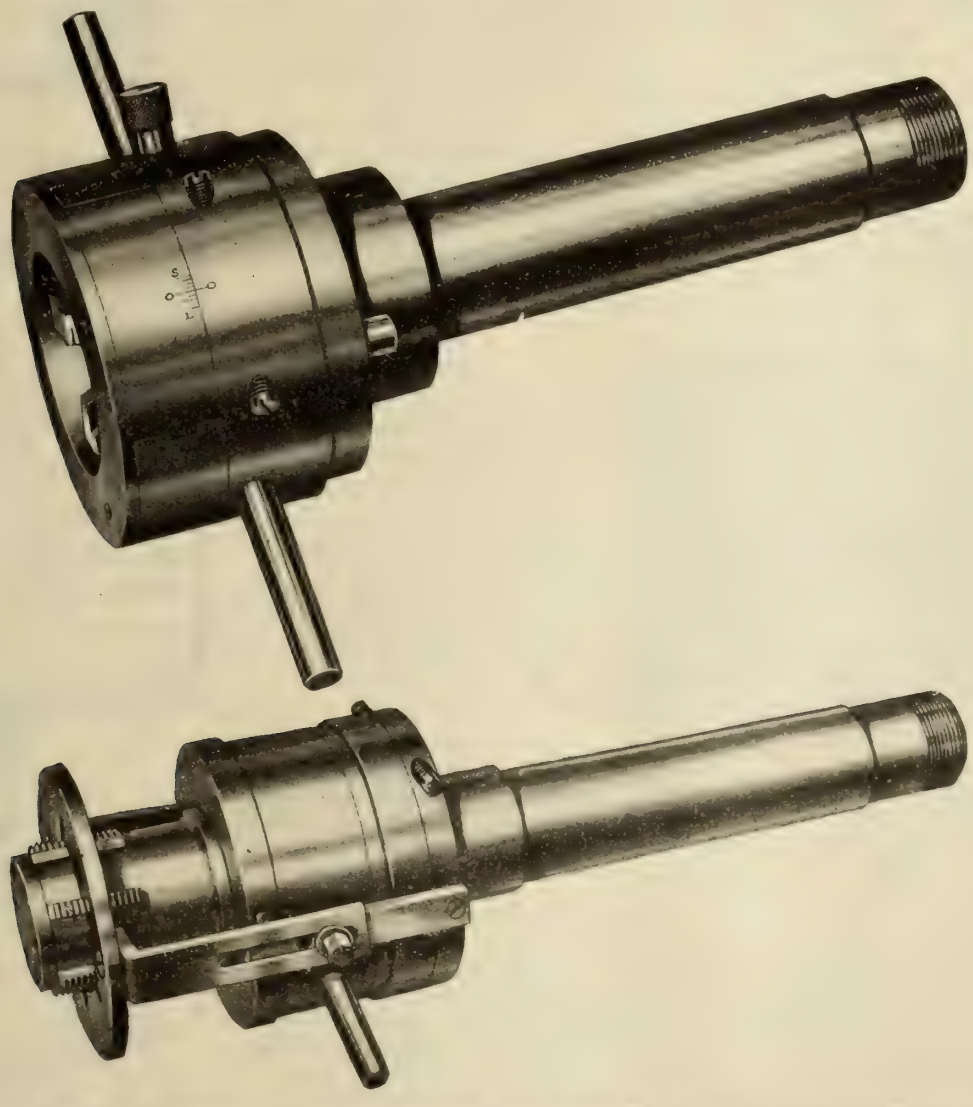
GEOMETRICS

For Cutting Screw Threads

GEO MET RIC

Right on the Lead

Self-Opening and Adjustable Die Heads and Collapsing Taps made in many styles for the many makes of Machines employed in producing Screw Threads.



Geometric Die Heads and Collapsing Taps are furnished with specially threaded shanks to fit them for use in the special threading fixture provided on the Gridley Single Spindle Automatics. Whatever make of machine, there is a Geometric to fit it.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents;
Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S.

Upon the Health of your employees depend your profit and production



Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)



Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments, and we'll tell you how much the cost will be.

Puro Sanitary Drinking Fountain Co.

Canadian Agents:

McKENZIE BROS.

888 F. St. Andre St., Montreal, P.Q. Canada

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

TRADE GOSSIP

The National Slag Products Ltd., are busy erecting a modern plant at Hamilton, Ont. The raw material needed for construction is being provided on contract by the Steel Co., of Canada. This new company will manufacture building tile, bricks, roofing, slabs, floor slabs, field gram tile, fence posts, door and window lintels, door and window backs, and allied lines and will utilize a special process in their manufacture. A market for these products has already been arranged and the plant will have an initial minimum capacity of 6,000 5" x 8" 12" tiles per day.

The company is capitalized at $300,000, of which one-third is 7 per cent. cumulative preferred stock, and the remainder common stock. Of the latter only one-half, or $100,000 is being issued at present. No public offering of stock will be made, as most of it has already been taken up by private subscription.

The board of directors, who are well-known engineers, contractors or financial men, include: William H. Yates, president; David Rick, vice-president; J. P. Anglin, Hon. G. D. Robertson, H. J. Daly, W. R. Fleming, Gordon Hutton, and E. J. Robertson, manager and secretary-treasurer.

* * *

Heavy decreases have taken place in the import of lumber of all kinds from Canada, reports London England, and the same holds good regarding paper, although wood pulp receipts were greater.

* * *

According to reports the Australian state governments are giving financial assistance to firms experimenting in the manufacture of paper from Australian woods. So far, the results have been very encouraging.

* * *

The fair which will be held in Lyons, France, from Oct. 1st. to 15th, should be of great importance in the promotion of international trade. Every effort is being made by the promoters to secure representatives from every country.

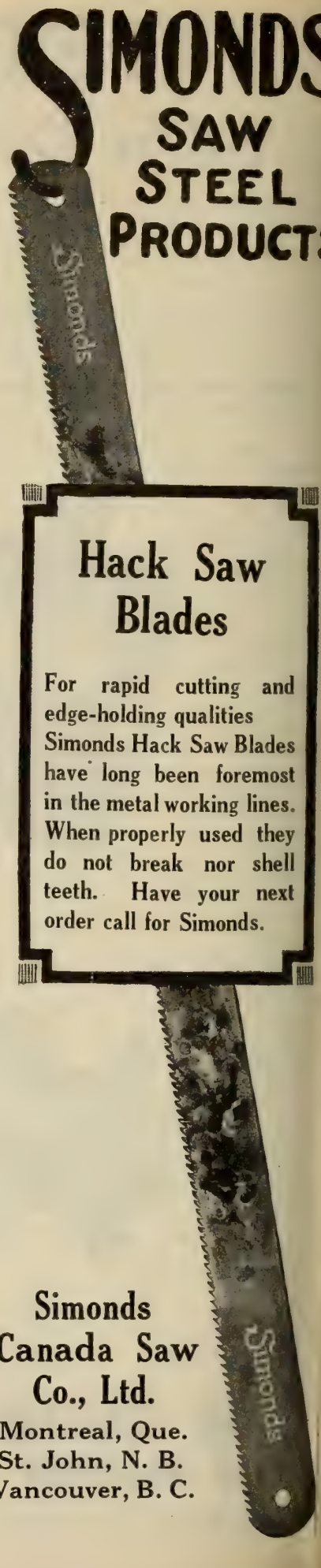
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According to reports, Belgian steel, profiting by the exchange situation, has succeeded in undercutting the production of Australian mills, thus defeating the tariff as a protective measure. It is stated that Australia has been canvassed at prices much below market rates.

* * *

The eight hour day has become law in Belgium, the King having given his official assent to the movement. It has been pointed out however that the law will not suppress foreign competition, nor the necessity for cheap production. One good feature however is the fact that the workmen have taken to the piece work idea and a good output has been secured in many lines of industry.

SIMONDS SAW STEEL PRODUCTS



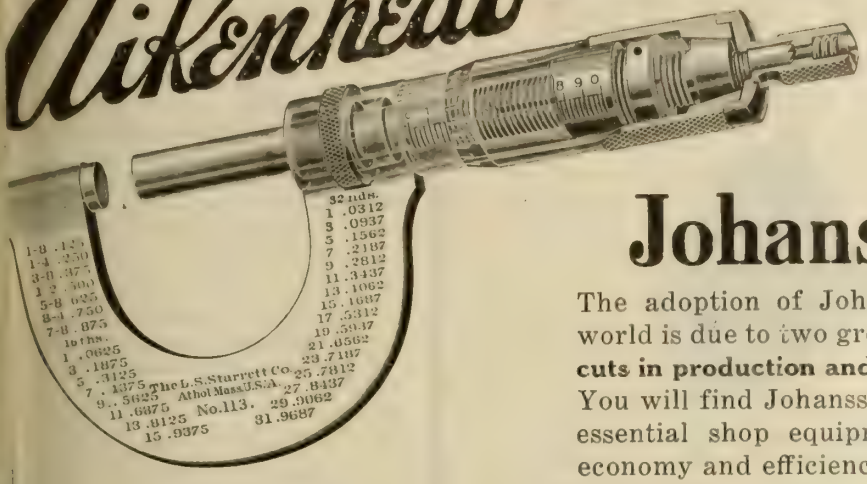
Hack Saw Blades

For rapid cutting and edge-holding qualities Simonds Hack Saw Blades have long been foremost in the metal working lines. When properly used they do not break nor shell teeth. Have your next order call for Simonds.

Simonds Canada Saw Co., Ltd.

Montreal, Que.
St. John, N. B.
Vancouver, B. C.

Aikenhead's



Johansson ACCURACY

Johansson Gauges

The adoption of Johansson Gauges all over the world is due to two great factors—**they make short cuts in production and cut manufacturing costs.** You will find Johansson Gauges are considered as essential shop equipment in those shops where economy and efficiency is carefully studied.

The Johansson book tells all about them. Write for yours to-day.

Johansson Adjustable Limit Snap Gauges eliminate the cost of making and maintaining solid snaps. They eliminate the tendency of the operator to work to "absolute dimension" and get results even in the hands of unskilled operators.

Single Spindle Hand Tachometers

Hand Tachometers supply the need for accurate, durable and handy speed recorders for all-round use. They indicate accurately the revolutions per minute, either right or left hand, of shafts and spindles; furthermore by using the measuring disc, periphery or surface speeds are determined. The result (either revolutions per minute or feet per minute) is instantly shown on the dial without watch-timing or calculating of any sort. The slightest variation in speed occurring during a fraction of a minute is also shown at a glance. Belt slipping and consequent loss of power is, therefore, quickly detected.



Aikenhead's

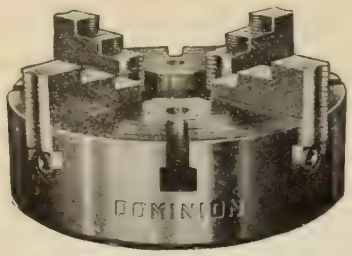
"Everything in Tools"

The reputation of a manufacturer's product is his greatest asset. The firm which represents him to the purchaser must have a reputation equal to his own.

Aikenhead's is the Canadian headquarters of many makers of the world's finest tools.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

DOMINION STEEL PRODUCTS CO.
LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

3

Engelhard Automatic Temperature Controller *for Heat Treating Enameling, Etc.*
Canadian Builders,
Ford-Smith Machine Co., Hamilton, Canada
Address all inquiries to
CHARLES ENGELHARD, INC.,
30 Church St:, New York,N. Y., U. S. A.

PATENTS
ATTORNEYS

Paper Mill Machinery
BERTRAMS LIMITED
SCIENNES EDINBURGH

PATENTS
Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

BLACK DIAMOND OVENS
"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd
Brantford, Canada
BLACK DIAMOND OVENS

NSMITH BELTING
158 YORK ST. TORONTO

HAMILTON ENGINEERING SERVICE
LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
195 KING WILLIAM ST. HAMILTON

TRADE GOSSIP

Owing to the depression in Japan the trade commissioner for Canada in that county has found it practically impossible to interest dealers in Canadian lines. Importers do not wish to enter new business until present supplies have been almost exhausted.

* * *

Shipbuilding in the United Kingdom is much depressed at present. There is a hope however that the bottom has been reached. As compared with figures for the March quarter, the latest report shows a reduction of 104,000 tons in the tonnage launched.

* * *

The Morse Chain Co., Ithaca are going to have an exhibit at the Exposition of Chemical Industries to be held in Chicago during the week of Sept. 12 1921.

* * *

A commission has been appointed to calculate building and working expenses for exploiting the orefields near Kiruna in Lapland. The ore has been examined and the percentage of iron is between 65.5 and 68.5, and of phosphorus .00 to .008. The quantity of ore is estimated at 35 to 40 million tons.

FIRMS WANT TO SELL OUR GOODS

Information regarding the following lines can be obtained by communicating with this paper and mentioning the numbers.

3250. **Products for France.**—A firm subject at present attached to the French Commission in New York and shortly returning to France, desires to represent Canadian manufacturers and producers for that country and Europe in general. Following are some of the goods he is prepared to handle: textos, minerals, manufactured products such as agricultural machinery and paper pulp.

3236. **Trade with India.**—The London office of an Indian house is anxious to be put in touch with Canadian exporters of lines suitable for the Indian market.

3237. **Hardware and Metals.**—The London office of an Indian house is anxious to be put in touch with Canadian exporters of all kinds of hardware, tools, iron and steel staples, building materials, enamelware and kitchen utensils.

A FLOATING EXHIBITION

An original method of advertising British manufactures is being developed by an influential company. A big liner of a special type will be constructed with accommodation for a large number of exhibits and with room also for many exhibitors and crowds of visitors. The ship will call at numerous ports throughout the world and will therefore, form a floating exhibition of British productions.

Classified Opportunities

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the full-est investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners if mutually satisfied. Box 767, Canadian Machinery. (etfm)

DOMINION OF CANADA PATENT—WOOD screw, No. 177803, free to any one who will manufacture same. Address ADAM J GEHRING, Glenville, P. O., Maryland, U.S.A.

SALESMAN WANTED

WANTED — BY WELL-KNOWN AMERICAN manufacturers of pneumatic tools enterprising salesman for Canadian field. Reply giving full experience, present connection, etc. All replies will be treated in confidence. Box 782N, Canadian Machinery.

J. RHODES & SONS, LTD., GROVE Ironworks, Wakefield, Eng., the largest manufacturers of Power Presses in England, are open to appoint a commission Agent in Canada for the sale of their Power Presses. A real live Agent who thoroughly understands the selling points of Power Presses is required, and one having a show-room would be an advantage.

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, Capers, milling machine and planer, etc. Hour or contract basis. Prompt delivery. W. H. Bowing Machinery Co., Toronto. (etfm)

MACHINE WORK WANTED

We are equipped to handle all kinds of general and special machine work. All operations in our shop are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT

Builders of Reliable Machinery.

SUNCLO BRAND

WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

USED MACHINERY FOR SALE

1—13″ x 5′ South Bend Engine Lathe.
1—18″ x 8′ Mueller Engine Lathe.
1—20″ x 10′ Whitcomb Blaisdell Engine Lathe.
1—24″ x 10′ Bertram Engine Lathe.
1—Power Hack Saw.
1—No. 3 Greenard Arbor Press.
1—Air Hammer.

CHAS. P. ARCHIBALD & Co.
285 Beaver Hall Hill Montreal

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

CANADIAN MACHINE SHOP

Will handle medium Specialty Line — Manufacturing and Selling

Apply Quickly

Box No. 715F
CANADIAN MACHINERY

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (otfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

FOR SALE

SUCTION HOSE — SUCTION HOSE 2¼-inch rubber suction hose, in 15-foot and 20-foot lengths; shipped subject to inspection.

ENDLESS THRESHER BELTS RUBBER stitched, new, in lengths of 100 feet, 120 feet and 150 feet.

LARGE STOCK OF ENDLESS STITCHED canvas belts, seasoned, stock in any lengths you may require.

TANK PUMPS, INJECTOR HOSE, THRESHer supplies of all kinds.

N. SMITH, 138-140-142 YORK ST., TORONTO.

1—BEATTY D.D. HOIST 7-IN. x 12-IN.

1—BEATTY D.D. HOIST 8-IN. x 12-IN.

3—1-YARD CLAM SHELL BUCKETS.

1—NO. 5 AUSTIN GYRATORY CRUSHER.

WILSON-McGOVERN, LIMITED, LUMSDEN Building

ELECTRIC STORAGE BATTERY LOCOMOtives for sale. Two. 36-inch gauge. Complete and in good condition. R. T. Gilman & Company, Dept. "E," 211 McGill Street, Montreal. (etfm)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.

THE KATIE FOUNDRY, GALT, ONT.

PARTIAL LIST

Machine Shop Equipment

At Extremely Low Prices

LATHES—All sizes and lengths of bed. Special price quoted on rebuilt 20 in. x 8 ft. C.M.C.

AIR COMPRESSOR—8 in. x 8 in. Chicago Pneumatic.

TANKS—10 Tanks 10 ft. 6 in. diam. x 29 ft. 6 in. long. 19,000 gals.
3 Tanks, 10 ft. 0 in. diam. x 39 ft. 0 in. long, ⅝ in. Heads. 22,893 gals.
Full line of other Steel Storage Tanks, open and closed, all sizes.

PUMPS—1 Triplex Power Pump, 1½ in. x 6 in. Hydraulic Machy. Co. Also 1 in. x 5 in. West Tire Setter.
1—Centrifugal Pump, 2½ in. x 1½ in. Gould.
1—Gould Triplex Power Pump, 2 in. x 3 in.

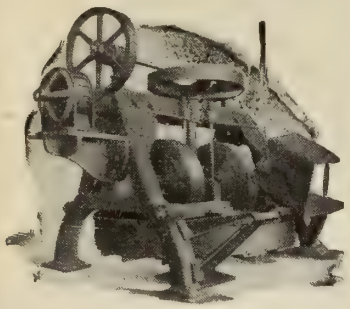
Milling Cutters and Reamers, full assortment, all sizes and shapes, at less than half price. Send us your enquiries.

Standard Equipment & Tool Works

Dept. K. 307 St. James St.
Main 2286 MONTREAL
(20)

HINTS TO BUYERS

Canadian Steel Foundries Need Frost Improved Sand Mills



WINNING FEATURES

Heavy Mullers
Unloading Device
Motor or Belt Drive

The Frost Mfg. Co.
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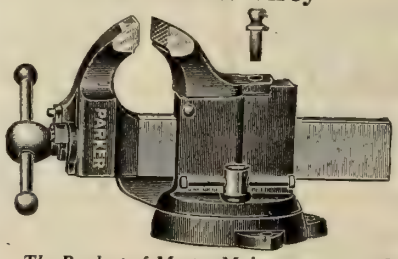
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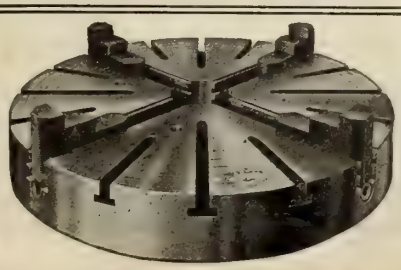


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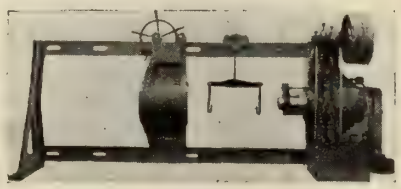
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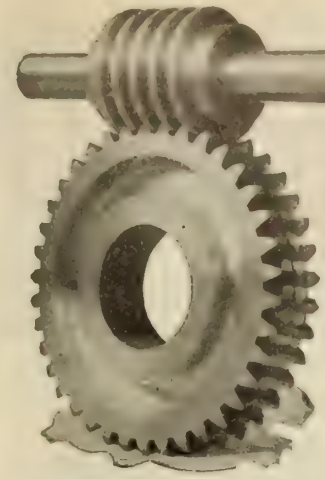
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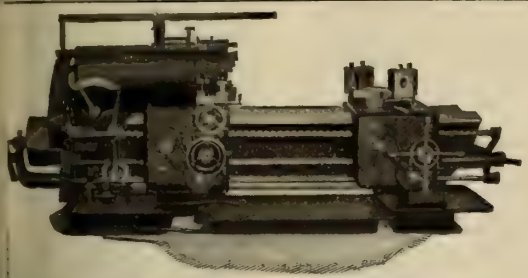
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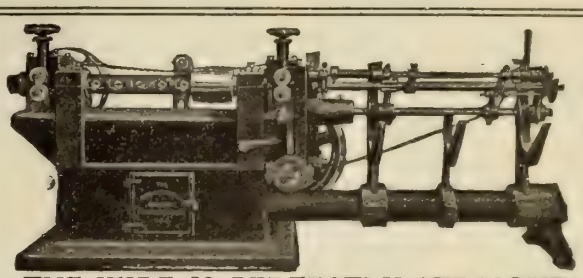
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Walker & Sons Metal Products, Ltd., Walkerville, Ont.
Waterous Engineering Works, Limited, Brantford, Que.

Castings, Hyd. Press
Canada Steel Foundries, Montreal, Que.

Castings, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Spence & Sons, Ltd., Wm., Owen Sound, Ont.
Smith Falls Malleable Castings Co., Smith Falls, Ont.

Castings Monel Metal
Canada Driver-Harris Co., Ltd., Walkerville, Ont.

Castings Naval Bronze
Kilgour Brass & Metal, Ltd., Hamilton, Ont.

Castings Nichrome
Canada Driver-Harris Co., Walkerville, Ont.

Castings Nickel
Canada Hanson & Van Winkle Co., Toronto, Ont.

Castings Semi-Steel
Pacific Mfg. Co., Thos., Montreal, Que.
Quebec I. & Steel Foundries, Hull, Que.
Southworth Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Waterous Engineering Works, Limited, Brantford, Que.

Castings Steel
Algoma Steel Foundries & Steel, Ltd., Hamilton, Ont.
Canada Steel Foundries, Montreal, Que.
Spence & Sons, Wm., Owen Sound, Ont.
Vanadium Crucible Steel Co. of Can., Ltd., Hamilton, Ont.

Centrifugal Pumps
Allis-Chalmers Mfg. Co., Jersey City, N.J.

Centring Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Greenlee-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold Chains) of Canada, Ltd., Montreal, Que.
Weed Chain Co., Lisbon, Ohio.

Chains, Driving
Canada Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold Chains) of Canada, Ltd., Montreal, Que.
Weed Chain Co., Lisbon, Ohio.

Chucks, Bertram
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St Louis, Mo

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Greenlee-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can Link-Belt Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Fine
Holden Co., Ltd., Montreal, Que

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Cutters, High Speed
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Banfield & Sons, Ltd., W. H., Toronto.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll,

Files and Rasps
Atkins & Co., Inc., E. C., Indianap
Foss Machinery & Supply Co., Ge
Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll,
Morrow Screw & Nut Co., Ltd.,
Ingersoll, Ont.
Nicholson File Co., Port Hope, O
Simonds Canada Saw Co., Montrea

Filing Machines
Garlock-Walker Mchy. Co., Toront
Oliver Machinery Co., Grand Rapids
Williams Machinery & Supply Co.,
Montreal, Que.

Filler, Iron (See Cements, Iron
Smooth Mfg. Co., Jersey City, N.

Fire Extinguishers
Can. Consolidated Rubber Co., L
Montreal, Que.

Fittings, Pipe
International Malleable Iron Co.,
Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto

Flux, Galvanizing
British Smelting & Refining Co.
Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, O

Forging Machinery
Acme Machinery Co., Cleveland,
Bertram & Son Co., Ltd., The
Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilt
Canada Machinery Corp., Galt, O
Can. Fairbanks-Morse Co., Ltd., M
Garlock-Walker Mchy. Co., Toront
National Machinery Co., Tiffin, O
Stewart & Co., Duncan, Glasgow
Steel Co. of Canada, Ltd., Hamilto

Forgings, Drop
Canada Foundries & Forgings Co
land, Ont.
Dominion Forge & Stamping Co
Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada
Montreal, Canada.
Canada Foundries & Forgings Co
land, Ont.
Can. Atlas Crucible Steel Co
Toronto, Ont.
Dominion Bridge Co., Ltd., Lachi
Dom. Foundries & Steel, Hamilt
Hepburn Ltd., John T., Toronto,
N. S. Steel Co., Ltd., New Glasg

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sh
Que.
Can. Ingersoll-Rand Co., Ltd., Sh
Que.
Ford-Smith Machine Co., Hamilt
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, O
Petrie, Ltd., H. W., Toronto, On
Rice Lewis & Son, Ltd., Toronto,

Foundry Supplies
Atkins & Co., Inc., E. C., Indian
Rice Lewis & Son, Ltd., Toronto,
Sturtevant Co., B. F., Boston,

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal,

Fuel Oil Burning System
General Combustion Co. of Can
Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co
delphia, Pa.
General Combustion Co. of Can
Montreal, Que.
Rockwell Co., W. S., New Yo

Furnaces, Heat Treating Coa
General Combustion Co. of Can
Montreal, Que.
Mechanical Engineering Co., Thre
Que.
Rockwell Co., W. S., New York

Furnaces, Heat Treating Oil
Armstrong-Whitworth of Canad
Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., St
Que.
Can. Fairbanks-Morse Co., Ltd.,
General Combustion Co. of Ca
Montreal, Que.
Mechanical Engineering Co., Thr
Que.
Rockwell Co., W. S., New York
Walker & Sons Metal Produc
Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction C
delphia, Pa.
Petrie, Ltd., H. W., Toronto, O
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Produc
Hiram, Walkerville, Ont.

Furnaces, Tempering and A
Brown & Sharpe Mfg. Co., Provid
Electric Furnace Construction C
delphia, Pa.
Mechanical Engineering Co., Thr
Que.
Rockwell Co., W. S., New York
Walker & Sons Metal Produc
Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Tor

Gages, Comparator
Jones & Lamson Machine Co.,

BUYERS' DIRECTORY

...l, Vt.
...Ltd., Alfred, Toronto, Ont.
...Inc., C. E., Ploughkeepsie, N. Y.
...e, W. B., San Francisco, Calif.
...tt Co., L. S., Athol, Mass.

Gage Measuring (See Tool Work)
...d & Sons, Ltd, W. H., Toronto, Ont.
...herman & Co., Ltd., J., Sheffield, Eng.
...ent Machine Co., Ltd., Montreal, Q.
...field Tap & Die Corp., Galt, Ont.
...bson Inc., C. E., Windsor, Ont
...tt Co., L. S., Athol, Mass.

Gage Recording
...l Co., Waterbury, Conn.
...bson Inc., C. E., Windsor, Ont.
...y Instrument Co., Toronto, Ont.
...rthie, Ltd., John, Birmingham, Eng.
...e & Sharpe Mfg. Co., Providence, R I.
...r Fairbanks-Morse Co., Ltd., Montreal.
...field Tap & Die Corp., Galt, Ont.
...bson Inc., C. E., Windsor, Ont.
...n & Whitney Co., of Canada, Ltd., ...to, Ont.

Gage Special Measuring (See Tool ...k)
...field Tap & Die Corp., Galt, Ont.
...n & Whitney Co., of Canada, Ltd., ...to, Ont.

Gages Standard
...ong Whitworth Co. of Can., Ltd., ...real, Que.
...l & Co., Inc. E. C., Indianapolis
... Inc. C. E., Ploughkeepsie, N. Y.

Gages Thread
...ble, Ltd., John, Birmingham, Eng.
...n & Sons, Ltd, W. H., Toronto, Ont.
...field Tap & Die Corp., Galt, Ont
... Inc., C. E., Ploughkeepsie, N. Y.
... Co., L. S., Athol, Mass.

Gas Oil Compressed
...Liquide Society, Toronto, Ont.

Gas Compressed
...et Lite Co. of Can., Toronto, Ont.

Gaskets
...al State Fibre Co. of Can., Ltd., ...o, Ont.
...ic Tire & Rubber Goods Co., Ltd., ...o, Ont.
...ber Tire & Rubber Co. of Can., ...d Toronto, Ont.
...ic Co., Ltd., Montreal, Que.
...n Mfg. Co., Jersey City, N.J.

Gauges Vacuum and Pressure
...Instrument Co., Toronto, Ont.

Gears
...n Foundries & Forgings Co., Wel-...d, Ont.
...el Foundries, Montreal, Que.
...ams State Fibre Co. of Can., Ltd., ...o, Ont.
...undries & Steel, Hamilton, Ont.
...l Gear & Machine Co., Toronto, ...
...hia Gear Works, Philadelphia, ...
... Engineering Works, Limited, ...l, Que.

Gear Centers
... Co., R. A., Battle Creek, ...

Gear-Cutting Machines
...n & Son Co., Ltd, The John, ..., Ont.
...hine Co., Bridgeport, Conn.
...n Sharpe Mfg. Co., Providence, R.I.
...banks-Morse Co., Ltd., Montreal.
...ear Shaper Co., Springfield, Vt.
... H. W., Toronto, Ont.
...achine Co., D. E., New London, ...n

Gear Cutting Machines
...n Sharpe Mfg. Co., Providence, R.I.
... Machine Co., Hamilton, Ont.

Gear Cut
...-Belt Co., Toronto, Ont.
... Foundries, Montreal, Que.
... Foundries & Steel, Hamilton, Ont.
...or Co., Ltd., Orillia, Ont.
...r & Steel Foundries, Hull, Que.
... Engineering Works, Limited, ... Que.

Gear Cutting
...Sharpe Mfg. Co., Providence, R.I.
...SKF Co., Toronto, Ont.
...achine Co., Ltd., Montreal, Q.
...n State Fibre Co. of Can., Ltd., ...n Ont.
...idge Co., Ltd., Lachine, Que.
... Products Co., Brantford, Ont.
... Machine Co., Hamilton, Ont.
... Son, Robt., Montreal, Que.
...Gear & Machine Co., Toronto, ...
...d., John T., Toronto, Ont.
... Co., A. B., Hespeler, Ont.
... & Iasco, Montreal, Que.
... & Supply Co., Montreal, Que.
... Co., Ltd., R., Galt, Ont.
...ia Gear Works, Philadelphia, ...ans) of Canada, Ltd., Mont-...
... Engineering Works, Limited, ... Que.

Gears Dished
...dy Sons, Wm., Owen Sound, Ont.

Gears Forged
...da ...ndries & Forgings Co., Wel-...d, Ont.
...an T... & Supply Co., Montreal, Que.

Gears Herringbone
... Products Co., Brantford, Ont.
...milton Gear & Machine Co., Toronto, Ont
...iladelphia Gear Works, Philadelphia, Pa.

Gears, Molding Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven, Mich

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton,

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation

BUYERS' DIRECTORY

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn
Burgess & Marchand, Montreal, Que.
Crescent Machine Co. Ltd. Montreal
Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blaskill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Reliuving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal
Tallman Brass & Metal Co., Hamilton, Ont

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton.
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Allenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthlie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Rods
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd.,
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, O.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Ford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castle
Galt Machine Screw Co., Galt.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Ont.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Ont.

Oils
Canadian Oil Companies, Ltd., Toronto, Ont
Cateract Refining Co., Toronto,

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Cateract Refining Co., Toronto.
Imperial Oil Ltd., Toronto, Ont.
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co., Toronto.
Dominion Oxygen Co., Toronto.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd.
Graton & Knight Mfg. Co., Mass.

BUYERS' DIRECTORY

Gilford & Sons, Ltd., Halifax, N.S.

Pap Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Pate
Perkinshaugh & Co., Ottawa, Ont.
Mann & Marion, Montreal, Que.

Pan Wet and Dry
Fir Mfg. Co., Chicago, Ill.

Patt-Shop Machinery (See Woodworking Machinery)
Gra Machinery Corp., Galt, Ont.
Gill Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Dominion Machine Co., Ltd., Montreal, Q
Ottawa Foundry Co., Ltd., Ottawa, Ont.
Wm. Patterson Works, Galt, Ont.

Peanuts, Steel
Standard Steel Co., Sherbrooke, Que.

Photographh Motors
Canada & Sons, Ltd., W H., Toronto

Pewter Tin
Smelting & Refining Co., Ltd., Montreal, Que
Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Hapwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canada Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Hall & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Machine & Tool Co., Detroit, Mich
Ward Co., Ltd., R., Galt, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford Ont.

Pipe Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Tools' Tools
Canada Hardware Ltd., Toronto, Ont.
Canada Ltd., Montreal, Que.
Roberts & Son, Ltd., Toronto, Ont.

Pipe Treading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Planing Machines
National Acme Co., Cleveland, Ohio.
Rockford Turret Machine Co., Madison, Wis.

Planer Parallels
Ideal Mfg. Co., Niagara Falls, Ont.

Planer Machines
Roberts & Son Co., Ltd., The John, Ont.
Canada Machinery Corp., Galt, Ont.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Canadian Machinery & Supply Co., Geo. F., Montreal, Que.
Cincinnati Walker Mchy. Co., Toronto, Ont.
Petrie Ltd., John T., Toronto, Ont.
Gardner Ltd., Alfred, Toronto, Ont.
Ideal Mfg. Co., Niagara Falls, Ont.
Monarch Mfg Co., Muskegon, Mich.
Powermachinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Roberts & Son Co., Ltd., The John, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Roberts & Son Co., Ltd., The John, Ont.

Plumbers' Brass Goods
Sanitary Drinking Fountain Co., Taunton, Mass.

Pneumatic Tools
Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto,
Cincinnati Walker Mchy. Co., Toronto, Ont.
Chicago Pneumatic Tool, Chicago, Ill.
Pneumatic Tool Co., Grand Rapids Mich.

Polishing and Buffing Machines
Bertrams Ltd., John, Birmingham, Eng.
Canada & Co., Chas. P., Montreal, Q.
Emerson, J. G., Everett, Mass.
Brown Sharpe Mfg. Co., Providence, R.I.
Wilson & Van Winkle Co., Ltd., Toronto Ont
Canada Machine Co., Hamilton, Ont.
Cincinnati Walker Mchy. Co., Toronto, Ont.
Bertrams Ltd., John, Birmingham, Eng.

Presses, Automatic
Ideal Steel Co. of Canada, Ltd., Windsor, Ont.

Presses, Bed and Frame Parts
Bertrams Ltd., John, Birmingham, Eng.
Chambersburg Pulley Co., Philadelphia, Pa.
Fisher Governor Co., Ltd., Orillia, Ont.

Presses, Cam Lever
Atlas Press Co., Kalamazoo, Mich.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, H. W., Toronto, Ont.
Sterling Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Ferry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Alkenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., E., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Alkenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Tuttle Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co., Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg Co., Providence, R.I
Canadian Fairbanks-Morse Ltd., Montreal. Q

Screens
Can. Wire & Iron Goods Co., Hamilton.

BUYERS' DIRECTORY

Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, n.
Can. Ingersoll-Rand Co., Ltd., Sherb[illegible], Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Sp[illegible]field, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, (
Pratt & Whitney Co., of Canada, [illegible]
Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont
Morrow Screw & Nut Co., Ltd., [illegible]
Ingersoll, Ont.
Pratt & Whitney Co., of Canada, [illegible]
Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield [illegible]
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachm[illegible]
Ackworthie, Ltd., John, Birmingham [illegible]
Archibald & Co., Chas. P., Montre[illegible]
Burke Machine Tool Co., Conneaut, [illegible]
Geometric Tool Co., New Haven, C[illegible]
Greenfield Tap & Die Corp., Galt, [illegible]
Jardine & Co., A. B., Hespeler, On
National Acme Co., Cleveland, Ohi[illegible]
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham [illegible]
Butterfield & Co., Inc., Rock Islan[illegible]
Can. Fairbanks-Morse Co., Ltd., Mo[illegible]
Geometric Tool Co., New Haven, C[illegible]
Greenfield Tap & Die Corp., Galt, [illegible]
Jardine & Co., A. B., Hespeler, On
Morse Twist Drill & Machine Co. [illegible]
Bedford, Mass.
National Acme Co., Cleveland, Ohi[illegible]
Pratt & Whitney Co., of Canada, [illegible]
Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, C[illegible]
Jardine & Co., A. B., Hespeler, On
Murchey Machine & Tool Co., D[illegible]
Mich.
National Acme Co., Cleveland, Ohi[illegible]
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound [illegible]

Testing Metals and Materials
Toronto Testing Laboratory, Toronto [illegible]

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, O

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Islan[illegible]
Greenfield Tap & Die Corp., Galt, [illegible]
Jones & Lamson Machine Co., Spri[illegible]
Vermont.
Murchey Machine & Tool Co., D[illegible]
Mich.
National Acme Co., Cleveland, Ohi[illegible]
Pratt & Whitney Co., of Canada, [illegible]
Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Spri[illegible]
Vermont.
Landis Machine Co., Inc., Waynesbo Pa

Threaded Wires
Torrington Company, Ltd., Upper [illegible]
ford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ol
Geometric Tool Co., New Haven, C
Greenfield Tap & Die Corp., Galt,
Jones & Lamson Machine Co., S[illegible]
field, Vt.
Murchey Machine & Tool Co., D[illegible]
Mich.
National Acme Co., Cleveland, Oh
National Machinery Co., Tiffin, Oh
Williams Tool Corp. of Can., Ltd., [illegible]
ford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., S[illegible]
field, Vt.
Pratt & Whitney Co., of Canada [illegible]
Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton,

Tongs
Hepburn Ltd., John T., Toronto, (

Tool Cases
Rice Lewis & Son, Ltd., Toronto, (

Tool Holders
Armstrong Bros. Tool Co., Chicag[illegible]
Bilton Machine Co., Bridgeport, Co
Gisholt Machine Co., Madison, Wis
Williams & Co., J. H., Brooklyn,

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sher[illegible]
Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The [illegible]
Dundas, Ont.
Canada Machinery Corp., Galt, On
Williams & Co., J. H., Brooklyn,

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co.
Toronto, Ont.

BUYERS' DIRECTORY

Tee Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Brams Ltd., Edinburgh, Scotland.
Bross & Marchand, Montreal, Que.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cherman & Co., Ltd., J., Sheffield, Eng.
Fe Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Ke Pneumatic Tool Co., Grand Haven, Mich.
Kilgour & Hillier Mfg. Co., St. Catharines, Ont.
National Machine Tool Co., Racine, Wis.
Rice Tool & Machine Co., Lachine, Que.
Richards & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Shurtleff Co., L. S., Athol, Mass.
Stanger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wells Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Bee Work
Bain Engineering Corp., Ltd., Toronto.
Brent Machine Co., Ltd., Montreal, Que.
Fred Smith Machine Co., Hamilton, Ont.

Blowers, Blow
National Electro Products, Ltd., Toronto, Ont.
Price, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
R. Lewis & Son, Ltd., Toronto, Ont.

Brakework, Railway
Can. Steel Foundries, Montreal, Que.

Brakework, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Bushings
Stern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Cook-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Keedy & Sons, Wm., Owen Sound, Ont
Pratt, Ltd., H. W., Toronto, Ont.
Prince Clutch & Pulley Works, Toronto, Ont.
Reid (Hans) of Canada, Ltd., Montreal, Que.

Transportation Systems (See Trucks)
Matthews Gravity Carrier Co., Port Hope, Ont.

Twist Bits
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Trays and Tramways
Can. Link-Belt Co., Toronto, Ont.
Mead Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Western Crane Works, Walkerville, Ont.
Wood Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hearn Ltd., John T., Toronto, Ont.
Mann Leaf Mfg. Co., Montreal, Que.
Mead Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

Trucks, Industrial Motor
Mann Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

Tube Products
Tube Co. of Canada, Toronto, Ont.

Tubes, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubes, Flexible
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Toronto, Ont.

Tubes, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubes, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Do Steel Products Co., Brantford, Ont.
Tube & Supply Co., Montreal, Que.
Metal Products Co., Ltd., Toronto, Ont.

Tubes, Seamless Brass & Metal Co., Hamilton, Ont.

Tubes, Welded
International Nickel Co. of Can., Ltd., Toronto, Ont.
Metal Products Co., Ltd., Toronto, Ont.

Tubing, Welded Steel
Tube Co. of Canada, Toronto, Ont.

Turbines, Water
Engineering Works, Ltd., Montreal, Que.
Keedy & Sons, Wm., Owen Sound, Ont.

Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Carter Welding Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.

Welding Filler Rods
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond State Fibre Co., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Price, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Pipe
Canada Foundries & Forgings Co., Welland, Ont.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Wrenches, Tap
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
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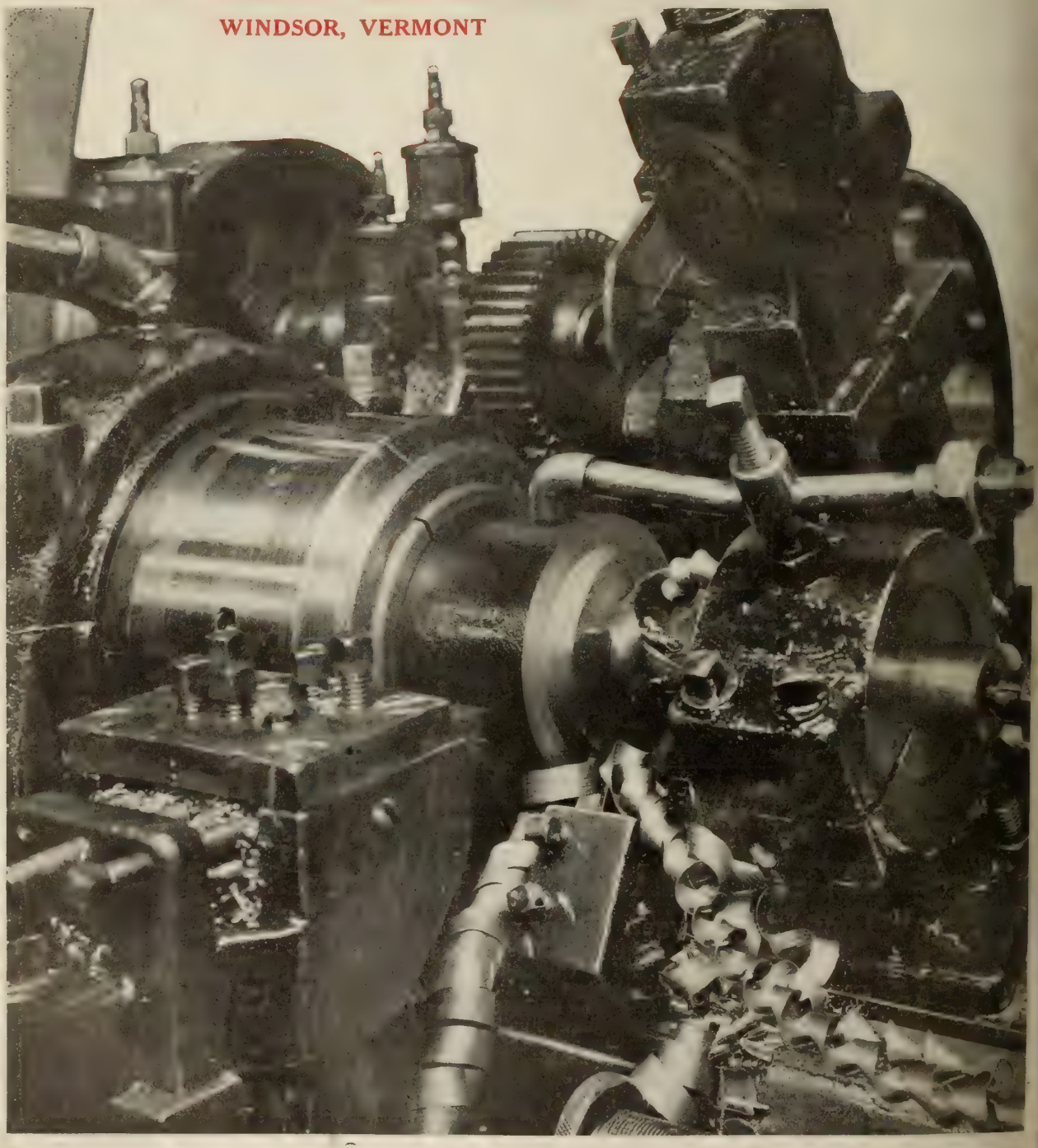


All day long—six days a week

You know it takes a sturdy well-balanced machine to turn a job like this on a heavy feed and get a smooth even chip.

You can get results like this all day long, six days a week, on a Gridley Single Spindle Fully-Automatic Turret Lathe. Find out how many.

THE NATIONAL ACME COMPANY
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CANADIAN MACHINERY AND MANUFACTURING NEWS

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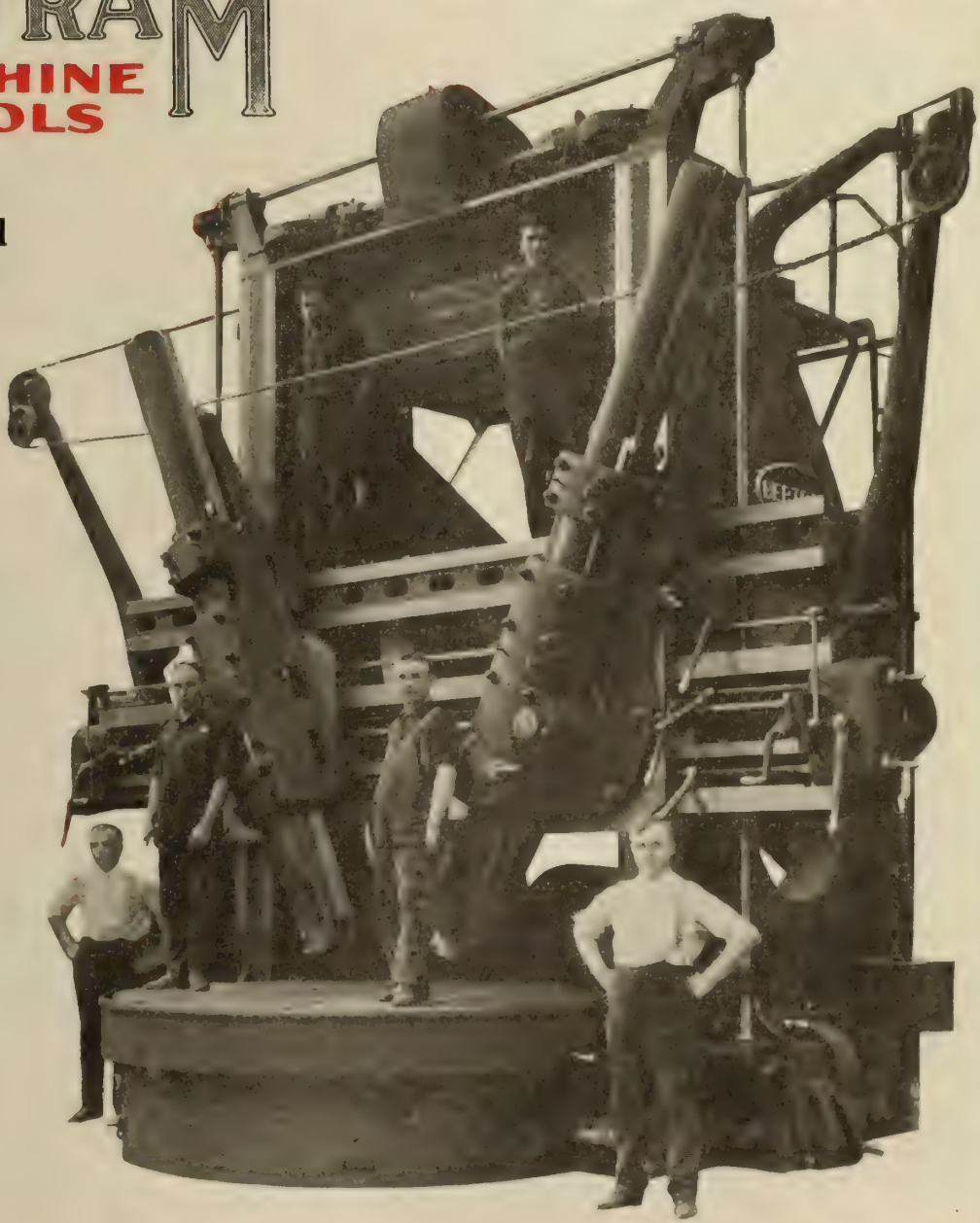
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The BERTRAM Page

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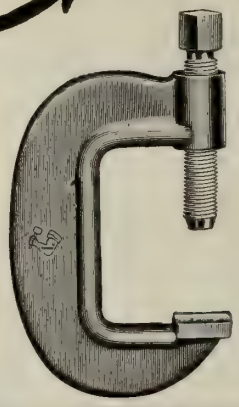
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Made in Canada by

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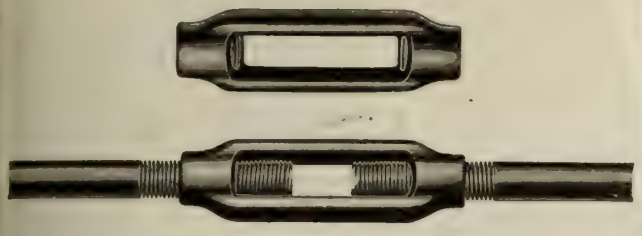
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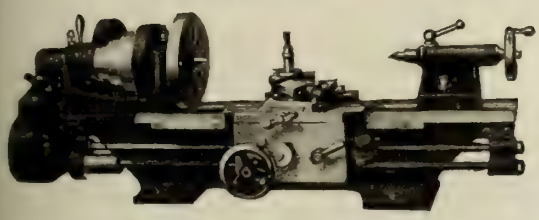
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Between Centers - -	18½ inches
Collet Capacity - - -	¾ inch

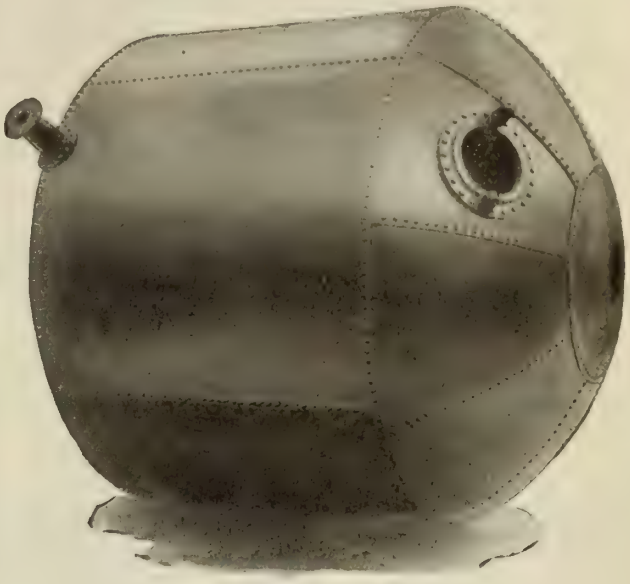
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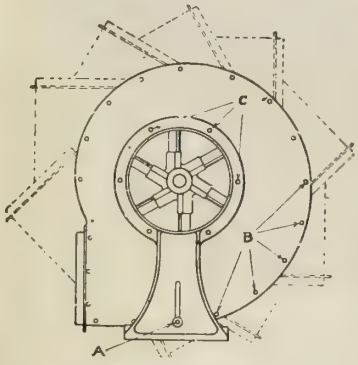
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

Insurance companies reduce the premiums where adequate precautions have been taken to prevent fires.

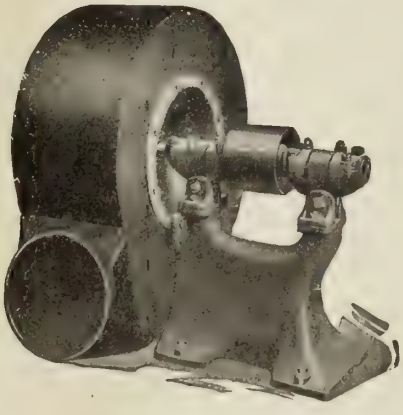
Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





The Canadian Standard Planing Mill Exhausters have reversible housings so that the outlet can be adjusted instantly to any angle desired.

This eliminates necessity of crossed belts. Simplifies changes on alterations in piping or building.



The housing is of heavy rolled steel plate securely bolted together with angle irons. round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

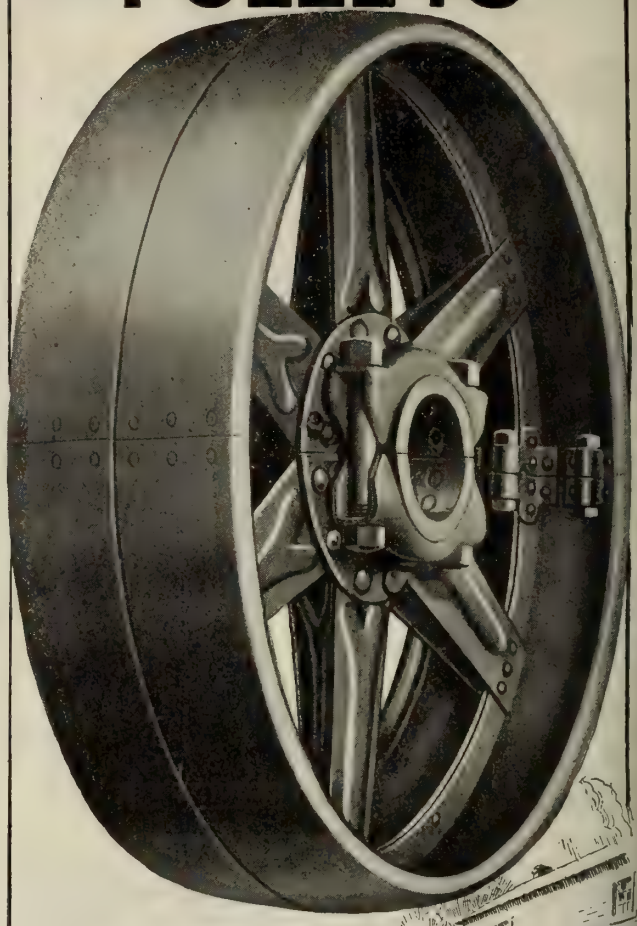
Every fan carefully tested by running test at speeds in excess of that required.

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Canadian Blower & Forge Co.

Kitchener - Ontario

AMERICAN STEEL SPLIT PULLEYS



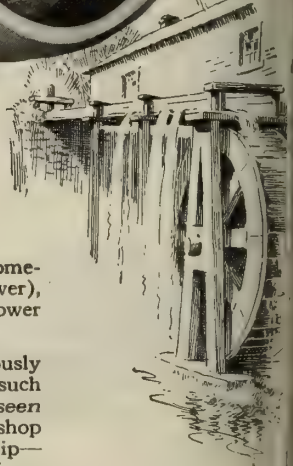


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Today, with tremendously expensive power costs, just such wastes are occurring *unseen* in the average machine shop through excessive belt slip—excessive friction in bearings, dead weight of pulleys that consume power.

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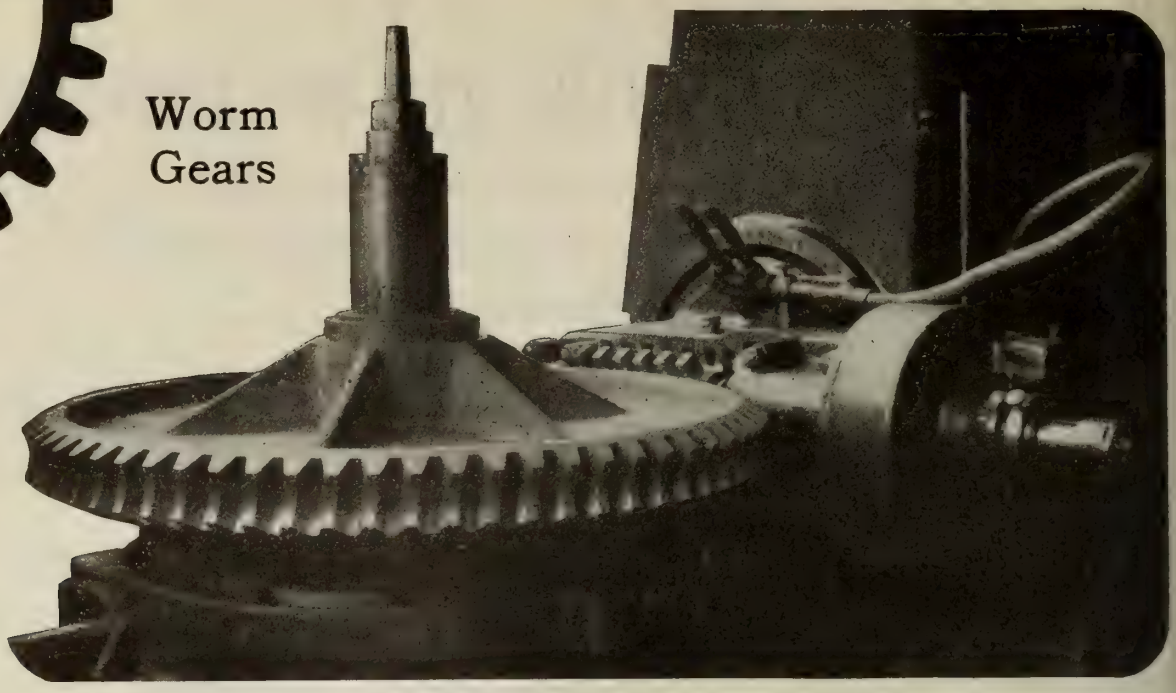
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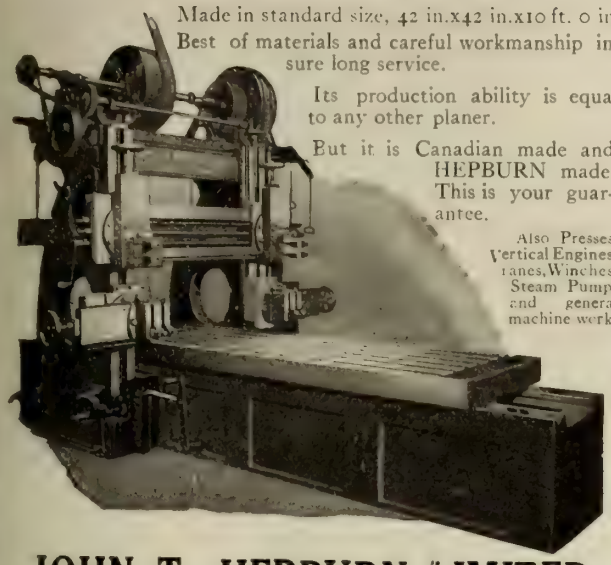
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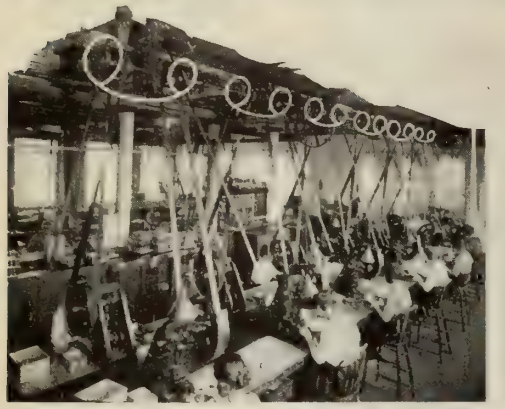
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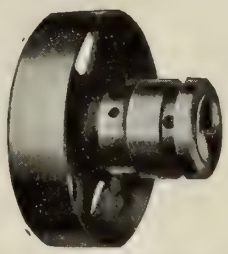
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

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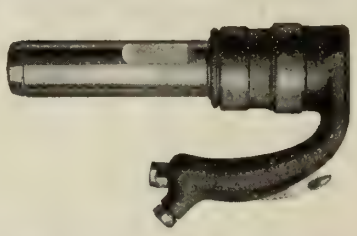
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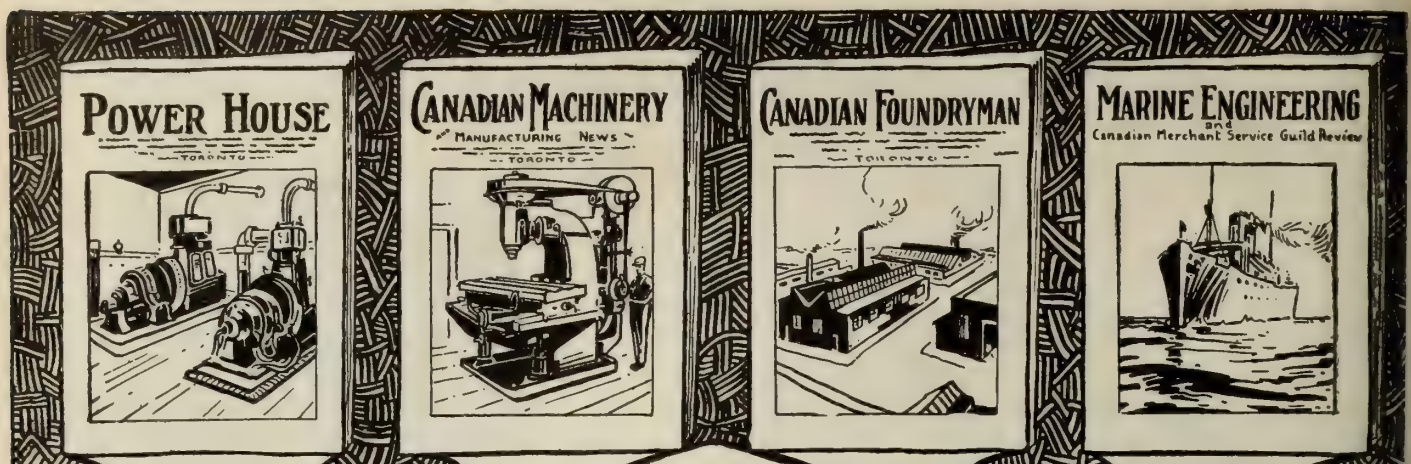
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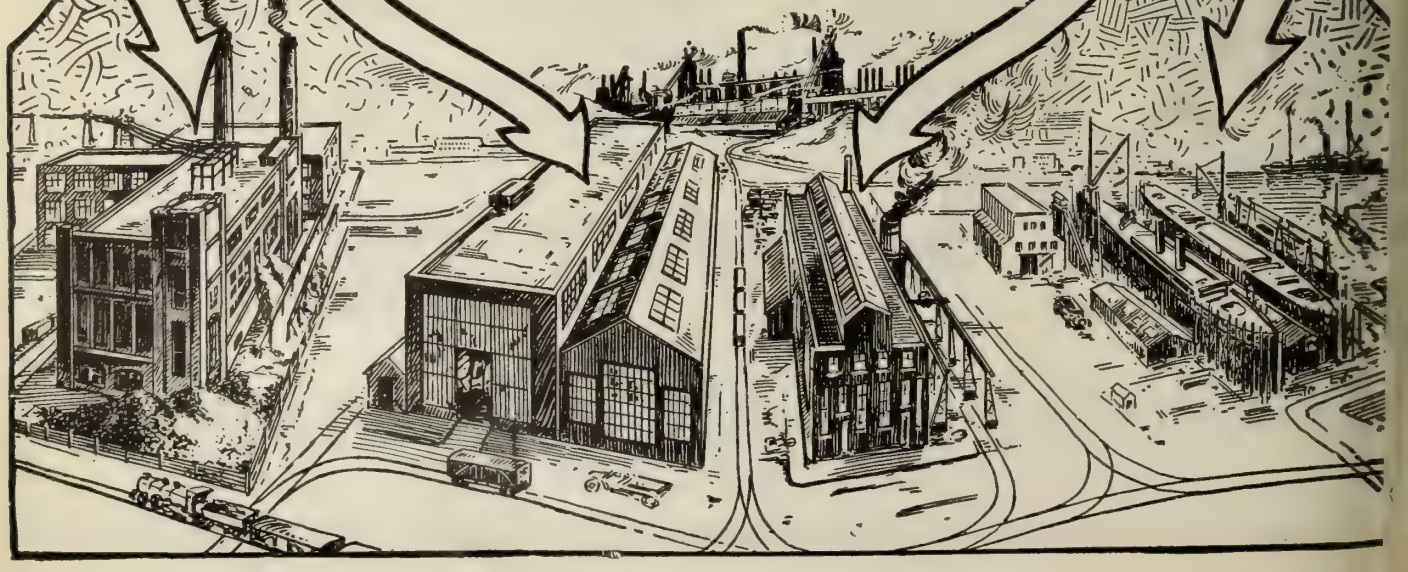
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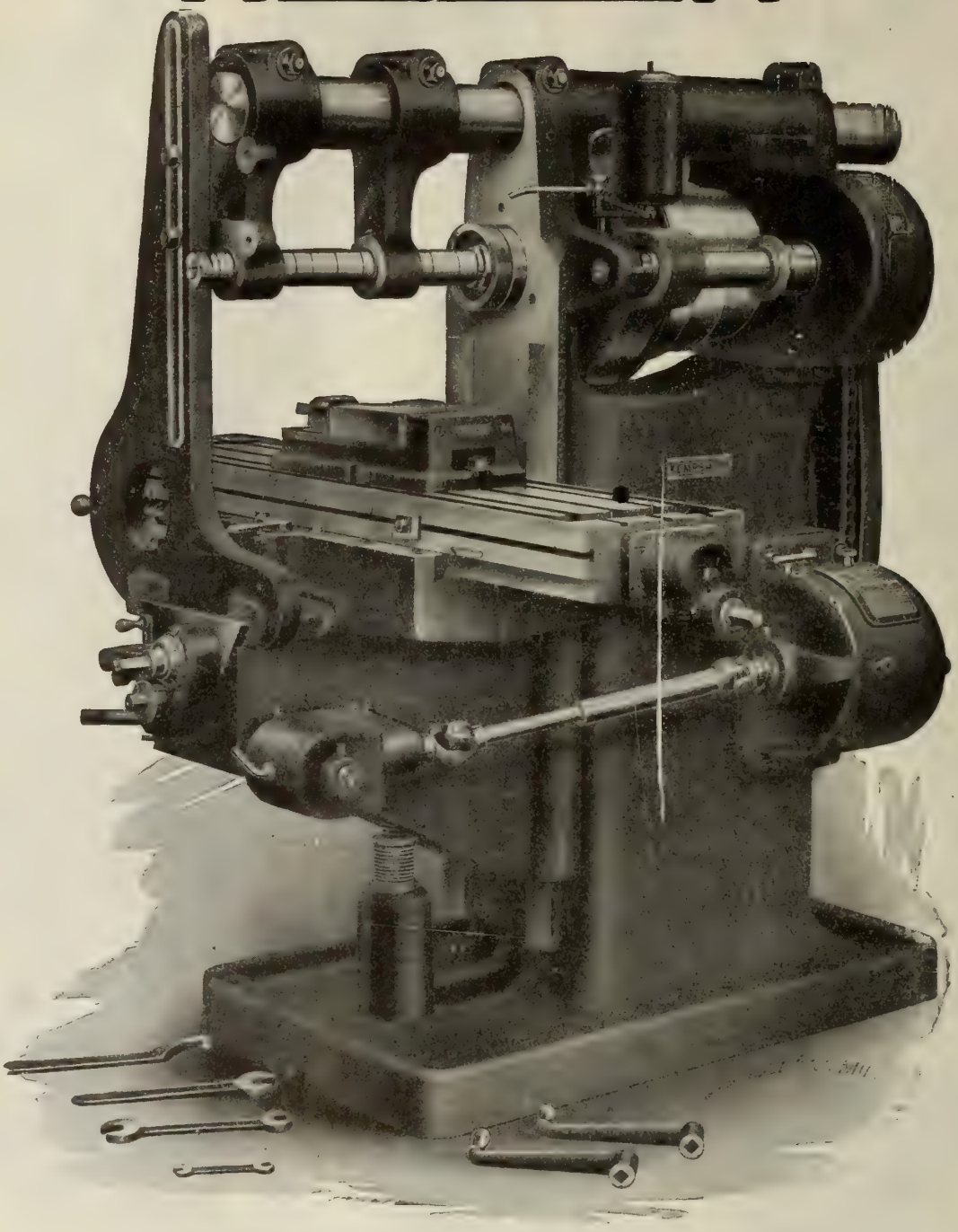
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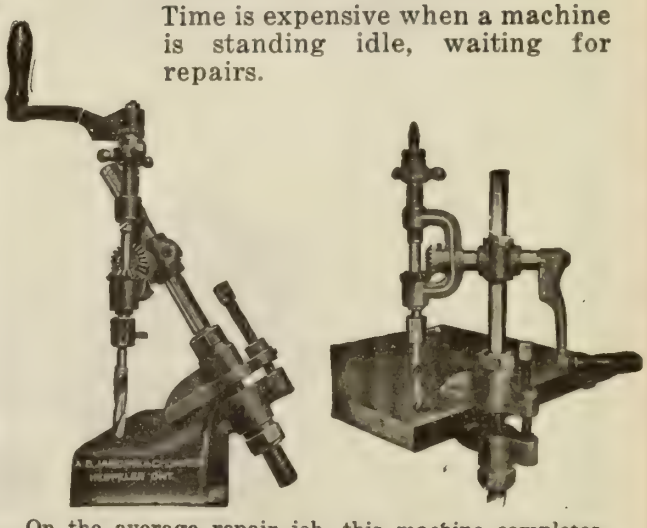
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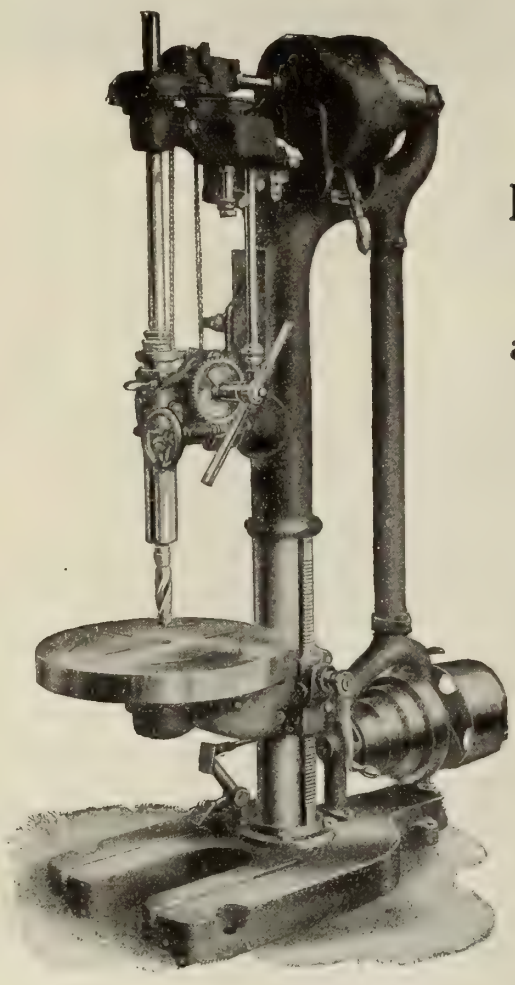


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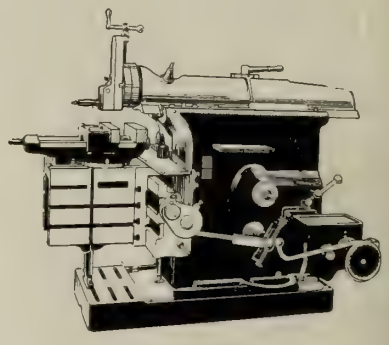
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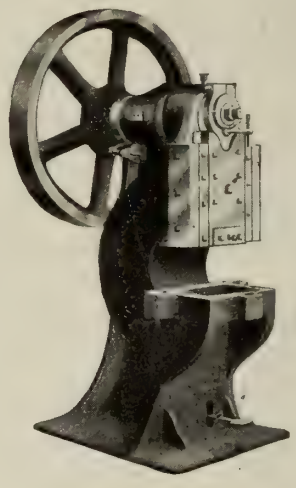


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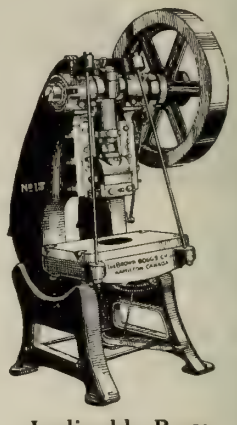
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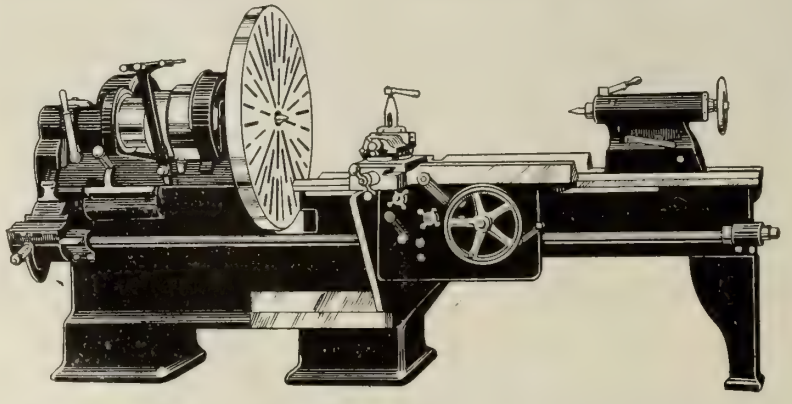
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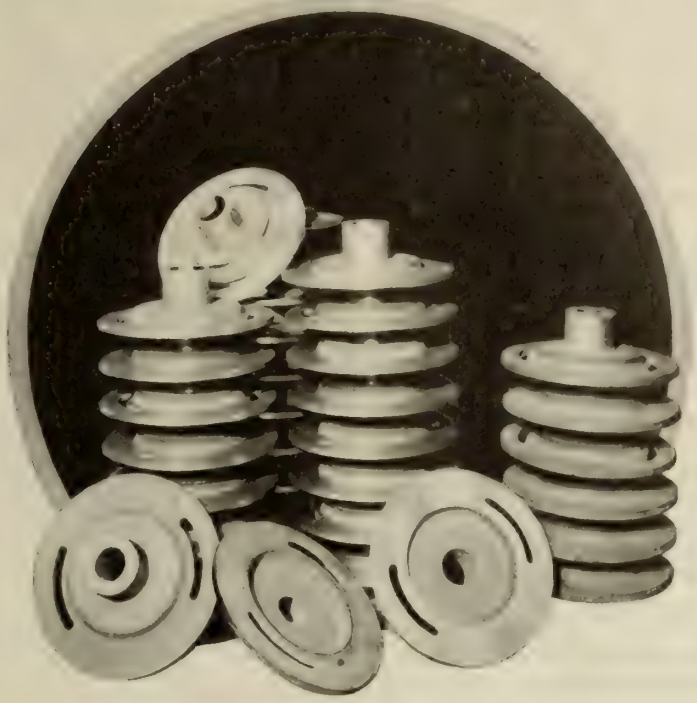
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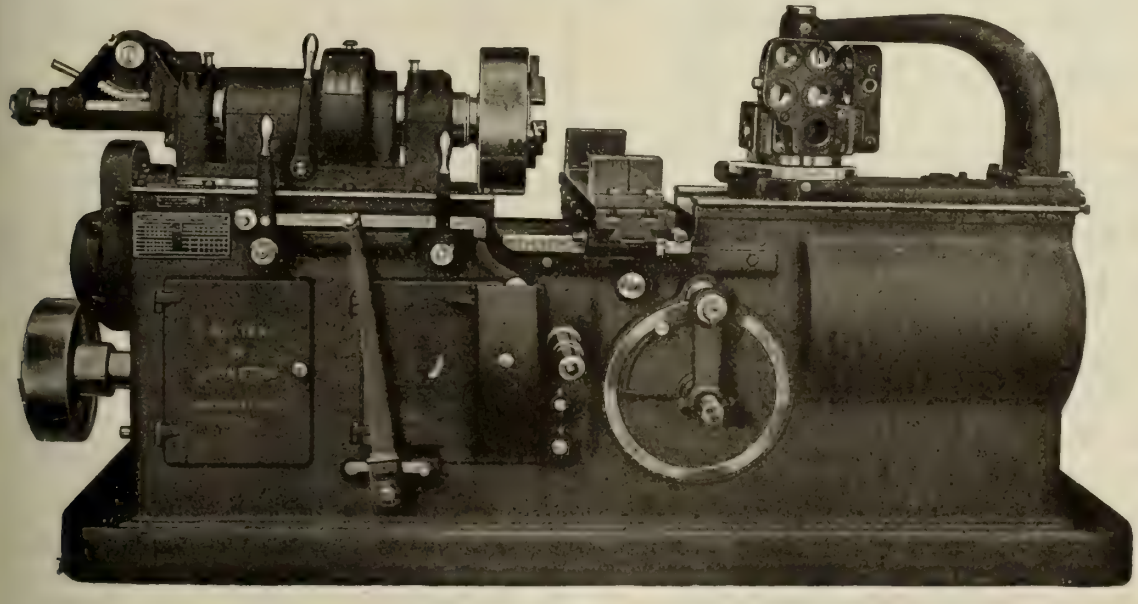
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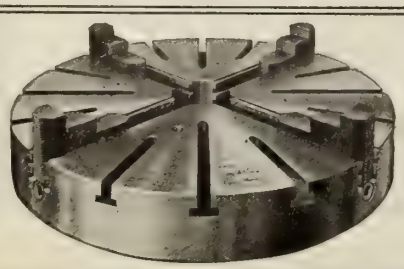
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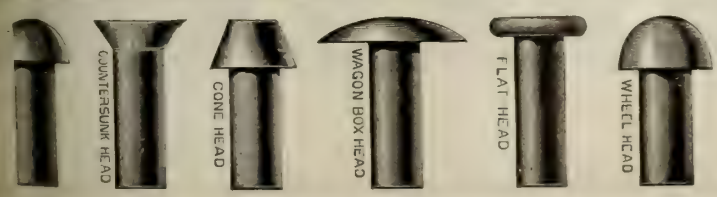
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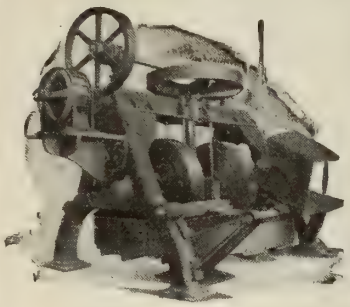


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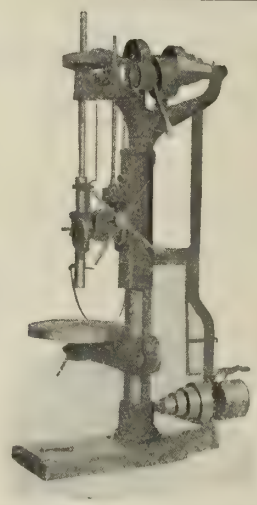
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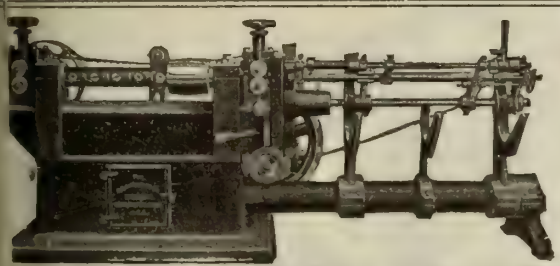
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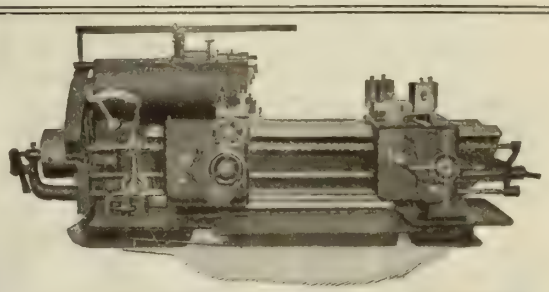


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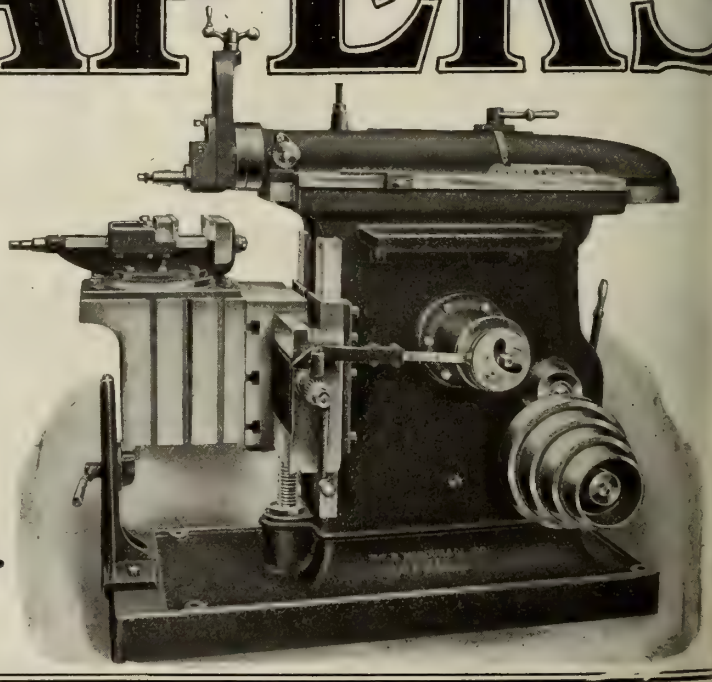
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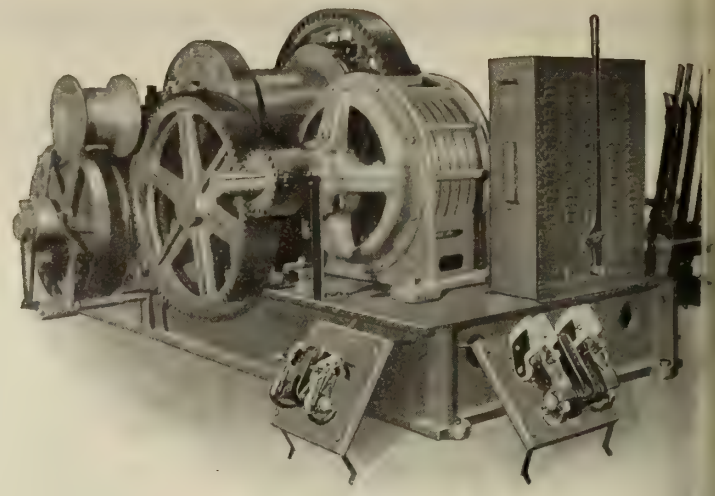
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If interested tear out this page and place with letters to be answered.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

XXVI, No. 8. August 25, 1921.

The Proper Care of Belting—Points to Watch

Selection of Belting—Importance of Proper Alignment of Pulleys —Various Types of Belt Joints—Method of Preparation—How to Keep a Belt Effective—A Record Should be Kept.

By J. H. MOORE.

IN COMMENCING the subject of "The Proper Care of Belting" let it be thoroughly understood that we are going to discuss the many phases of transmission trouble which can ruin the best belt in the world. An improperly aligned, or a poorly supported belt will, in a short time, cause endless trouble with the belts. These are only two of a great many troubles, so that transmission difficulties can well be left out of the present article, to be discussed separately at a later date. There are few users of belts who give the attention they deserve, and undoubtedly a fallacy exists that a tight belt is all that is necessary. A tight belt in many cases is very desirable, but there is more to it than this. Some mechanics will tell you that if a belt gets slack, take off, chop a piece out of it; replace it and stick her on again. We use the manager of the shop advisedly to show with what contempt a belt is often held.

Before a belt is installed, all possible stretch should be taken out of it. This can be accomplished by means of any of the stretching devices at present on the market. If at all possible the task of keeping the belt in proper shape should be handed over to one man. Incidentally speaking, the belt supervisor should be a good man, not merely a handy laborer. Employ a man who understands belts; who realizes that temperature and climatic conditions have to be reckoned with; and who has the powers of imagination. The latter characteristic helps him to picture what he would feel were he the belt.

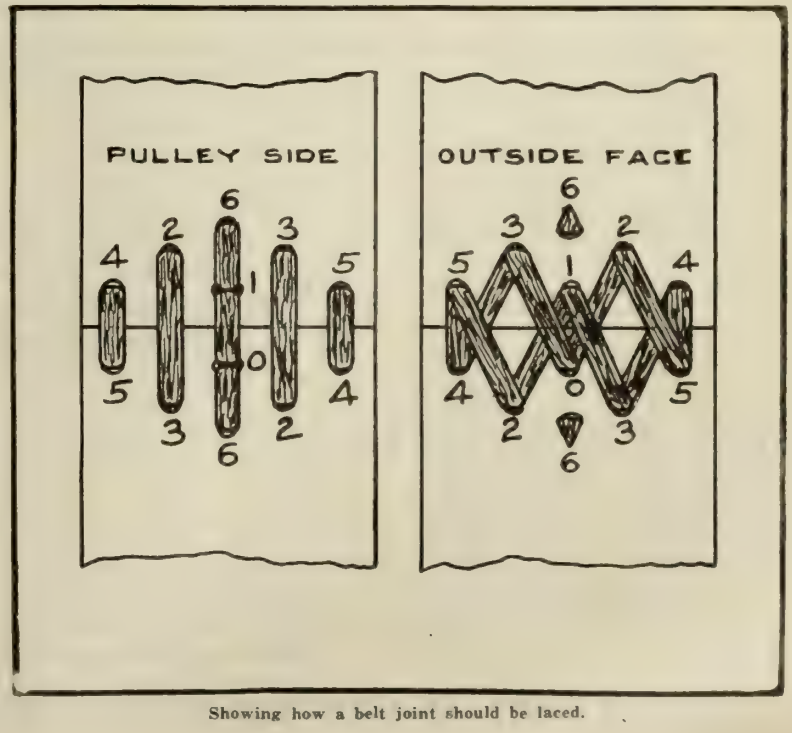
Just think for a moment what a belt has to undergo on a jerky drive. Picture the belt winging round the pulley of the driving machine. The strain rises suddenly from practically nothing to a pull of several hundred pounds as the belt leaves the driving pulley on its trip to the shaft. Add to this normal condition a jerky drive (and they are often found),—what ensues? While the belt is tightly stretched under the pull it is violently jerked and tugged, really placing the big strain on it at the worst possible time. If the machine is not running smoothly the belt is alternately let down and tightened up on the slack side, and each tightening creates a sharp, sudden strain that eventually tears the belt to pieces. Have you ever seen a belt that was fairly slack act just like a whip? Of course you have; but did you ever stop to think how you would stand up to such sudden tightening and slackening? And now, since we have pleaded the cause of the poor neglected belt, we will consider how to overcome some belt troubles.

Selection of Belting

When selecting belting many things have to be taken into consideration. Assuming first of all that a leather belt is going to be used, uniformity in the material is of very great importance. It pays to purchase a high grade belt, for while the initial cost may be greater, the service received will more than make up for the extra cost. As previously stated the belts should be thoroughly stretched before using so that they do not have to be "taken up" every few days.

Where belts are exposed to the weather or to the action of steam, rubber belts are generally used as they do not absorb moisture or stretch as readily as leather under like conditions. Again comes the question of quality. The best grades of such belting contain nothing but new rubber, while others are made largely of reclaimed rubber. High grade belts contain a heavy make of cotton duck, while the cheaper grades have a lighter quality of duck. Providing the proper grade of duck is used a 3 or 4 ply belt of this nature is said to be equal in strength to a single leather belt. A 5 or 6 ply belt is about equal to a double leather belt and so on in proportion.

Canvas stitched belting again is often used when the material coming in contact with the belt, or the surrounding atmosphere would ruin an ordinary leather, cotton, or rubber belt. Such belts are al-



Showing how a belt joint should be laced.

so applicable to belt conveyors, when the material to be handled will not cut the cotton fibre. Steel belts are also used, especially in England and other European Countries, and for information on this latter subject we would refer readers to the June 21st issue of Canadian Machinery. Of course there are all makes and grades of belting, each manufacturer claiming for his particular product some inherent advantages. A good plan is to use sufficient for a test drive, place it under the worst conditions possible, then watch results. Once you get a belt to suit you, stick to it. True you can still continue an occasional test drive, but until you have definite proof of the new belt's qualities, keep using what you have found to suit your purpose.

Belt Joints

An endless belt can naturally run smoothest when there is no obstruction to cause it to jump. For this reason some claim the cemented belt joint to be the most satisfactory. The accompanying sketch shows clearly how such joints are made, and in making the joint the belt ends should be tapered to a smooth, even surface, keeping them, of course, square with the edges. Depending upon the width of the belt, the length of the lap can vary, and the following figures have been found to give excellent results:— For 1 in. width belt, length of lap. 5 in.; 2 in. belt, 5 in; 3 in. belt, 6 in; 4 in belt, 6 in; 5 in. belt, 7 in; 6 in. belt, 8 in; 7 in. belt 8 in; and 8in belt, 9 in. of lap. Above this width the length of lap is usually made equal to the belt width, and after 18 in. wide belts have been reached, the lap need go no longer than this amount.

Before cementing a joint of this nature the belt should be placed over the pulleys and the proper tension obtained by means of clamps. After drawing the belt a little tighter than is necessary, to allow for slack, level the ends to form the lap, applying the cement to both surfaces while hot. Should the belt be very large, cement only a few inches at a time, then hammer down the cemented section thoroughly, proceeding in this manner until the complete joint has been cemented. Last, but not least, the joint should be hammered carefully along the edges. The clamps should be left on for at least an hour, longer if possible. In the case of smaller belts, the cemented lap is often clamped between boards to which the belt has been previously tacked in proper position. There are various cements used, some home made, others which can be purchased, but it is the method rather than the cement used which interests us.

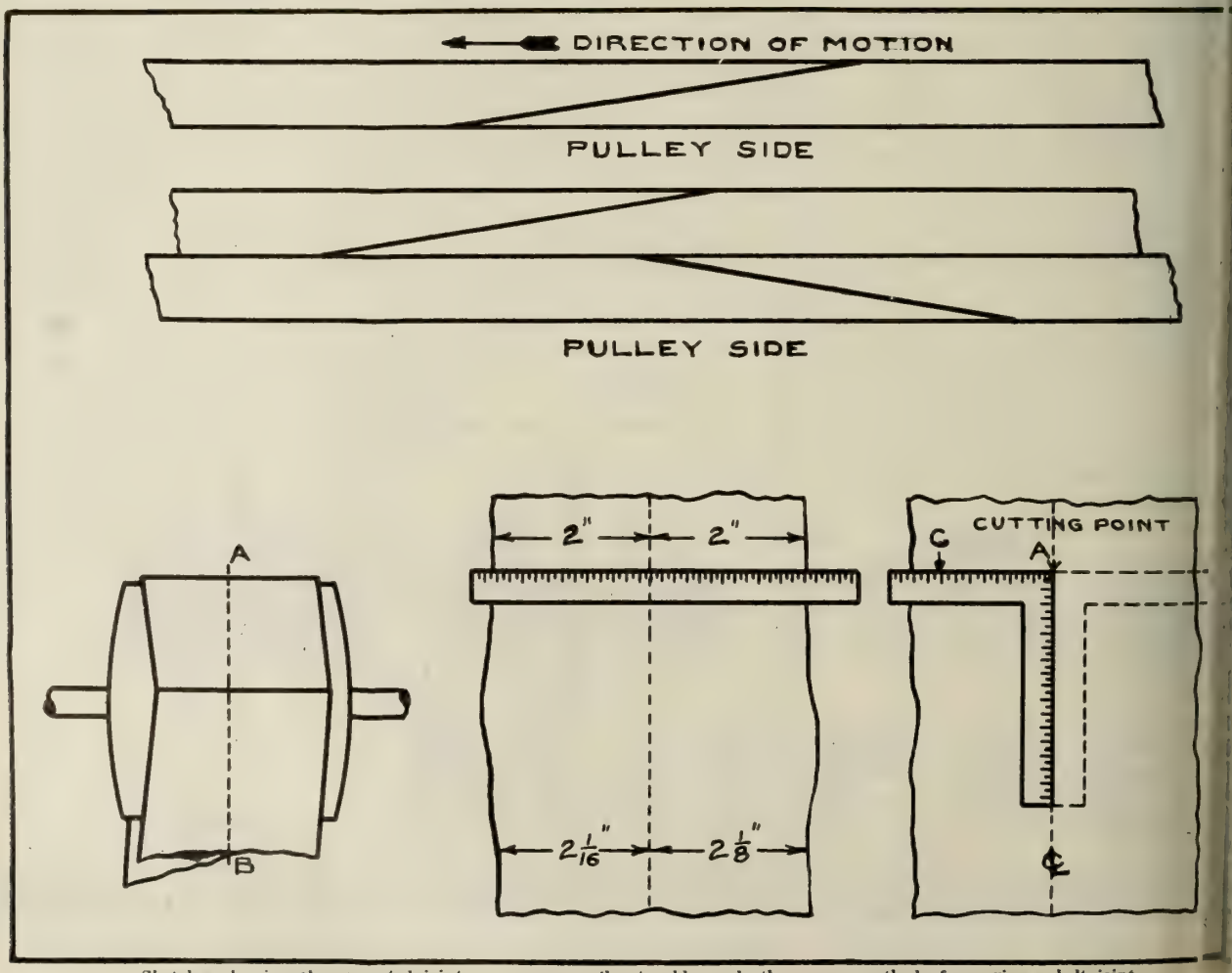
Referring to the sketch, it will be noted that the point of the lap is on the pulley side. The lap is placed in this way to prevent the end from opening, for when the point is to the outside the tendency is to open up, especially if the belt is travelling at a high rate of speed. On a double ply belt the laps should be arranged as shown in the other sketch. With this arrangement the points of the laps in both piles will be to the inside, this way being protected. Of course o[ther] on this method differ but the pra[ctice] shown has been found to give ex[cel]lent results.

The Laced Belt Joint

There are several ways of lacin[g] but the sketch shows a very satis[factory] method of lacing. When making joint, cut the ends of the belt 'p[er]' square. Do not make the holes any than absolutely necessary, for ot[her] you will only weaken the belt at [the] ched section. In making a joint i[t is] visable to use a good strong thin [lace] preference to a thick one. The [more] the lace the less will be the jar on e[ach] as it goes round the pulley. The [best] lacing should always be kept on [the] ley side, and as a general rule th[e num]ber of holes for belts of various [widths] can be as follows:—

For 1 in. to 2 in. belts, ¼ in. v[ide] ing is sufficient, and three holes [each] side of the joint will do. From [1] 4½ in. belt, 3 to 5 holes at each [end] all right, and from there to 5 in [belt] wil be found sufficient. From [6] 9 to 17 holes are usually punc[hed] pending upon conditions and th[e] of the drive. The lacing usually [used] ranges from ¼ in. in the smalle[r] ½ in. in the larger belting, b[ut] 6 in width ⅜ in. lacing will b[e] enough.

The distance that the holes s[hould]



Sketches showing the cemented joint—a common pulley trouble, and the proper method of squaring a belt joint.

nch from the end remains an open
est, but good practice calls for the
st w in the smaller belts ranging
m in. to ½ in. from the end, the
one row being back from ¾ in. to
n. bove 4 in. width, the holes go
k proportionate distance.
The est practice is to commence at
ce er and work out and back on
b ple. The figures on the illustra-
n a Fig. 2 can be followed out in
w. Starting at 0 and 1, the order
is llows:—2, 3, 4, 5, 4, 3, 2, 1, or
ot sides of the center being identi-
Th locking is performed by passing
fre end through a small hole 6, and
ma short slit to form a hook that
pr vent the lace from coming out.
k should be to the outside of the
an after it is made should be slight-
ha red down.

e rious methods of fastening belts
toe and other types of fasteners re-
en comment. As a rule a small ma-
is sed in conjunction with the fas-
c pressure being exerted which
ca ne teeth to enter into the belt.
Ad im there is nothing like them
ow ers again say they wouldn't do
wi he leather belted joint, or the
ri oint as the case may be, and so
on.

Things to Watch

Wh discussed the methods of join-
bel we will consider points to
lo or and avoid after the belts
op eration. When a belt runs
ir races back and forth across the
pu is not giving its best service,
wi last long under such conditions.
Ov g such a trouble investigate the
wi e if they are cut square, and
on you will find that here is where
so e lies. It seems so easy to cut
a are but it is far from a simple
wh the procedure shown in the
sh uld be carefuly followed out.
Th of pulley used makes a great
eac in the length of life and ser-
vi elt. The larger the pulley, the
be rain, so that it is advisable to
th pulleys as large as you can.
ble elt can often be used on a lar-
ins pulley, thus conveying more
wh ereas a double belt on the
sm ulley would wear out too
qu

Ma turers of belting are only too
ha ve advice on the proper care of
po . For example J. H. Walker,
ma irector of the Dominion Belt-
Co amilton, says that every belt
ha e a proper dressing applied
ono y to keep it in condition. By
thi drying out is prevented, and
reta their gripping qualities on
wh ich means a retention of the
ef ower transmission. A belt
co taining resin or mineral oils
ma be used, as these ingredients
are trimental. Never use a belt
co taining animal oils on rubber,
or titched cotton duck belting.
Th er time to apply belt dress-
is wh n the plant is closed down for
ov ; for instance, Saturday, as
Mo da morning it has had a chance
ab the belt and keep it soft and
pliable. If kept in this condition there is no excuse for anyone resorting to the questionable remedy of applying resin, or any sticky dressing to get the proper power out of belts.

Belts used in saw mills and other plants that are shut down during the winter months should be taken off, rolled up, and kept in a warm place. If left on the pulleys and exposed to the changeable atmospheric conditions of a Canadian winter they will certainly have deteriorated by spring. Carelessness in starting up machinery too quickly is liable to cause belts to slip on pulleys, thus injuring them. This can be obviated by putting on the power gradually, which gives belts a chance to get a grip on the pulleys.

Another important matter is to have proper alignment of pulleys, as many belts give out before their time owing to defects in this respect. Another mistake made by some belting users is practising false economy in getting belts too light for the work they have to do. While a certain weight of belt may at first do the work required, if it is necessary to keep it on a constant strain to accomplish this, both belt and machinery are going to wear out much faster than if there is a "reserve." In other words, heavy enough belts should be used to ensure their not being overstrained. This may cost a little more at first, but pays in the long run.

The Federal Engineering Co., Ltd., Toronto, Canada speaking on the same subject ask this important question: Why do so many firms spend so much good money in buying good belts, and not give them necessary attention afterwardsi

In order that a belt may remain efficient, they continue, it must be kept pliable. No matter what kind of belt is used there are two enemies at work, each trying to shorten the life of belting. These are hardening of the belt fibre and belt slip.

Hardening of belts to our mind can be absolutely avoided by belt dressings, but all belts must not be dressed in the same manner. For example, our Scandinavia belts, which are solid-woven, and filled with a bituminous dressing, can be kept soft and pliable by dressing occasionally with the same material with which the belt is impregnated, or in place of this material castor oil may be used.

For leather belts either of the above dressings may be used, or many of the bar belt dressings on the market. Do not, however, use bar belt dressings on Scandinavia or other textile belts. The textile belt should have a liquid dressing which will soak well into the fibres of the belt. Liquid dressings should be applied warm, and with a brush to the pulley side of the belts. Once a month is not too often.

Rubber belts do not require any dressing. Balata belting may require a little attention of this kind at times, but great care is necessary. The only time a Balata belt requires dressing is when the pulley side of the belt becomes smooth and glossy. The dressing to be used is castor oil, and this should be put on just a drop here and there. This castor oil sparingly applied, after the belt has been run, will give a "tacky" feeling to the surface of the belt, which will stop slipping. We have seen thousands of Balata belts ruind by having too much oil or improper belt dressings used on them.

Recently we had two of our Balata belts returned to us to have the ends respliced, as the splices had come apart. On examination the belt was found to be soaked with oil. This oil had dissolved the balata gum, allowing the splices to slip apart, and permitting the plies to open up. We made up the splices again, cautioning our friends against using oil or dressing on this kind of belting. They wrote back that they had been using bar belt dressing. This kind had been recommended to them for use on their leather belts, and they were using it on all belts. Never use belt dressing of any kind on such belts, and only a very little castor oil, as previously directed. It is better to let these belts go without dressing than to put too much oil on them.

With regard to slipping of belts, this is a very serious evil. Often it is only detected by careful observation, and by tests. The result of belt slip is cracking across the width, and when you find a belt cracked in this way you can rest assured that your belt has been slipping. This defect must be remedied as soon as posible, or it may cost a lot of money in ruined belting.

First, examine the belt and see if it is soft and pliable. If it is not, the belt should be made so immediately.

If it is soft, and still slipping, it may require adhesive, provided the belt is not overloaded. Belting running from large to small pulleys with comparatively short belt centres nearly always requires an adhesive, but it should not be used on all kinds of belting. For instance belting made in plies is apt to be pulled apart in the plies or splices from the drag of this material.

In conclusion we would suggest some system whereby a record can be kept of the different belts and their performances. Various plants are finding such a plan to be of advantage. For example, suppose you require a belt. Place a steel tape over the pulleys and determine the correct length required. Place this length, together with other particulars of the belt used, the nature of the drive, etc., on a card, keeping this on file. State the date of application and leave spaces to record when the belt needed repair, when it should receive its dressing, etc. Do not forget the cost. Do not be afraid to put everything of importance on the card for this is the only true method of actually knowing what your belts are costing you, and what grades are standing up best. If such a plan is inaugurated there will be less idle machines in manufacturing plants. A foreman wouldn't think of allowing a laborer to operate his high class machines; why then should he let any Tom, Dick, or Harry, attend to the belts which keep those high price machines in operation.

Operating Compressed Air System Efficiently

The Successful Operation Depends Largely Upon Provision Made for Receiver of Sufficient Capacity—What to Do if Demand Fluctuates — Various Examples of Installations

By JOHN S. WATTS

THE successful operation of a compressed air system depends more largely upon the provision of a receiver of a sufficient capacity, regarded as a reservoir, than is commonly understood. It is a common custom to refer to the catalogues of manufacturers of air compressors, who give the sizes of air receivers that are usually used with a given size of compressor, and while the size of receiver they recommend is sufficient for average conditions, with a fairly steady demand for air, the capacity should always be looked into by the engineer who is responsible for its installation, and checked up by as close an estimation of the requirements as the case will permit.

Where a fluctuating demand is to be supplied, it is much more economical to instal a large receiver than it is to have a large compressor, the difference in first cost being considerable. Further, in operation, it is much easier on the machine, to have it running under a steady load, as it will with a large enough receiver, than to have the compressor large enough to carry the peak load and be constantly dropping the load and picking it up again.

The capacity of an air receiver, as a reservoir, is the quantity of air which it will give out between the pressure at which the unloading valve on the compressor cuts off the supply and that pressure at which the tools being driven by the compressed air will fail to function properly because of too low pressure.

For example, we will suppose that the unloading valve closes at 100 pounds gauge pressure, and that the lowest useful pressure at the air receiver is 80 pounds. This is a range in absolute pressures of 115 to 95 pounds, or 20 pounds expansion. In thus expanding from 115 to 95 pounds, the ratio of expansion is 20/115 or 0.174; that is, at constant temperature the receiver will deliver 0.174 of its cubic contents in falling from the highest to the lowest allowable pressures.

Taking the average sizes of receivers recommended for use by the makers of air compressors, we find that the total cubic contents of the receivers vary from about one-fifth of the capacity of the compressor (in cubic feet of free air per minute) for small compressors to one-fifteenth in large ones. The compressor capacity is given in terms of cubic feet of free air, that is at atmospheric pressure, which must be converted into its equivalent in cubic feet of compressed air at the temperature of the receiver which, if we take this temperature to be about that of the atmosphere, will make the delivery into the receiver about one-eighth of the compressor capacity in free air.

The reservoir capacity of the standard receivers as usually installed is about 1.6 for small compressors, to one-half for large ones, of the rated capacity of the compressors in terms of compressed air per minute. That is the receiver will take care of an overload of 100 per cent. for 1.6 to ½ minute respectively, or a 20 per cent. overload for five times these figures, viz., eight to two and one-half minutes.

It should be noted at this stage that the receivers as recommended by the makers are not intended by them to be used as reservoirs to take care of large fluctuations, but are primarily intended only to equalize the pressure in the system, which would pulsate disastrously if there was no receiver, because of the intermittent delivery at each stroke of the compressor.

The reservoir capacities as given above, in use are increased somewhat, as the delivery of the compressor in cubic feet of compressed air will increase as the pressure in the receiver falls, and in some cases this makes a decided difference in the capacity of receiver that will be required. No attempt is made to consider the variation in actual deliveries of the compressor caused by variations in the temperature of the incoming and compressed air, all of which vary the figures given, but cannot very well be allowed for, except on the assumption that they will be equal.

It will be noted that the re... capacity for large compressors i... one-third that of the small ones, t... son being that under ordinary ... tions the larger compressor will ... plying air to a large number of ... which will tend to a steadier ... than if only two or three machi... being driven, when it might occ... all of them would start and stop ... same time.

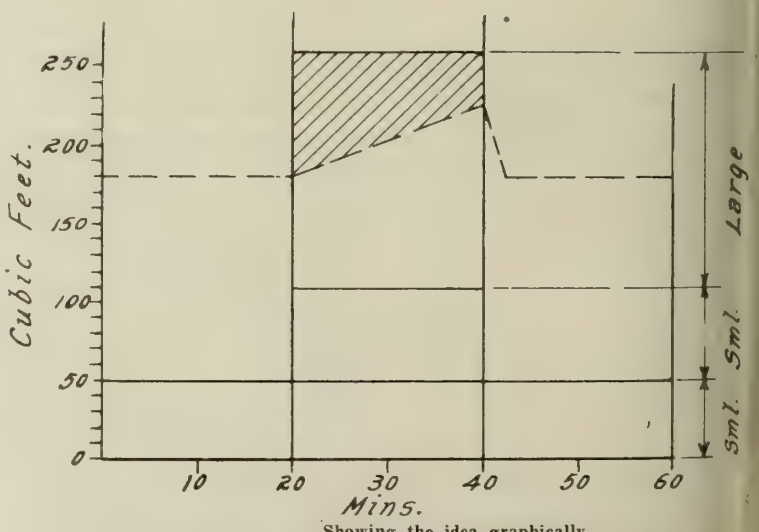
While it is generally more ... satisfactory, under average co... (when the air is used in a large ... of relatively small tools, such as ... hammers, chippers and air dri...), simply instal the size of receive... monly used with a given compres... question deserves considerable ... when air is proposed to be use... machine which will require a la... intermittent demand.

Since it has become more ge... purchase electric power instead ... plant having its own steam powe... the steam hammer is of necessity ... by air, as well as hoisting engi... other apparatus formerly using ... the discarding of the individua... boiler having compelled the ch... air in such machines. This has ... frequent trouble through a lack ... derstanding of the conditions wh... to be met, and the purpose of thi... is to attempt to show how these ... ties may be foreseen and averte... most effective means.

A Concrete Example

The clearest way will be to co... concrete example, which we will ... be that of a shop using a nu...

Continued on page 31



Showing the idea graphically.

John Conley Receives Advice on Thread Cutting

The Difference Between Lead and Pitch—The Use of Indicators —Examples Worked Out for Instruction Purposes—Method of Gearing Up Lathe—How to Cut Taper Threads.

By J. DAVIS

"HOW are you getting along with your thread cutting?" John Conley looked up at his father plied:

"N very well. There are a lot of g I don't understand, and on some the men in the shop do not agree."

"t's quite likely, son. I can re- some things I believed for years, e day woke up to the fact that I wrong, but tell me some of the hat are troubling you."

"right, dad. First, what is the ce betwen the lead and the

"pitch of the thread is the dis- e etween the center of one thread center of the next. The lead is ance the screw moves endways evolution."

"e lead and the pitch are one and e thing."

"always. That is the case in a lehread screw, but not in a double iple thread; so that in making culations for thread cutting al- nsider the lead, and not the

"the pitch not cut any figure at aring up the lathe?"

"not in gearing up the lathe, but n the width of the tool."

"'s that?'

"W. if you are going to cut two in the same space as you cut one e your tool will only be half as

"athe I am running is rather old d, dad, and I have to change the r every different thread, but I of those jiggers that tell me put the nut in gear, for which y thankful."

"that indicator is quite a useful . I remember when I was run- athe we didn't have any such e used to put a chalk mark on late, another on the lead screw, until they both came to the top then put in the nut. It was work of art, I can assure you."

"ld like you to explain the prin- he indicator."

"ght, but first of all let me give al method of finding gears. The nciple of gearing up a lathe cutting is one of ratio, or pro- The ratio of the driving wheels ven wheels must be the same d of the screw to be cut is to f the lead screw. In order to s ratio the first thing to do is lead of the screw to be cut; is simple universal method. wn the lead of the thread to be form of a fraction. An easy way to express the lead of any given thread is to draw a horizontal line thus ——— placing the number of threads below the line and the number of inches above the line. The resulting fraction will be the lead of the thread."

Example: Lead of 6 threads per inch equals

$$\frac{\text{Inches}}{\text{Threads}} = \frac{1}{6} \text{ lead,}$$

and so on for all even leads. In cases where there is a fractional number, multiply both inches and threads by the least number that will bring them to a whole number.

Example: Find lead of 6¼ threads per inch. Proceeding as before: multiply by the least number that will bring them to a whole number.

$$\frac{1}{6\frac{1}{4}} = 1 \div \frac{25}{4} = \frac{4}{25}$$

Here is a more difficult one: Find the lead of 3 2-3 threads in 1¾ inches.

If the lead is given in decimals, bring it to a fraction by placing noughts or ciphers under each decimal figure, and 1 under the decimal point, thus: lead of decimal .75=75-100=¾, and so on.

Having found pitch of screw to be cut, find pitch of leading screw in the same way. After finding lead of screws to be cut and lead of lathe screw, the next step is to find ratio by inverting, or turning upside down, the pitch of the leading screw and multiplying.

After finding ratio, a number of different sets of gears can be found by multiplying the ratio by any number we choose, but care must be taken to multiply both numerator and denominator by the same figure so as not to alter its value.

Find wheels to cut 4 threads per inch leading screw 2 threads; thread to be cut according to rule.

$$\frac{1}{4} \times \frac{2}{1} \times \frac{10}{10} = \frac{20}{40}$$

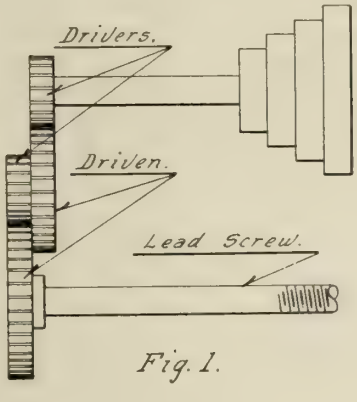
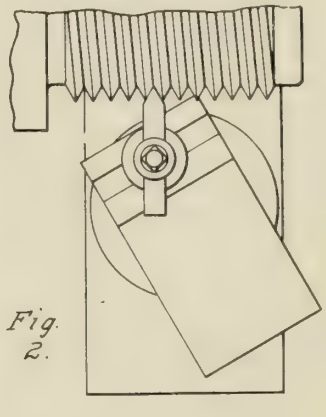
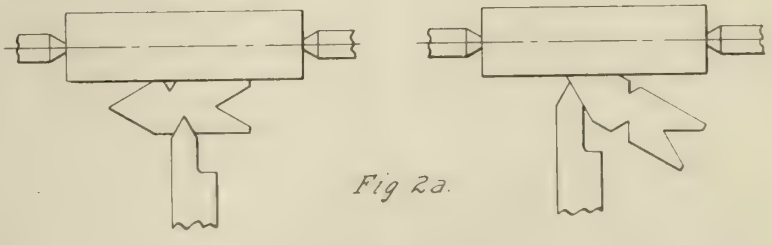


Fig. 1.


Fig. 2.


Fig 2a.

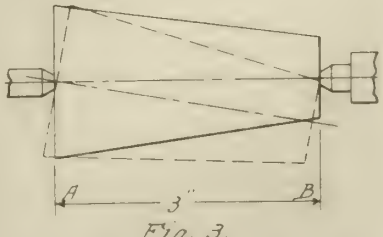
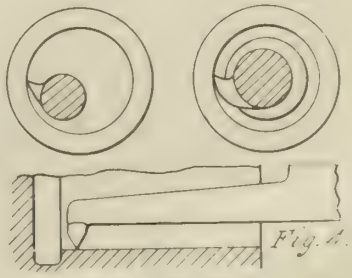


Fig. 3.


Fig. 4.

These sketches show the various suggestions in thread cutting.

Find wheels to cut 3 1-7 threads in 2 1-5 inches with a lead screw ½ inch pitch. According to rule:

$$\frac{\text{Inches}}{\text{Threads}} \quad \frac{2\ 1\text{-}5}{3\ 1\text{-}7} \times 35 = \frac{77}{110}$$

$$= \frac{77}{110} \times \frac{2}{1} = \frac{154}{110} \text{ or } \frac{77}{55}$$

from which any number of different sets of wheels may be obtained.

Sometimes it happens that the number of teeth in a gear wheel would be too large to employ a single train of wheels. In this case compound gears must be used. Here is an example that would require compound gears. To cut 24 threads per inch with a lead screw two threads per inch. Proceed to find ratio as before:

$$\frac{1}{24} \times \frac{2}{2} = \frac{2}{24} \text{ ratio.}$$

Take the numerator of the ratio, which is two, and find any two numbers which multiplied together will equal that number. Then take the denominator of the ratio, which is 24, and find any two numbers which multiplied together equal 24 or

$$\frac{2 \times 1}{12 \times 2}$$

We have now divided the ratio into four factors of equal value, which will enable us to use compound wheels. We can take any figure in the numerator or denominator and multiply, add, or subtract at will, as long as we do not alter the relative values in adding or subtracting; the amounts added or subtracted must be the same proportionate amounts of each, such as 1-3 or 1-4 or 1-5, and so on as the case may be. Take the first two figures in our example and multiply each of them by ten.

$$\frac{2}{12} \times 10 = \frac{20}{120} \text{ \& } \frac{1}{2} \times 50 = \frac{50}{100}$$

Wheels required, therefore, are 20x50 driving wheels, and 120 and 100 driven wheels.

The two top wheels are driving wheels and the two bottom wheels are driven. The sketch, Fig. 1, illustrates the position of the wheels on the lathe.

It is required to find gears to cut 16 threads per inch—lead screw ½ inch pitch? Then:

$$\frac{1}{16} \times \frac{2}{1} = \frac{2}{16} = \frac{2 \times 1}{4 \times 4} = \frac{20 \times 30}{40 \times 120}$$

To prove the wheels, multiply all driven wheels together; then multiply all the driving wheels together and divide the driven by the drivers. If the wheels are correct, you will get the same ratio or proportion as exists between the pitch of the leading screw and the pitch of the screw to be cut. Take the above example—driven wheels.

Ratio of wheels between driver and driven 8 to 1.

$$\frac{\text{Threads to be cut} \quad 16}{\text{Threads on lead screw} \quad 2}$$

Ratio required, 8 to 1.

There used to be a joke about an apprentice in the shop where I served my time who wanted to cut a thread and required a 98-tooth wheel. In those days we used to beg, borrow, or steal wheels from each other. However, he couldn't find the wheel he required, but he finished the job, and when asked how he managed it, he said triumphantly, "Oh, I wouldn't let a little thing like that stick me. I got a wheel with a hundred teeth and broke out two teeth."

"Dad, how does a prime number enter into lathe calculations?"

"I can best explain that question by giving you a concrete example. Suppose we want to cut a thread .654 lead, with a lead screw 3 threads to the inch. Find ratio according to rule. Find factors, or reduce to its lowest proportion, and we find that one of the factors is 109. Therefore it would be impossible to cut this thread without a 109 gear or a multiple of 109, because 109 is a prime number."

"I think I have got the idea of gearing up the lathe clearly. Now I want to ask you one or two questions about the actual handling or operating. What makes the tool dig into the thread and leave a nasty jagged cut, and very often break off the point?"

"In cutting a vee thread the tool rest should be moved around 30 degrees (as shown at Fig. 2), for American threads and 27½ degrees for Whitworth threads, this being half the angle of the thread. The reason for this is that when a cut is taken, the tool cuts on one side only, which gives a cleaner and better thread than is the case when the tool-rest is set at right angles to the lathe centers. In the latter case the tool must cut on both sides at once. This means a smaller cut and a rougher finish."

"How about cutting a left-hand thread?"

"In cutting a left-hand thread the direction of the rotation of the lead screw is usually reversed and the carriage run from left to right, although I have cut left-hand threads on some long sleeves by reversing the direction of the work instead of the lead screw. This had the advantage that I was able to see what the tool was doing before it advanced very far into the work."

"You didn't explain the indicator, dad. How does it tell when to engage the nut?"

"When the number of threads on the work can be divided by the number of threads on the leading screw without a remainder, the nut may be engaged at any time or place. In all other cases put down the pitch in fractional form reduced to its lowest term. The numerator will indicate the least number of complete inches that the carriage must travel after taking the nut out of gear with the leading screw before it comes to the right place to put it in again. If you have no indicator put the carriage against the tailstock for a starting place, and measure on the lathe bed the required number of inches, or some multiple of the same, according to the le th of screw to be cut. Stop the lath a this mark, and run the carriage bac to the starting place for a fresh cut. / taking the first cut, measure the th carefully to see if the lathe is cuttin right pitch. In thread cutting it i portant that the tool should be se actly at the center. If the tool is se high or too low, it will make an impe thread. When the tool commences t it is sprung to one side a little ur is advanced up the thread far enou cut on both sides; this causes a thread on the end, which is apt to d one when fitting it into place. To this, chamfer the end of the screw, finishing the thread.

In cutting multiple threads sele wheels so as to have one on the spindle that can be divided into t three equal parts as required, the ceed the same as for single thread one thread is cut, with the except the finishing cut. Chalk the bott any one space on the spindle gea also chalk the tooth of the chang which meshes with this space. If double thread, count half the nun teeth on the change gear and m the same way. Adjust the quadr swing plate so that the second tooth will mesh in the chalked sp the spindle gear, and proceed to second thread. When taking a fi cut, take the screw out of the so as to be able to move the sadd without moving the tool, drop th rant and mesh the gears at t chalk mark and finish the second The same method will do for t more threads. This is the gener cepted way for cutting double o threads, although there are othe which, under favorable circum are quicker and more convenien instance, a double or triple can b one operation by a tool that is with two or more cutting edges the lead of the thread to be cut."

"I don't want to weary you, b are just one or two more que would like to ask. In cuttin threads should the tool be set angles to the axis of the work surface?"

"Both."

"What do you mean?"

"Well, for an American th should be set to the axis, an British or Whitworth standard be set to the surface."

"We had an argument about over the tail stock for taper wo effect does this have?"

"If the center is set over by the tail-stock it will give an pitch and also a drunken threa the dead center is set over, the be in the position of the dotted sketch, Fig. 3. The work wo to be set over so that the face parallel to the center lines A pose the piece to be 3 inches that it is to be threaded 10 th

Since the length of taper, measured on the slope, is greater than the length of the piece measured parallel with its axis, it will require more than 30 revolutions to carry the tool entirely over the work, consequently there will be more than 30 threads on the piece, and it will not measure up exactly 30 threads per inch.

"Taper work should always be done with the taper attachment. When a thread is cut by setting over the tail-stock, owing to the angularity of the tail of the dog, it does not travel at a uniform speed with the lathe face plate. The end of the dog can be observed to slide back and out the notch of the face plate. Where this condition takes place, the thread cannot be a uniform pitch."

How can I overcome the spring of the tool in cutting a long thread in a small lathe?

Use the threading gauge shown at A for setting up the tool, and see that the shank of the tool is approximately parallel with the work so that the side of the tool will not rub against the thread before the point gets to the bottom of the hole. In threading long small work the biggest trouble to contend with is the spring of the tool. Many lathe tools make the cutting edge of the tool lower than the top. This means that the point of the tool must pass through a distance equal to half the diameter of the work before the cutting edge of the tool is directly over the center of the shank of the tool. As shown, a much stiffer tool can be used.

In cutting threads in very long brass bushes, the work is sometimes driven by the carriage of the lathe and the tool is carried in a parallel bar between the centers of the lathe. While this method gives excellent results for long threads such as nuts for roller bearing housing, etc., it is open to the objection that for every cut the tool must be moved back to its starting place by means of a reversed belt or else the tool must be removed from bar."

COMPRESSED AIR SYSTEM

Continued from page 28

...s, air hammers, drills, etc., the consumption of which will be, say, ... feet of free air per minute. In ...ing this figure, we must take the ...number of tools that may be ...at one time, as it is impossible ...ion any number of them being ...at the same time.

...dition we have to provide air for ...by 24 inch and a 16 by 36 inch ...hammer. First we must estimate ...consumption of air of the hammers, ...assuming that they will make ...blows per minute (sixty strokes), ...working, and that air is admitted ...two-thirds of the stroke (a hammer ...ion completes a full stroke), we ...equire

...× × 2/3 × 60 = 60 cubic feet ...the small hammer.

1.396 × 3 × 2/3 × 60 = 148 cubic feet for the large hammer.

Total 208

Further assuming that the hammers are at work for twenty minutes and at rest for forty minutes, the average consumption will be 208 × 1/3 = 70 cubic feet per minute of compressed air for the hammers. The average pressure at the hammers being ninety pounds, the equivalent in free air will be 60 times 70, or 240 cubic feet of free air per minute. Adding to this the 300 cubic feet used by the small tools, we find that the compressor must have a capacity of at least 720 cubic feet of free air per minute. Adding about two-thirds to this for safety, we decide on a compressor of a capacity of 1,200 cubic feet per minute free air. Converting this into compressed air at 90 pounds pressure, we have a delivery of 200 cubic feet per minute. At that pressure the small tools will consume 300/6 = 50 cubic feet per minute.

The small hammer 60
The large hammer 148

Total 258

We note from this that the compressor will handle, without calling on the receiver, all the small tools, and either one of the hammers alone, but is 58 cubic feet per minute short of being able to handle all the tools running together.

Obviously the worst condition will be, when both hammers start working together, which condition we have agreed will not last for more than twenty minutes, if both should start a heat together and work for the maximum period. The condition to be met can be most clearly understood by showing the factors graphically, as in the accompanying chart. The heavy full lines indicate the consumption of air by the various tools, the vertical ordinates representing cubic feet of compressed air per minute, and the horizontal ordinates an elapsed time of one hour. The dotted line represents the available delivery from the compressor, which when the demand is less than the capacity of the compressor, will be 1,200 × 15/100 = 180 cubic feet per minute. But, as pointed out before, whenever by reason of the demand exceeding the supply from the compressor, the pressure in the receiver falls, this output will increase, until when the pressure in the receiver has fallen to 80 pounds, it will become 1,200 × 15/80 = 225 cubic feet per minute. This is indicated in the chart by the rising dotted line.

The quantity of air to be supplied by the receiver, during the peak load, will be that represented by the shaded area in the chart, and is at the rate of 258 —180 = 78 cubic feet per minute, at the beginning of the twenty minute period, and 258 —225 = 33 cubic feet per minute at the end of that period. The total cubic feet of air will be the average of these two, multiplied by the time, viz., twenty minutes, or

$$\frac{78+33}{2} \times 20 = 1{,}110 \text{ cubic feet.}$$

As calculated above, for the range of pressures of twenty pounds, the reservoir capacity of the receiver is 0.174 of its cubic contents, and therefore the total cubic capacity of the receiver must be

$$\frac{1{,}110}{0.174} = 6{,}380 \text{ cubic feet.}$$

This demands a receiver about twelve feet diameter by fifty-five feet long, which is undoubtedly much larger than would be usually used. The example is probably a rather extreme case, but was taken as a good example of the saving effected by using a large reservoir receiver. In this case the alternative was to purchase a compressor having a capacity of at least 1,720 cubic feet, instead of 1,200.

TRAINING OPERATORS.

"The importance of the training of operators for both gas and electric welding cannot be overestimated," says Mr. Spraragen, chairman of the American Bureau of Welding. "A very large number of welding experts regard it by far as the most important problem. Widely different ideas as to the proper procedure to follow in the training of welding operators prevail even among experts. For instance, the time required for the correct training of an operator, as stated by a number of authorities, varies from three weeks to two years. Nor is there any greater agreement of the opinions as to what the training should include. Some say that the rudiments of a technical education is necessary, while others stoutly maintain that the operator should only be trained in the correct manipulation of the electrode or torch. In nearly every case where welding has been condemned or where severe legislation has been enacted to restrict its use, the case can be traced directly to poor welds made by unqualified operators."

FOR E. J. THOMAS.

Canadian Machinery has received a most unusual request, namely to acquaint the above named gentleman that his friends are worrying about his absence.

They state as follows: "Won't you please write, letting us know where you are. If you are sick or out of work, please come back to your loved ones. We are all worried about you."

The missing gentleman served in the Canadian army, was gassed and wounded, and has been missing since April 1, 1921. Does anyone know about this?



WELDING AND CUTTING



Some of the Possibilities of Fusion Welding

This Process Can Not Only Be Used for Repair Work, But Can Be Applied to the Manufacture of Metal Parts and in Construction Work—Efficiency Is of First Importance.

*By A. S. KINSEY

THE possibilities of the welding of metals by fusion are far greater than expected. It seems but a short time ago that practically only the railroad shop superintendent and his welders were capable of appreciating the value of fusion weld. The process seems to have drifted into existence without a sponsor, and for a number of years it failed to recieve the attention of the man who should have been most seriously concerned—the mechanical engineer. Of course it is easy now for us to appreciate the value of this method of making a weld, and we may wonder at the indifference of the technical man regarding its merits.

There never was any doubt in the mind of some men as to the possibilities of the fusion weld, and now the most encouraging signs are found in the interest displayed by the technical engineer and his ready approval of the process. Important metallurgical principles are introduced when metal is melted for welding, and no one can appreciate this more than the engineer. He finds in the process not only a fine tool for repairs but he already has learned to apply fusion welding to the manufacture of metal parts and in connection work. No modern mechanical process possesses more encouraging possibilities than the welding of metals by fusion. There are good reasons for this. Let us consider some of them.

An ideal condition would be to have all members of structure solid and without a made joint. The best piece of metal is the one of continuous grain, unriveted, unwelded, so that while a joint is a substitute it is well known that in many instances certain mechanical designs and repairs require either soldered, riveted or welded. For strength the choice must be riveted or welded joint. The riveted joint has its points of advantage and in many cases can not be superseded but it will not serve where uniform thickness of the metal of the joint is required, nor is it always to be depended on for tightness where there is breathing action and high pressure.

The welded joint is not of modern conception, the forge weld undoubtedly dates back to the earlier working of metals. However, the other kinds of welds have been in use less than 20 years. All welding is done by either one of two principles, plasticity or fusion. The forge, the electric resistance and the thermit compression welds depend upon plasticity, while the electric arc, the thermit cast and the oxy-acetylene welds employ the principle of fusion. The respective merits of these two methods of making welds are rapidly becoming well understood.

Welding by plasticity has accomplished much. We have but to consider the manufacture of ordinary wrought iron and steel pipe to appreciate the value of the forge plastic weld. The speed and non-oxidizing features of the electric resistance weld also have proved to the greatest advantage, as in the making of steel chain for example.

But the plastic weld is limited in its application and is confined almost entirely to mild steel. The fusio w however, has a broader range of se ness among the metals. Espec ly this true of the oxy-acetylene w which is applicable to mild ste steel, high speed steel, the ne a steels, cast iron, wrought iron, an um, copper, brass, bronze, le zinc, in fact all of the commercia le may be welded by the oxy-a yl torch. Now the possibilities of g fusion weld depends on (1) high strength, (2) ductility, (3) den control of the welders, (5) a method of testing welds.

Tensile Strength

The tensile efficiency of a w based on its thickness being t as that of the base metal. Th iency is of first importance, but not be obtained at the expense ibility, that is the bending and ing qualities of the metal. In t ing of steel, for example, the d is of much importance. Agai cure the proper tensile effici welded metal must be thorougl to the sides of the vee of the ba One of the best ways of securi tensile efficiency, say in mild to use a welding rod of nickle s ing a tensile strength nearly do of the base metal. The result to be a weld of higher tensile than its base metal. Of course ple reinforcing of a weld is practice.

Ductility of Weld

The ductility of a fusion welc larly of steel, must be consi though there now are some w argue that a weld does not nee bending quality. One of the trations of the value of duct steel weld is to be found in t facture of welded steel tubi can be made cheaper than drawn tubing. In order to ob size tubing the practice is to steel in diameters of from 1 t and then cold draw these tul smaller sizes desired, some of ing as low as 5-32 inch outsid with 1-12 inch hole. It is to

FUSION WELDING

At one time only the railroad shop superintendent and his welders were capable of appreciating the value of the fusion weld. At present we realize its benefits, and one of the most encouraging signs is the interest displayed by the technical engineer in this process.

A better control should be kept on welders. We should know exactly what such men are doing. The foreman should be capable of inspecting the work of the welders, and the men themselves should be trained to thoroughly understand the principles of their work. A night school class on the practical metallurgical end of the business would be a good thing.

Fusion welding made its debut in the repair shop but is now used in many manufacturing plants, and the work it has accomplished in the automobile industry is well known..

* The author is professor of Shop Practice, Steven's Institute of Technology, and presented this matter before the Cleveland section of the American Welding Society.

that this tubing has an oxy-acetylene fusion weld along its full length of many feet which must be capable of withstanding the strain of repeated cold drawing as the large tube is reduced to the smaller diameter. The weld not only withstands this treatment but also is found to be ductile enough to successfully stand being flattened, crushed, knurled or bended. The welding of the large size tube is done at the rate of from 3 to 5 feet per minute with multiple tips in an automatic machine.

Porosity

One trouble with welds has been the lack of homogeniety of the welded metal, and usually the trouble is due to oxides. This applies to all methods of welding but probably less trouble is experienced with the oxy-acetylene weld. In most cases the weld must be absolutely nonporous and the density of its metal should be equal to that of the base metal. A fine illustration of what may be accomplished in this direction may be found in some recent designs of electric sterilizing transformers. In this type of transformer a high voltage terminal is filled with a combination of helium and nitrogen gasses held at a constant pressure of 150 pounds to serve as gaseous dielectric. Of course it is necessary for the pressure of the gas to be maintained constant and therefore the welded joints of the transformers must not allow the gas to leak away. Many attempts were made to weld these transformers but the welds proved to be so porous that the gas pressure could not be maintained until the oxy-acetylene process was brought into use. This has proved highly satisfactory and the elimination of oxides has been so complete that the weld is absolutely nonporous so far as the use of gas at high pressure is concerned. Other evidences of the nonporosity of the fusion weld may be found in its use in refrigerating systems where anhydrous ammonia plays an important part. In this case the weld must withstand high pungent gas pressures and be absolutely tight. The oxy-acetylene weld has been very successful in this regard.

Control of Welders

There must be a better control of welders. We must know more exactly what these men are doing in all of their work. Much attention is being given to this problem at the present time by the American Welding Society. One plan discussed is to require the shop foreman employing welders to have a thorough knowledge of the possibilities of the art so that he may be capable of inspecting the work of the welders from time to time just as he is familiar with and can pass on the work of other mechanics in the shop. The welders themselves should be trained to thoroughly understand the principles of their work by giving them, say, an evening course in the practical metallurgy of the subject. With these precautions, and assuming the men to be of average intelligence and dependability the danger of poor welds should be greatly diminished. Many oxy-acetylene welding schools are springing up over the country and they will undoubtedly accomplish much good in this direction. There is another plan for controlling welders which is being considered carefully and undoubtedly will meet with much success. We speak of the testing of welds.

Testing of Welds

A number of ideas have been suggested for the testing of welds. Some shops require their welders to make sample welds each month which are tested and the results posted on a blackboard for all the shop men to read. This has both its advantages and disadvantages. Another plan is to cut out a section of weld, where it is practicable, and examine it for fusion and porosity. If the welder does not know just when his work is to be tested, he is likely to be forced to constant care. We know of some cases where welders are being required, after making a good sized weld, to stamp their initials and the date alongside of the job so that there can be no question as to responsibility for workmanship, if the weld fails. The testing of welds is of vital importance and it will be of interest to many to learn that a special committee of the American Welding Society is devoting considerable attention to the question at the present time.

In the above remarks we have briefly indicated the factors that usually determine the possibilities of fusion welding. Alongside of these may be placed the experience of thousands of repair and manufacturing plants of this country where the application of fusion welding is meeting with almost uninterrupted success and satisfaction. The fusion weld made its debut in the repair shop. It has proved itself of inestimable value in that place. During the past five years, however, it has been gradually expanded to the manufacturing plant where now it is of the greatest value. Its application to the automobile industry is well known.

There was a time when all steel tanks were riveted. Now there are millions of them being made each year with all welded joints. The all-riveted locomotive fire box is now being welded. Intricate castings which formerly it was impossible to make are now cast in part and welded. One of the newest and most interesting applications of the oxy-acetylene process is in the welding of telegraph and telephone wires. Some of the raildoads have started this practice with the idea of eliminating the ordinary twisted splice joint. The results show that the mechanical strength of the joint is often greater than the wire itself and that the conductivity efficiency in some instances is as high as 100 per cent better than the twisted joint. The first cost of the work may be higher than the twisted joint but the increased conductivity and the fact the joint will never have to be made again makes the welding highly preferable.

We might cite many illustrations of the possibilities of fusion welding in manufacturing, but probably what will be of greater interest to you will be to tell you of the success of the oxy-acetylene fusion weld in new alloyed steels. Fine success has been obtained in the experimental welding of steels such as nickel, chromium, tungsten, cobalt and vanadium. The depositing of alloyed steel on cheaper base metal where intense heat and wear are concerned has been successfully accomplished by the oxy-acetylene torch. This is opening up a fine field for fusion welding and making available certain applications of alloyed steels which were not practicable before.

Just as it is not difficult to produce convincing evidence of the value of fusion welding in modern shop practice, so it may not be considered too venturesome to prophesy the future possibilities of the fusion weld. A process which started as a makeshift of mechanics has become a sure right hand method of the technical engineer for the repair and production of machinery whose value is incalculable.

SOME WELDING HINTS.

In performing welding jobs, such as on aluminum crankcases, the following kink, given by a writer in the "Journal of Acetylene Welding," can be used to advantage. Often-times is it required to weld a large hole, in which case a chill of galvanized iron is provided, backing up the hole and welding against this when filling the hole with aluminum. Galvanized iron is preferable to any other material, such as tin or iron, since it peels away from the aluminum quite readily, and can therefore easily be removed after the weld has been completed. This is undoubtedly due to the zinc content of the galvanizing composition.

The chief value of the use of the chill is that it causes the filler to cool and harden prematurely, thereby preventing it from contracting after the weld is finished. It also prevents the heat of the weld from spreading, which might cause the job to crack back. The chill is fastened in place by a wrought-iron strap, made in the shape of a boiler crab, which arches the hole. A hole is then drilled through the strap and a similar one through the galanized-iron plate, the two being fastened together by means of a bolt and nut. In making the weld, the metal is first applied to the inner corners and the space filled up by working toward the centre.

Just before the centre is reached, and when it is impossible to add any more metal without touching the bolt, the strap should be loosened, the bolt removed, and the hole filled with the molten metal. Greater success will obtain if the work is done quickly, handling as large an amount of molten aluminum as possible at a time and covering the entire surface of the galvanized chill in a few minutes.

The chill causes the added metal to cool almost as fast as it is connected to the edge of the break. After the weld has been finished and cooled, the chill can be removed by gently prying it away from the weld by means of a cold chisel. The flame of the torch should be kept in motion while performing the work, and should not be pointed toward the weld, but rather across the melting portion; otherwise it is almost certain that the flame will not only injure the metal, but will also burn away the galvanizing if pointed directly toward the weld.



WHAT OUR READERS THINK AND DO

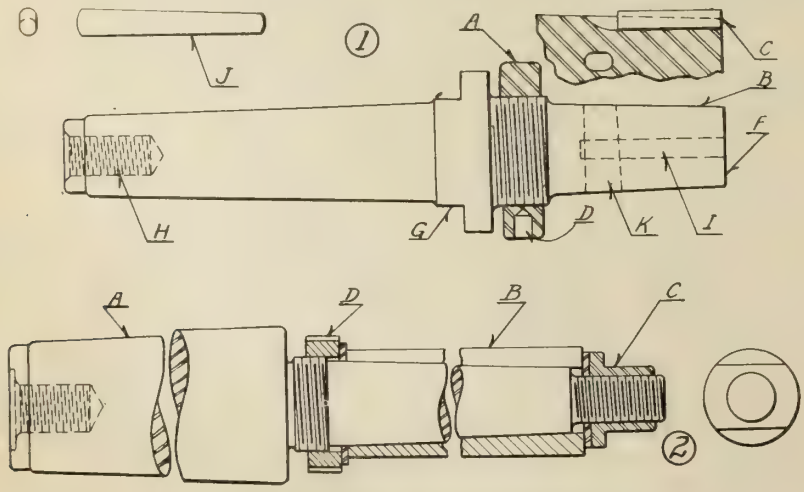


DESIGNING ARBOR FOR WORK REMOVAL

By F. S.

Where a work arbor is permanently attached to a machine it is often advisable to provide some means for forcing the work off after the machining has been performed. Two types of arbors with this end in view are here shown. Fig. 1 shows an arbor used in the tapered hole in a milling machine. The opposite end is intended for holding work with a tapered hole. The work is forced on the tapered diameter B and driven by the key C. The work is removed by means of the collar A, this collar being turned back against the work. In some instances arbors of this character are made with a nut and washer on the end F for forcing the work on the arbor. G is the driving portion of the arbor, the flats fitting into the slot in the milling machine spindle. The front end of this arbor is provided with a small tapered hole for holding small cutters, which are removed by means of a tapered pin driven through the hole K. This may also be used for removing work from the arbor.

The arbor shown in Fig. 2 is used for holding work with a straight bore, the work being placed over the diameter B of the split bushing. The nut C is used for expanding the bushing and holding the work, while the work is removed by action of the nut D—the opposite nut being released when either of the others is being used. These types of arbors may be made to suit any class of work, the dimensions being governed by the size and style of the pieces required.



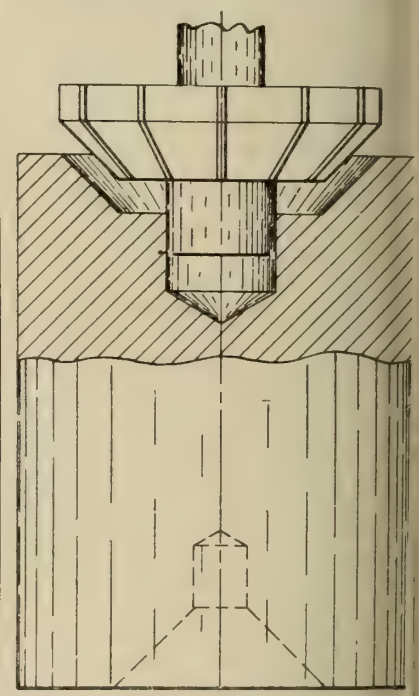
View showing the two styles of arbors.

SAVING WORN MACHINERY.

The high cost of iron and steel has stimulated engineers to develop efficient means of restoring parts which have become so worn that they are fit only for the scrap heap. A typical example is an engine crankshaft, which after a certain degree of wear, gets out of line to such an extent that it is useless. Welding has been largely used in the work of restoration, fresh iron or steel being welded on to the worn parts, and the whole then made true in a lathe. There are objections to this process in certain cases, and in order to overcome these objections a British engineer has developed a method of depositing nickel on the worn parts. The piece of machinery to be treated is first made free from grease and dipped bodily into a bath of molten wax. After the wax has cooled it is removed from the parts which have to be restored and is left on the others as a protective covering. Cleaning in a bath of acid is followed by immersion in an electro-plating bath which deposits nickel on the exposed surfaces. The coating of nickel is extremely hard, and when the process is properly carried out the nickel adheres with remarkable tenacity to the metal on which it has been deposited. Crank shafts, spindles, axles, pistons and similar objects can be made quite serviceable again by the nickel layer at a cost below that of replacing the whole part. Deposits up to one-eighth of an inch can be applied successfully. It is expected that this process will be developed alongside the welding processes which British engineers have brought to so high a pitch of usefulness in many repairs, such a the mending of cracked or broken cast ings, which could not be handled by th deposition of nickel.

VALVE GRINDING

How much of a valve do you waste grinding it in? The superintendent of a refrigerating plant hit upon a scheme to save valves and seats when they were ground in. In such a plant, valve grinding reaches the stage of a fine art and, as most of the parts are expensive, a saving along this line is worthy of note. The scheme may be seen by observing the drawing. The



plant used the conventional type of valve seat refacing tool for touching worn and pitted seats. Then instead of grinding the valve to a fit in the newly faced seat it was ground down in a false seat made in the end of a piece of soft steel. This false seat was reamed with the seat facing tool and so partook of the same bevel. By wearing down the rough in this false seat, the seat in the valve was saved just that much—and that was saved in an unrenewable part. When the valve looked perfect, it was placed in its final position for a close fitting grinding with its mate. These false seats were made up for all sizes used in the plant.



A Locomotive Punch Press

CAN YOU imagine a locomotive acting as a punch press? During the war, a locomotive was used in such a capacity with great success. According to the story, which is told in the proceedings of the civil engineers' journal of France, the Bordeaux works of the South of France Railway Company, like all other works in France, were called upon at the outbreak of war to adopt a portion of their machinery to the making of "75" shells, starting from steel bars cut to length. These were upset hot in a die and given successively preparatory shapes previous to the final shell shaped form. There was no time to wait for a hydraulic punching or draw down operation, so to save time a powerful locomotive was pressed into service. The engine was moved to a position in front of a stout wall on which the drawing-down die-holder was supported. The locomotive was then raised so that the wheels were clear of the rails, and a punch was fitted to the tail rod of one of the pistons.. A cup was then heated to a red heat and placed in the die. The test being successful, it remained necessary only to make the installation more convenient for use.

This was accomplished as follows: The buffer beam of the ngine was replaced by a much stronger one, built of plates nd sections, and fitted. in front of the cylinder utilized for the lrawing-down operations, with the die-holder, a kind of casing pen at the side for inserting the die. The cups were heated in reverberatory furnace erected close to the locomotive. On eaving the furnace, the base of the cup was slightly cooled by mmersion to a depth of from 2 to 3 centimeters in a tank of vater maintained at a constant level. At the same time, the ottom of the cup was freed of scale by means of a kind of nilling cutter worked by a small portable drilling machine lriven by compressed air, suspended from a jib and maintained t the right level by a counterweight. The cup cooling was so levised as not to water-harden the metal; it merely imparted to t sufficient resistance to prevent the punch from driving hrough the base of the cup. While the cup was being made eady, the man in charge of the punching inserted the first die, luly greased; his assistant then placed the base of the cup in he die, the regulator valve was opened and the punch drove he cup through the die. As soon as the forging had been riven through, the die, which in the process had been raised nd placed exactly in the axis of the cylinder, fell back in its eating and constituted a stop which helped to strip the forging rom the punch as the piston travelled backward. The forging hen fell on a gutter plate, whence it was removed and replaced n the punch when the piston was in the rear position.

The other two passes were accomplished in similar manner nd during the drawing-down operations, the punch was cooled y water jets and the dies were freed of scale, cleaned, greased nd placed in order for each successive operation. The nstallation ran successfully for about two years and produced everal thousands of 75 millimeter shells, pending the putting own of a more suitable hydraulic plant. ,

A New Style of Inducement

THE labor turnover in a printing plant near Chicago is only one-fourth what it used to be according to Frank H. Williams, who tells the story in a recent issue of Industrial Management. A phonograph is the cause of this change for the better. t seems that some six months ago this company installed a egular cabinet size phonograph in the shop. The workers are free to play the phonograph whenever they wish to do so. And ever since it was installed the workers have been sticking to their jobs as no workers in the plant ever did before and they have also been turning out more work and better work than was ever turned out by the plant before.

The phonograph was purchased by the company and by the workers themselves. The plant made the initial payment of $75 on the machine. The remaining sum of $75 still due on the machine was paid by the workers in monthly installments. The sum was raised by the workers paying in a definite sum of money each week to one of their number who in turn, took the payments to the concern from whom the machine was purchased.

In addition to making the initial payment of $75 on the machine, the company bought six records for it when first installed. Since then the company has also purchased other records from time to time.

But the employees wished a greater variety of records and now raise a regular sum of money each week to be used in the purchase of new ones. Also those employees who have phonographs at home bring records to the shop for use during the day.

Mr. Williams goes on to say that the use of the phonograph has unconsciously made the men work faster. Even the president of the company has gone into the shop and watched the workers when the phonograph was not running and again when it was playing some good tune. Without the music the workers plow along at the same old speed. But when the music starts, their fingers fly at a greater speed over the cases and they feed jobs faster than they ever fed them without the music.

The actual monetary value of the phonograph to the shop is a real item, as the manager figures that every time an old men quits and a new man takes his place the cost of this operation is at least $250. This cost comes in slow production by the new man while he becomes accustomed to the shop, in spoiled jobs which every new man is pretty sure to turn out, in jobs which must be reset because they are not set in keeping with the shop's style, and in time spent by the company executives in breaking in the new men. The phonograph has been in continuous use for six months and the interest in it is just as great as when it was first installed.

The Value of Study

SPEAKING on the value of study, L. A. Herbert in the "Service Bulletin.' says that to his mind studying is the greatest opportunity to succeed that the world ever offered to humanity. "If you won't study, you won't learn;" "and if you won't learn—then the other fellow will enjoy the success that would otherwise have been yours.

"Studying should not be viewed as something to pass away the time, but as a serious, important piece of work that concerns your success. Studying gives you the power to accomplish the things that you do not now have the power to accomplish.

"If you don't like to study—but would like to succeed—your position is inconsistent with the proven law of success. Studying is a simple and easy method of making success come quicker. It's like advancing the calendar of your progress several years.

"Studying is the pumping station of knowledge. It enables a man to get full benefit of other men's bought-and-paid-for experiences."

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Any reader who does not receive a scale within one week after his name as winner has been announced, should write us at once so that we can trace the matter up. Look for the winner next issue.

CONTEST OR AUGUST 25TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something that runs at 1000 R.P.M.
2 How to successfully waste money.
3 A product that has adjustable cutters.
4—Something small for something big.
5 –Wastes that are occurring unseen.
6—Something that is Canadian Made.
7 A case where special models are developed.
8 Two things that are said to never leak.
9—A product with three protective coatings.
10 A help to transportation development.
11—How to obtain two very essential qualifications.
12 Something that uses no electricity.

As there was no contest in the August 4th issue, we cannot report a correct list of names.

Closing Date for This Contest is Sept. 15th

The Quenching of High Carbon Steels in Water

Are Cracks in Steel Caused Through Two Factors?—Tables Showing Result of Experiments—Rate of Cooling During Quenching—Theory of Quenching—Summary of Points Investigated.

It is a well-known fact that during the quenching of high carbon steels in water, cracks are often formed on their surfaces. The cause is generally believed to be:

1st. The non-uniform distribution of temperature in the specimen during quenching.

2nd. The difference in martensitic expansion of adjacent parts during quenching.

A closer examination of the phenomenon shows, however, that the true cause is not so evident, as the sound due to cracking is often heard some ten seconds after quenching. The thermal stress is maintained so long as the temperature is not uniform throughout the specimen. For instance, in a short cylinder, about 2 centimetres in thickness and height, the difference in temperatures between the interior and exterior parts, during the first stage of the quenching process, may amount to several hundred degrees, and consequently a great stress will result, but after about ten seconds it does not exceed 20 degrees, and hence there is only a small residual stress. Again, at the moment of transformation of austenite into martensite during cooling, considerable expansion in volume occurs. In the case of rapid cooling the transformation does not, however, take place at the same moment at every point within the specimen. Hence a great stress due to unequal martensitic expansion will result which may lead to cracking, although after several seconds, during which the A1 transformation passes over the whole mass, this stress will also vanish.

If the cracks were due to the two causes above-mentioned, why do they not take place during the first stage of quenching, when the specimen is undergoing a large amount of internal stress, and why do they take place after a lapse of time? It is, of course, conceivable that at a very high temperature the material yields to an enormous thermal stress, and therefore this stress is subsequently released, in which case a thermal stress of considerable magnitude may result at room temperature, and may be the cause of the cracks occurring some ten seconds after quenching. The fact that in a high carbon steel, when quenched from a sufficiently high temperature, the cracks are produced immediately after quenching, shows, however, that a greater part of the thermal stress is not released by yielding, otherwise the immediate cracks would not take place at all.

It is a well-known fact that quenching cracks can often be observed in carbon steels or in steels with a small content of other elements, but that it is hardly possible to obtain such cracks in pure metals. These facts lead to the conclusion that the above causes of cracks are not sufficient to account for the observed facts. The present investigation was therefore undertaken to find the real cause of the phenomenon in question.

In order first to show that the cause of quenching cracks is not pure thermal stress, the following experiment was first made: Several cubes, 2 centimetres on each side, were made of steel containing 1.26 per cent. of carbon, and each cube was attached to the end of a thick iron wire, 2 millimetres thick and 30 centimetres long, by means of which it could be placed in the centre of an electric furnace, and be quickly removed for quenching. The furnace was of the resistance type, 25 centimetres long, consisting of a nichrome wire; its temperature was measured by means of a platinum and platinum-rhodium couple. The cubes were quenched in water from different high temepratures, and the quenching temperature at which cracking occurred was observed. If the crack did not occur, the same cube was used twice for quenching, and then renewed; if it cracked, a new one was always substituted.

The following table contains the result of the experiments:

Quenching temperature	680 deg.	700 deg.	750 deg.	770 deg.	800 deg.	820 deg.
Remarks	No Crack	No Crack	No Crack	No Crack	Crack	Crack
Cooling (the specimens first heated to 900 deg., then cooled and quenched).						
Quenching temperature	800 deg.	770 deg.	750 deg.	730 deg.	710 deg.	690 deg.
Remarks	Crack	Crack	Crack	Crack	Crack	No crack

From this table it is seen that during heating the crack does not occur unless the quenching temperature exceeds 800 degrees. During cooling from 900 degrees the quenching crack is always observed down to a temperature of 700 degrees, and not observed at any lower temperature. This limiting temperature is much lower than that during heating. As is well known, the Ar1 point is always lower by about 40 to 80 degrees than the Ac1 point; hence, from the above result of quenching experiments, it may be concluded that during heating or cooling the crack occurs when, and only when, the quenching temperature exceeds the Ac1 or Ar1 point, respectively. Hence the cause of quenching cracks is not pure thermal stress caused by non-uniform distribution of temperature due to rapid cooling, because if such were the case there would be no reason for the cracks occurring beyond the A1 point. The cracks must, therefore, have some connection with the A1 transformation.

In a soft quenching, cracks usually occurred in ten to fifteen seconds after quenching in water; they could be distinctly detected by the sounds accompanying cracking. The same fact also indicates that the thermal stress is not the direct cause of cracking because the cracking occurs after a lapse of time, where a greater part of the thermal stress due to the unequal cooling of the specimen passes off. As is well known, during cooling through the Ar1 point the specimen undergoes a considerable expansion due to the A1 transformation. Since during cooling the outer portion is always at a much lower temperature than the inner portion, the former, during the said transformation, exerts a great impulsive tension on the latter, and this may cause a crack in the specimen. But the fact that cracks often occur after the impulsive stress due to the Ar1 transformation is passed over, shows that the impulsive stress is not the actual cause of quenching cracks.

To get a general idea of the rate of cooling during quenching, a cylindrical piece having the same dimensions was made of the same material as the test specimens. It had two holes bored parallel to its axis and to its middle height, their inner diameter being each 2 millimetres; one hole was bored at its centre and the other just inside the lateral surface. In one experiment a platinum and platinum-rhodium couple was well insulated and inserted into the middle hole, its junction being, however, bare and in direct contact with the specimen, while the other hole was packed with kaolin. In another experiment the couple was inserted into the side hole while the central hole was packed with kaolin. In each case the cooling was measured by a milli-voltmeter with a pivoted needle inserted in the circuit of the couple, the motion of the needle being almost dead beat.

The result of quenching experiments will be next described. The investigation consisted of the measurement of hardness in quenched specimens by means of a Shore scleroscope, the distribution of internal stress being thus found. Four kinds of carbon steel containing the following constituents were chiefly investigated:

No.	Carbon per cent.	Manganese per cent.	Silicon per cent.	Phosphorus per cent.	Sulphur per cent.
1	0.28	0.25	0.42	0.032	0.070
2	0.68	0.51	0.19	0.029	0.027
3	0.91	0.31	0.11	0.027	0.004
4	1.47	0.25	0.34	0.040	0.004

The specimens were tested in the form of a cube, each side being 2.7 centimetres, or a short cylinder, 2.6 centimetres in diameter and in height. On a surface of the cube or the cylinder a narrow hole, about 3 millimetres deep, was bored, and a thick steel wire screwed in, as shown in Fig. 3; this wire served as a holder in the subsequent work. The specimen was placed horizontally in an electric furnace of nichrome wire, and heated to the required temperature. After maintaining the specimen at this temperature for ten minutes, it was quickly taken out of the furnace and dipped vertically into a water or oil bath, followed by a constant stirring, until the temperature of the specimen fell to that of the bath. The specimen thus quenched was polished with emery paper; sometimes it was at first ground with carborundum, care being taken, by dipping it frequently in water, not to heat the specimen too much, since heating may affect the structure and consequently its hardness. The specimen was placed on the platform of a Shore scleroscope, and the position of a point, at which the hardness was to be measured, was read on a section paper pasted on the platform. In the case of the cubes, the number of points by which the hardness was measured amounted to 36, and sometimes more, if necessary. These 36 points were divided into three groups, the outer group consisting of 20 points at the periphery, the inner group 4 points about the centre, and the middle group 12 points situated between these two. In the case of cylindrical specimens, the number of points amounted to 24 in all, the outer group being 12, the middle 8, and the centre 4. In cases when the general character of the distribution of hardness is to be sought, the mean value of hardness in each group was taken. The results of experiments showed that:

(1) In a soft quenching, such as in oil from a temperature not exceeding 820 degrees C., the hardness of different specimens is greatest in the outer portion, and decreases from its periphery towards the centre.

(2) In a medium quenching, such as that of a steel 0.9 per cent. carbon at 780 degrees in water, or that of steel 1.47 per cent. carbon at 900 degrees in oil, hardness is nearly constant everywhere.

(3) In a hard quenching, such as that of steel containing more than 0.68 per cent. carbon from 800 degrees C. or a higher temperature in water, the hardness is least in the outer portion and increases rapidly towards the centre.

(4) When cracking takes place, lines of cracking cut equi-hardness curves almost orthogonally. The form of equi-hardness curves is elongated in a direction normal to the line of cracking.

(5) In the cubes, the equi-hardness lines become roughly circular or elliptical at a short distance from the periphery. The same remark applies naturally to the case of cylindrical specimens.

(6) By grinding away a few millimetres from the surface layer step by step, the irregular deviation of equi-hardness curves from a circle or an ellipse gradually diminishes.

In the present experiment, cracking occurred in most cases, when the temperature of the specimens fell nearly to that of the bath. From the above, the following facts may be inferred:

(7) The hardness does not increase appreciably, so long as the quenching temperature is below the Ac1 point.

(8) When the quenching temperature increases beyond the beginning of the Ac1 range, the hardness rapidly increases, reaches a maximum at about 820 degrees, and afterwards slightly that the hardness of the outer portion decreases. It was found out from curves that the hardness of the outer portion was less than that of the middle portion and that the centre portion was greater than all.

One important fact discovered by the present investigation (3) is that in a hard quenching the outer portion is softer than the inner. This abnormal phenomenon is satisfactorily explained by the theory of quenching put forward by a writer in Science Reports.

According to that theory of quenching, the so-called A1 transformation is not a single, but a compound transformation, consisting of

$$\text{Austenite} \underset{\longleftarrow}{\longrightarrow} \text{martensite} \underset{\longleftarrow}{\longrightarrow} \text{pearlite.}$$

Thus, during a slow or rapid cooling, austenite is at first changed into martensite, which is then transformed into pearlite. During a very rapid cooling, such as a quenching, the change from austenite to martensite is so far retarded that when it is completed the specimen is nearly at room temperature, and therefore the next change from martensite to pearlite cannot progress, owing to the high viscosity of the material at room temperature. During a slow cooling austenite changes into martensite, and the latter, still at a very high temperature, changes immediately into pearlite. During heating, the A1 transformation consists in the reverse change, that is, from pearlite to austenite through martensite.

With regard to the volume per unit of mass, the relation is:

$$\text{Austenite} < \text{martensite} < \text{pearlite};$$

for martensite is known to exist in a more dilated state than austenite, as is seen from the expansion curves at high temperatures. Hence in the A1 range, during slow cooling, the elongation is a differential effect of the expansion due to austenite—>martensite and of the contraction due to martensite—>pearlite; during slow heating, the contraction is a differential effect of the expansion due to pearlite—>martensite and of the contraction due to martensite—>austenite.

In quenching experiments, the rates of cooling in the outer and inner portions of the specimen differ considerably from each other. In the outer portion where cooling is very rapid, not only the second change of the A1 transformation—martensite to pearlite—is stopped, but also its first change—austenite to martensite — is partially arrested, so that this portion ocntains a certain amount of austenite intermingled with martensite. In the inner portion the rate of cooling is not so rapid, and hence the austenite is mostly transformed into martensite; but its further transformation into pearlite is arrested. Since the austenitic structure is much softer than the martensitic structure, it is to be expected that the outer portion, containing a greater proportion of austenite than the inner portion, will be softer than this portion.

If the above view be correct, for soft quenching, such as quenching in oil from a moderately high temperature the outer portion may be just fully martensitized, while in the inner portion the transformation from martensite to pearlite is partial. In this case, the outer portion must be harder than the inner portion, as is actually brought out by experiments. In a somewhat harder quenching than in the last case, the outer and inner portions may possess nearly the same hardness. The fact that above 820 degrees the hardness gradually decreases as the quenching temperature increases, is explained by the same theory, that is, by a gradual increase of austenite arrested and mixed in martensite.

Several quenched specimens were examined microscopically to see whether any appreciable decarburization actually occurred; but except narow edges, or at least in portions where hardness was measured, decarburization was negligibly small. Hence the less hardening of the outer portions cannot be explained by decarburization. It is the common experience of smiths that by quenching pieces of steel in water, the edges are much softer than other portions; this fact is usually explained as the effect of decarburization during heating. In many cases, however, it is caused by the arrested austenite during quenching.

The cause of cracking was next investigated in a series of equi-hardness curves for a number of carbon steels with varying percentages of carbon, quenched from varying temperatures. These curves accompanied the original manuscript, but as their reproduction would have been attended with certain difficulties, they have been omitted from the paper, and are filed in the Institute library, where they can be consulted by any member interested in the subject. Since the form of the equi-hardness line was elongated in the direction perpendicular to the line of cracking, it is to be concluded that the martensite development is greatest in the elongated central portion and least in the peripheries; hence the martensitic expansion in the former portion is much greater than

at in the latter portion. The central ortion exerts, therefore, a great tension n both sides, this tension causing the racking of the specimens. This is why nes of cracking are normal to the ongated equi-hardness curves. Since ie difference in the specific volumes for artensitic and austenitic structures ncreases rapidly as the temperature lls, it may be understood why crack-g generally occurs when the tempera-re of the specimen approaches to room mperature.

Having thus far explained the dis-ibution of hardness and crack lines, ie question of how to avoid quenching racks arises. In quenching practice it not necessary to get very great hard-ss, except in the case of cutlery. It also evident from the above investiga-on that to obtain a martensitic struc-re too rapid cooling is unnecessary. order, therefore, that the specimen ay not crack during quenching, but at its hardness be properly developed, ienching must be medium hard, such as ienching in oil from 900 degrees, in hich case the hardness is nearly con-ant throughout the specimen; hence e stress due to the difference in the ructures is small, and consequently acking cannot occur. For a given eel, the quenching temperature of no acking can be experimentally found in e following way: The specimen is ienched in oil from three different tem-ratures, 800, 900, 1,000 degrees, and e hardness at the outer and central rtions is measured. Two curves of rdness-quenching temperature for ese two portions are drawn. The tem-rature corresponding with the inter-ction of these curves is that required; r quenching at that temperature uses nearly equal hardness in the out-le and central portions.

According to the above view, in a hard enched steel some austenite remains transformed at room temperature, at ich this austenite will slowly trans-rm into martensite. On the other nd, at room temperature martensite s a tendency further to be transformed o troostite, but its velocity is much aller than that of austenite—>mar-site just referred to. The conse-ence is that at room temperature a d quenched specimen will slowly in-ase its hardness with lapse of time. test this inference the hardness of a enched specimen was measured from me to time in the usual way, and its ean value plotted against the time er the quenching.

If the quenched specimen be constant-heated at 100 degrees, instead of let-g it remain at room temperature, the ove change from austenite to marten-te will be much accelerated; at the me time the change from martensite troostite will also be accelerated. nce the hardness first increases, aches a maximum, and then slowly creases.

In quenching a large piece of steel e distribution of hardness in the outer layer is exactly the same as in the case so far discussed; but in the innermost portion, where cooling is slow, the micro-structure becomes troostitic, and there-fore the hardness is here considerably smaller.

Summary

The result of the present investiga-tion may be summarized as follows:

1. In a quenched steel a certain amount of austenite is generally present inter-mingled in martensite. The amount of this austenite increases as the quench-ing temperature increases.

2. In small pieces of steel the per-iphery is harder than the central portion only when the quenching is very soft. In a moderate quenching the hardness is everywhere nearly equal, but in a hard quenching the periphery is always softer than the interior. This anomal-ous phenomenon is explained by the pres-ence of the arrested austenite in mar-tensite.

3. The quenching cracks in small pieces of steel occur when the hardness in the central portion is much greater than in the periphery. The cause of the cracking is attributed to the stress caused by the difference in the specific volumes of austenite and martensite; the specific volume of the former structure being much smaller than that of the lat-ter the central portion exerts a large tangential tension on the periphery, causing thereby the cracking of the specimen.

4. Since the difference in the specific volumes increases as the temperature falls, the cracking usually takes place when the temperature of the quenched specimen approaches room temperature.

5. In a hard quenching, the hardness generally increases with the lapse of time, owing to a gradual transforma-tion of the arrested austenite into mar-tensite.

6. In the case of a large specimen, cracking may take place in the A1 range, and also in the vicinity of room temperature. The cracking at the high temperature is chiefly caused by the stress due to the structural difference between the inner and outer portions—pearlite and austenite—just below the A1 point; that at room temperature is due to a similar stress as in the small specimens.

JAPANESE CEMENT INDUSTRY

The remarkable development of the cement industry in Japan is the subject of an interesting article in a recent num-ber of the Weekly Druggist, Tokio. It is pointed out that although the manu-facture of cement in Japan was com-menced in 1880, it was not until 1916 that an export trade was started; but from that date the productive capacity advanced at a rapid rate, until in 1919 it stood at 6½ million barrels, as against only 1¾ million barrels in 1908. The enervating dullness which sapped the energy of Japanese industry generally on the termination of the war had ap-parently little effect on the cement in-dustry. This singular immunity from so comprehensive a depression was preserved by the active promotion of the hydro-electric schemes and of general building and engineering works. The prosperity of the industry naturally res-ulted in the establishment of a number of new concerns. In 1914 the number of cemet manufacturing companies was twelve, with a total investment of 32 million yen, but at the end of 1919 the number increased to more than twenty, with a total investment of over 44½ million yen. The frantic establishment of innumerable businesses, always the concomitant of a boom, was only to be followed by a closing down of these petty concerns on the first signs of in-dustrial depression. As to the future, the article strikes anything but an op-timistic note. The industry at present appears to be suffering from the prevail-ing depression. The war prosperity was evolved rather out of the stoppage of imports from Europe and America than from any inherent qualities which Jap-anese cement might have possessed, so that it is not surprising that the export of cement from Japan should decline with the termination of hostilities and the restoration of industrial capabilities in Europe and America. For the present, the export of cement has not suffered to any appreciable extent as compared with 1919, but that Japan will be able to re-tain the foreign market she had ac-quired during the war is regarded as doubtful.

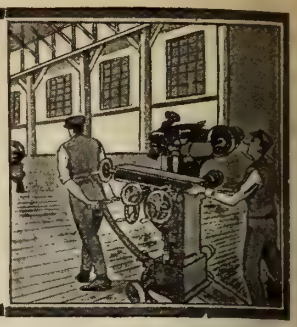
NEW METALLURGIC PROCESS

A process recently invented in Ger-many is said to provide a simple and ef-fective method of separating alloys into their metal components and extracting metals from mineral ores. According to reports, this process will have many advantages over the hitherto employed method of melting alloys and separat-ing the metal components. In this proc-ess the metals treated with the catalytic agents go into solution in a very short time, the treatment of big blocks of metal being effected in less than 30 minutes. Out of the solution thus ob-tained the various metals are dissected by the employment of simple methods of chemical reaction, which permit the re-taining of the metals one by one. The product first obtained is in the form of a muddy sediment which, after being dried, yields a metal powder ready to be used or melted in cruclbles, or to be treated by electrolytic process. Metals and concentrated ores can be treated in the same general way, although they re-quire one or two more operations than pure metal alloys.

The Webster and Perks Tool Co. Springfield, Ohio, have turned over an sold their grinding and polishing stand and accessory department of their bus-iness to the Hill Curtis Co. Kalamaozoo, Mich. The latter Co., at present op-erate a well equipped foundry, forge, machine shop, etc.



DEVELOPMENTS IN SHOP EQUIPMENT



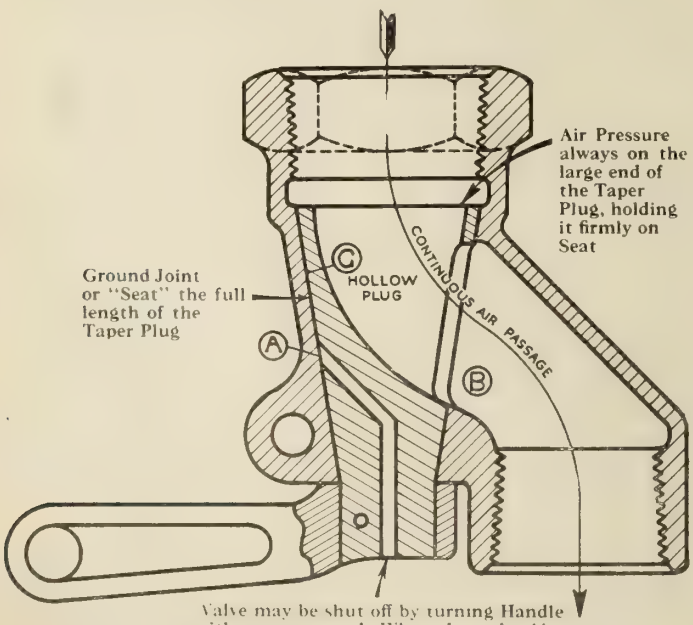
PRESSURE SEATED AIR-VALVE

The Cleveland Pneumatic Tool Co. of Cleveland, Ohio, has recently brought out an air valve for general use in air service which contains new features of great interest to all users of compressed air. The sectional drawing illustrates the new valve.

The destructive action of compressed air upon valve seats, packing and gaskets is well known and there has been for some time a demand by air users for a valve that would stand up in high pressure pneumatic service; in view of the above it was determined to design a valve in which the air could not come in contact with the seat—thus avoiding replacement of seats, and also to utilize the air pressure as a "seating agent" to hold the valve plug on its seat—thus eliminating packing, gaskets, stems and springs and reduce the valve parts to three, i.e., body, plug, and handle.

This was successfully accomplished by using a "hollow taper plug" with the large end uppermost; the air entering at the top, passing through and out of an opening in one side of the hollow plug into the supply chamber which connects directly with the air hose without the air coming in contact at any time with the valve seat—ground joint—which is the outer wall of the plug as indicated by the letter "C" on the drawing. The long "Arrow" shows the direction of the air in its travel through the wide unobstructed air passage of the valve which is free from any angle turns to impede its progress. The short arrow indicates the "point" on the large end of the plug where the air pressure is constant forcing the taper plug against the walls of the valve body forming a perfect seat. The valve is provided with a unique waste arrangement to allow the accumulated pressure in the air hose to escape to atmosphere when the valve is shut off as shown by air ports "A" and "B" on the drawing; this is to safeguard the operator who, when disconnecting the hose from valve often receives a gush of air in the face and accidentally gets scale or grit in his eyes.

This new valve has been subjected to severe service tests under both high and low air pressures, the high being 500 pounds, as well as submerged water tests and has successfully passed the most exacting tests that could be devised on liquids under pressure and on acetylene gas lines.



Sectional View Through Valve

NEW CLEANER

The Hanson & Van Winkle Co., Ltd., Toronto, Canada, have placed on the market a new cleaner called "Roylite." This solution is said to be the latest development in the process of chemicall removing oil, grease, enamel, paint o any kind of dirt from metal efficientl and quickly. It is said to contain cer tain alkali elements which will dissolv animal fat, oil, grease or buffing com positions, and it is claimed that th chemicals do not precipitate, but are a soluble and are held suspended in solu tion indefinitely, this, of course, enablin the use of the bath with less addition

There are various ways in which can be used, but best results are ob tained if the articles are immersed i tanks of hot solution; the hotter th better. Boiling hastens the action, an the chemicals used readily dissolve i water and are instantly ready for us The length of time required for clean ing depends on the nature of the work but it is said that no matter how lon the parts are left in the solution the will not tarnish or discolor.

The use of electric current increase its efficiency, and in some cases the wor can be entirely cleaned in two or thre seconds. After cleaning articles of ste and iron in this material they can b left to dry without fear of rust as th solution prevents oxidation. Followin are a few of its uses:

Cleaning all kinds of metals; remov ing paint, varnish, shellac or japan scouring floors, bottles or any kind o utensil, and any plan where caustic sod potash, lye or similar alkalis can b used. It will not harm the operator hands nor cause any obnoxious fumes.

When it has been used for some tim it may, according to the makers, be re juvenated by merely adding mor cleaner. A case is stated where 50 pounds of this solution cleaned 5,00 rims, or the equivalent to 20,000 squar feet of surface; and at the end of th operation several thousand further rim were cleaned merely by adding 10 pounds more of the cleaner.

FLOOR GRINDING MACHINE

A new design of motor driven grindin machine has been added to the line manufactured by the Marschke Manufa turing Co., of Indianapolis, Ind. It designed for heavy duty with the rota of the motor directly connected to th drive shaft, which is mounted on fou Hess-Bright ball bearings. The contr for the motor is placed in the pedestal o the machine, the operating lever protru ing through the front of the frame. Ma

SURFACE GRINDING MACHINE

An automatic surface grinding machine has been developed and marketed by Wm. Osterhom, consulting engineer, 1301 N. Knox Ave., Chicago, Ill. This new machine is intended for the surfacing of parts in large quantities, and will handle work up to 12x40 in. It is said to handle them rapidly and economically. The machine is fully automatic, with the exception of locating the work and locking it in a suitable fixture which is mounted on the table, being moved across the surface of the abrasive wheel by means of a cam. Upon the completion of the cycle of the cam, the fixture is tilted back 45 degrees away from the wheel, thus allowing the operator to remove the work. Provision is made for varying the length of the stroke, and a change gear box allows for varying the time of the cycle from 10 sec. to 2 min. depending on the work.

The feed of the wheel is automatically controlled by a cam this feeding the wheel gently forward on to the work during the grinding operation. The action of starting the grinding after placing the work in position is accomplished by pulling a handle on the top of the machine, which throws the belt on the tight pulley behind an arresting lever. The sheer drop on the cam releases the arrest lever, and also raises the work to the grinding position. A series of steps on the cam communicates a rotary action to a shaft to drive the wheel housing forward a preconceived distance against the work. A quick return of the lever to its original starting point traps the shifter arrest lever, unlocks the tilting work table and stops the action of the machine. An emergency stop is also provided.

Wear on the wheel is taken care of by means of a graduated handwheel, and a lever adjacent to the change gear box allows the operator to stop the rotation of the cam, but gives free swinging of the work arm, this allowing for the dressing of the wheel.

The machine can be equipped with automatic magazine feed. In this case, two magazines are used, one for receiving and one for delivery. The magazines control the operation of the machine as long as they are properly attended to. If the receiving magazine gets clogged up, the machine will stop, and will, also, if the raw material magazine is emptied up to a certain point. This method of grinding is adaptable to such work as facing of thin, hardened pieces of steel up to 6x6 in., thrust washers, and anything that can be handled and magazined properly. The plain grinding machine is recommended by the maker on such grinding as manifolds and housings where a 2-minute grinding cycle is used, one operator handling four machines. A cylinder wheel, 20 in. in diameter, 8 in. thick and having a 10-in. hole, is used. The weight of the machine is 7,800 lbs., and 20 h.p. is required when working at full capacity.

COMPARATOR DIAL

The B. C. Ames Co., Waltham, Mass., have developed and marketed a device which is intended for use in manufacturing plants on production work, as well as in the inspection department. This device is known as a comparator dial, and all parts are protected from dust and all bearing surfaces hardened and ground. The gage is adapted to use on most work ordinarily checked by micrometers, but the gaging pressure is controlled by a spring. The dial is 1 7-8 in. in diameter. A movement of 0.0005 in. at the measuring point appears at 1-16 in. on the dial. The point has a travel of ¼ in. so that although the gauge be set to a 0.5000 in. standard it will measure from 0.5000 to 0.750 in. The gage is useful on shafts or bushings having more than one diameter of nearly the same size. A stop is furnished for positioning round work. The device is furnished with two anvils, one 1-2x2 in. and the other 2x2 in. and scored. It stands 10 1-2 in. high, weighs 10 lb. and is finished in black japan.

STRADDLE MILLING MACHINE

The Newton, Machine Tool Works Inc., Philadelphia, Pa., have placed on the market a straddle milling machine, which is known by the trade name Model C-70. This is a specialized machine used for such work as the facing of bearings for crank-shaft of automobile engines, at the same time milling the oil slinger grooves. The feed motion on this machine is obtained by vertical movement of the table, and the loading and unloading is done at the top of the stroke. The spindle carrying the cutters does not change its position. The table of machine is raised and lowered by a cam providing slow feed and a quick return. The cutter mandrel is driven from both ends and is supported between cutters by bearings this preventing the tendency to buckle. Spacing collars are provided to hold the proper dimensions between the cutters these giving variation of 0.002 in. The machines can be equipped with a different number of cutters.

BUTT WELDING MACHINE

The Winfield Electric Welding Machine Co. Warren, Ohio, have marketed a butt welding machine known to the trade as Type B 6. This machine is self-contained and is intended for flash welding high-steel drills, handling ¼ to ¾ in. in diameter. A 15-kw. transformer and a 6-step self-contained regulator are provided. The lower dies are copper and the upper dies tool steel. Water circulates through all copper terminals.

Dies located at the front of the machine clamp the work and a single toggle hand lever is used to upset the weld. It is said that the machine is so constructed that the small particles formed by the flash cannot get into the bearings and moveable parts. The machine occupies a floor space of 42x40 in., the height of the dies is 36 1-2 in., while the complete weight is approximately 1,000 pounds.

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B. G. NEWTON, Manager
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J. H. MOORE, Technical Editor
T. H. FENNER, Associate Editor
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The Care of Belting

IN another portion of this issue will be found an article on "The Care of Belting." If belting received the attention it deserved such an article would be unnecessary, but unfortunately many run away with the idea that belts take care of themselves automatically. The foolishness of such a belief should be self evident to everybody, especially mechanics, but apart from a casual and occasional daub of dressing spread carelessly, the average workman leaves belting to its own devices. Others imagine, that a tight belt is bound to be all right. There is no thought of, perhaps, an uneven drive; the center of the driven shaft being too near to that of the driving shaft, and the one hundred and one things that can make or mar the finest belt produced.

Many a workman has condemned a belt, when he himself was to blame. Our shoes wear out quickly or slowly according to the use, or abuse we give them. In like manner a leather belt, in fact any belt will wear out rapidly if abused. It pays to make sure the pulley is running true, and that the shaft on which the pulley revolves is properly aligned. When selecting a belt do not consider first cost only. Service, not first cost, is what counts. It is much better to pay a little more for belting, than to buy a poorer grade, only to find that in a short time machines have to be shut down until a repair can be made.

This may seem unnecessary advice, but we know that in many factories such advice is very much needed. Here is a case in point. A certain plant, not many miles from the publication offices of this journal had two large main drives, one for each side of the shop. Every month or so, one of these belts would break with a noise like a gun going off, and of course that side of the factory which the belt was driving was idle until a temporary repair could be made. During the night a workman would make a decent repair, that is he would cement the joint, not merely lace it, as was done in the temporary adjustment. This went on for about two years. Nobody seemed to trouble about the breakages, taking them as a matter of course.

A new superintendent came to this plant and shortly after his arrival one of the belts repeated this performance. On examination he noticed the many repair marks. After enquiring how often this occurred, he had the belt temporarily repaired to get the shop running, then sent for some double belting. Things looked rosy until the cost as found to be more than formerly. The superintendent however, pointed out how much money was being lost in wages, not to speak of loss in production. But why go further? He got his double belting and the trouble was over.

Of course a firm of this standing should have known enough to use double belting for such a drive, and they should never have considered the first cost, but the fact remains that they did **not** know, and that they **did** look at the cost side of it. Get away from such a viewpoint, and where you are not sure, ask someone who does know about belting. Manufacturers of belting are only too willing to give advice, without even suggesting their own particular product. When you have found a b that suits you, stick to it. Use a best drive for the purpose discovering a better belting if possible, but until you ha proven the other belt to be equally as good, or better, stick the style that is rendering you good service. Give your be care and they in turn will give you the best of service, if t material is in them.

Lightness and Strength

"IF you can give us a box that will be lighter, yet equa as strong—why go to it, but you'll have to show m These words were spoken a few weeks ago by a shop super tendent to a salesman who was claiming he could supply bo for this firm's product that would be equal in strength, only half the weight of the style being used.

Nothing daunted the salesman made off with a promise return in a few days with a box that would stand the te When he came, he brought with him a special packer, who he explained, would pack the product as it should be pack Wtih the greatest of care the box was completed, then pass over to the superintendent for inspection.

"It looks fine," was the non-committal remark of the m they must please, then he proceeded, with the help of his m to give the box the treatment it would receive on the ro Inside of three minutes the machine which was contained the box had broken through in two places and the pet dre of the large order for the enthusiastic salesman had vanis into thin air.

"I still believe I can give you a box to suit your purpos finally came from the salesman's lips. "My former answ 'Go to it and show me' holds good," replied the superintend without any malice and off the salesman went to make anot box.

Without question, the weight of packages has been redu considerably within the past few years, but in some ca weight cannot be sacrificed without reducing the streng Reinforcement may be all right in some instances, but wh lugs and other heavy sharp points stick out, good heavy l ber seems to be the safest plan. Had the above scheme b successful the salesman would not only have landed a r order, but the firm spoken of would have saved over $8, yearly in the cost of boxes alone, not to speak of the frei charges, the larger number of machines possible to be pac in a car and so on. Everybody would have benefited, but this case reinforcement, with lighter lumber, did not fill bill.

The Cause of Accidents

In analyzing the reports of 1,000 accidents in the pet leum industry, it was found that over 31 per cent. were to workers being struck by falling objects; 10 per c by improper use of hand tools; nearly 9 per cent. by r falling and tripping; 8 per cent. by men being struck passing objects, and about 4 per cent. by stepping on nails.



MARKET DEVELOPMENTS



Feeling of Confidence Returning to Market

Improvement Continues Although Gradual—Freight Rates In States May Drop Soon—Slight Increase in Steel Demand—Machine Tool Situation Looks Better—Boiler Tubes Take Sudden Drop.

THE market situation is certainly improving. While the movement may be slow, it is sure and there is a decided feeling of confidence coming into the market which speaks well for the future.

The demand upon the steel industry continues, and it is expected to grow in volume as time goes by. Pig iron prices have stiffened, and although these have yet to be tested, no decline later is looked for. In fact everybody has got the feeling that the bottom has not only been reached, but that it has been severely scraped. Dealers are optimistic as to the future and feel the worst has been safely passed.

Machine tool dealers have much to look forward to. The keen competition existing between automobile manufacturers, coupled with the lower prices, means that these manufacturers must look for the quickest and most economical production method. Dealers are being consulted in an advisory capacity, and if they toe the mark, as they should be able to do, suggesting the best machines for the various operations, good business should result.

Small tools continue to move, but very slowly. A few firms are re-opening after a three or four months closure, so that this branch of the market should show improvement soon.

Taken in all there is much to be thankful for, as both dealers and buyers are beginning to realize that many lines are down to practically 1914 levels and cannot drop further. Buyers are at last showing a tendency to purchase for purposes of stocking up.

IMPROVEMENT IN MARKET CONTINUES FREIGHT RATES MAY BE REVISED SOON

PITTSBURGH, August 25.—There is a continuance of the slow improvement in iron and steel conditions. To some this improvement may be disappointingly slow, but a great many in the trade are quite satisfied for there to be any continued improvement at all, seeing that everything has been on the down grade for nearly a year and any turn at all however slight would be welcome.

So much trust might easily be put in the price advances a number of pig iron producers have announced, as the advanced prices still have to be tested, but certainly the pig iron market is much improved when producers are at any rate trying to advance prices instead of putting them down as they were doing for about ten months. The price advancing movement began in the Chicago district, and the Inland Steel Company is commonly given credit for starting this. At any rate while actual sales of foundry ironware recently made at $18, f.o.b. Chicago furnace the regular asking price there at present is $20. The Manning and Shenango valley furnacemen took up the idea promptly, and began announcing an advance in basic iron from $18 to $20. Foundry iron had been $19 valley, and some have announced an advance to $20.50, but that is not general. Bessemer, which had been $20, valley, remains at this figure, and a sale of 10 tons has just been made at the price. Basic iron presented the case that need first attention. There have been no sales in the Valley-Pittsburgh market at the advanced prices, but since the advances in basic were announced there have been no sales at the old price either. There has simply been no inquiry for a while, and there is none just at the moment.

The possibility has developed that freight rates on the materials that have to be assembled to make pig iron will be revised by October rather than in December or January as was the recent expectation, but the matter is in doubt. The furnacemen do not seem to be applying much pressure to the railroads, while the Interstate Commerce Commission is doing nothing, beyond having allowed it to become known that it would approve any reductions the railroads may propose. The expectation is the reductions will be about 20 per cent, when made. The freight assembly cost at valley furnaces of the ore, coke and limestone needed to make a ton of pig iron is fully $10, against not over $5 in 1914. A 20 per cent reduction straight through would therefore deduct $2 from the cost of making pig iron. Furnacemen claim that even with a $20 price on pig iron such a freight rate reduction is already discounted. There is some question, however, whether that is correct. The low point in pig iron was in the early months of 1915, when basic pig iron was $12.50, valley, and foundry iron $12.75. Coke at ovens is about $1.25 higher, the cost of producing iron ore and limestone is higher and the wage cost at blast furnaces is higher, while with a twenty per cent reduction in freights the increased freight cost on raw materials would be about $3. It is quite possible that all the increases together, added to $12.50 or $12.75 would make about $20, and it is universally admitted that when pig iron sold in 1915 at $12.50 or $12.75 the furnaces were doing no more than break even if indeed they were doing that. Eastern Pennsylvania has shown no advance in pig iron and indeed there has been no little decline within the past fortnight. However, the general feeling among pig iron producers is that pig iron ought to advance and as stocks have been very considerably reduced the furnaces may be able to put their views into operation.

There has been only a slight increase in steel demand in the past week, but there seems to be no question that there has been some, particularly in sheets, bars and the tubular goods. The sheet mills as a whole are operating at 35 or 40 per cent, while the pipe mills are probably averaging above 30 per cent, there being a very decided increase thus shown as compared with operations at the middle of July.

There is heavy demand for galvanized sheets for repairing car roofs and little demand for other items of car repair. Otherwise the railroads are doing practically nothing in the buying line. The financing scheme for the railroads, whereby the Government is to provide funds of about $500,000,000, has been encountering much opposition in Congress and while it will doubtless go

through the railroads may not get any relief at all until late in the year. The money would be used first to pay debts and perhaps next to take out more rails, against the contracts made for this year, while next there might be some buying of equipment or improvement in other directions.

Construction projects are still being held in abeyance very largely. Everyone seems to have his own guess as to when and how business conditions will experience any great improvement. The improvement now progressing in the iron and steel industry is of course recovery from a special depression caused by stocks of steel and steel manufactures that had to be distributed. The demand upon the mills is still quite below a normal relation to the present volume of business generally, so that improvement in steel can continue for some time even without general business improving.

Mill Operations

The rate of steel ingot production is probably up by this time to a rate of 25 per cent of capacity, and that is some gain since the average rate in July was only about 21 per cent and at the middle of July the rate was lower still, probably 18 or 19 per cent. Some shipments are being made of stocks of finished steel at mills and some semi-finished steel in stock is being rolled, so that shipments of finished steel have increased in somewhat greater ratio than has the production of ingots.

The expected wage reduction of the Steel Corporation was announced last Saturday, to be effective Monday, August 29. The common labor rate is reduced from 37 cents to 30 cents an hour, other rates being adjusted in keeping. It has been certain ever since the last of the independents got down to a 30-cent rate, in the latter part of July, that the corporation would make this reduction. Some of the independents are paying 27 cents and some 25 cents, but 30 cents seems to have the claim to be the standard. The Steel Corporation has had a policy of lagging behind the independents in both wage reductions and price reductions. The corporation's wage reduction will probably have a good sentimental influence on the steel market, as it has been known that some buyers of steel held that they could not have confidence in steel prices as long as mills were paying higher wages than they needed to pay.

Steel Prices

We quote blue annealed sheets in ordinary sized lots at 2.25c against 2.40c formerly quoted, and note that hoops can often be gotten at 2.30c, particularly from strip mills, against 2.40c formerly quotable. Rivets are softer, 2.35c having been done on structural rivets. Otherwise the steel market has declined in the past week or indeed since August 1. Considering wage rates, freight rates and other items of cost present steel prices are practically as low as were the prices at the end of 1914, they having been the lowest since 1898. While the steel mills have claimed this for several weeks it is only now that buyers are showing any signs of believing the claim.

POINTS IN WEEK'S MARKETING NOTES

A slow improvement continues in the iron and steel industry. Pig iron prices have stiffened somewhat, but too much trust cannot be put in them as they have still to be tested. One fact remains sure however, the market is much improved.

It is likely that the revision of freight rates on the materials that have to be assembled to make pig iron will take place on October 1st, rather than in December or January. This change is not certain, but rumors are abroad to that effect. It is expected that the reduction will be about 20 per cent. This reduction would deduct $2 from the cost of making pig iron.

There has been a slight increase in steel demand during the past week. Sheets, bars, and tubular goods have been especially active. A heavy demand exists for galvanized sheets for repairing car roofs, and a small demand for other items in car repair. Otherwise railroads are doing practically nothing in the buying line.

Machine tool sales are fairly well scattered, but shop executives have become more interested and will now talk to dealers, especially regarding production methods. This condition is largely due to the keen competition among automobile plants, and as one dealer puts it, "They realize they must get the best method of producing if they are going to stand the pace."

The small tool market still shows that purchasers are buying for actual wants only. Prices are being shaved where there is anything like a good order coming. Some dealers are looking forward to increased business shortly as several plants have opened up after a closure of three or four months.

A tendency to purchase for stock purposes has arisen. As one dealer puts it "Many of us are convinced the market in a good many lines has gone the limit so far as declines are concerned." In some cases dealers are not allowing the buyers to dominate the market, stating a price, then letting that remain as a final quotation.

There has been quite a drop in boiler tubes. Some of the yards are carrying very heavy stocks, and it is expected that they will clear this stock out as soon as possible.

HUGE GAS HOLDER IS BEING ERECTEI

Hamilton, Ont., is to be the home o a huge gas holder which is being erect ed for the United Gas and Fuel Co. Th tank will be capable of containing fiv million cubic feet of gas, and effort are being made to have it finished b the first of December.

Special equipment and specially train ed men are necessary on this type o work, and the foundation for the struct ure is a circular platform of cement o the same circumference as the holder it self.

On the concrete foundation is lai the steel floor, which is made of man steel plates riveted together. 60,00 rivets are required to fasten the plate of the bottom together alone. When th bottom sheet was riveted it had to b raised about three feet into the air i order that the riveters might work mo easily. After the job was completed, th great area of steel was lowered to i resting place on the concrete by mea of 144 screws which between them su ported the weight of 250 tons of ste Between the steel and concrete is a th bed of sand to give even support to th bottom and prevent the weight fro resting on the rivet heads alone.

The outer plates of the big tank a built up to a height of 32 feet 4 inche Each plate is curved, and is 26 feet length, 59 inches wide, and the first ri weighs 3½ tons. This is the weight the first of the seven ring plates, a the weight of the other six varies they go higher, becoming less as th go higher. Inside the first circle of st are five smaller rings, or "lifts," son what lighter in construction, each o 16½ inches inside the other. The in "lift" is covered over by the big st crown constituting the top of the c tainer. The first or inner "lift" is feet in diameter, and 30 feet 10 inc in height. The second is 202 feet 9 inc in diameret and 31 feet 6 inches height; the third, 205 feet 6 inches diameter and the same in height; fourth, 208 feet 3 inches by 31 feet inches, and the outer lift 211 feet 32 feet.

Some interesting equipment is be uesd in the constructional work. One table machine is a "bull" riveter, wh weighs nine tons, and is capable of d ing 1⅝-inch rivets cold. The machi used for driving the smaller rivets capable of driving 25,000 a day.

To construct the big "lifts," a "t with revolving arms is erected in middle of the base of the tank, and sides built up by means of this appa tus, which is fed with material by a crane.

The gas enters the holder throug tunnel underneath the concrete fo ation, and is forced into the inner or shell through a pipe. It is colle over the water in the tank till the ho is extended to its fullest height.

DEALERS FIND SHOP EXECUTIVES MORE READY TO TALK BUSINESS WITH THEM

Special to Canadian Machinery

TORONTO—Although there is not enough improvement in the market as week to warrant the assumption at trade has taken a decided turn for e better, one can readily find indica- s and opinions that there has been me improvement.

Machine tool sales have not materially proved—in fact they are still fairly ell scattered, and in small lots. But ere are some shops that have become terested to the point of expressing willingness to have demonstrations ven in their works, especially in cases ere shops are interested in production thods.

"The automobile shops in particular alize," stated one dealer, "that with e new prices of cars and the increasing mpetition in the selling of them, and th the very large number of used rs offering, they must get the very st in the matter of production if they e going to stand the pace. Every op- ation that can be improved upon must changed, and there is on small amount study being given to this matter right w. The result is that the machine tool der and especially the one who can cuss mechanical details from the en- neering point of view, is having his ance to talk things over with the ex- utives now, and there are prospects business. I know of one shop that is conducting experiments in the mak- of fly wheels and other parts, and if se turn out as expected it may mean scrapping of equipment that was ght only a short time ago."

This same dealer also stated that e was quite a difference in the at- tude of the buyers. "Even two months a or less," he claimed "it was a hard tter for a machine man to get a good aring with any of the firms, but there been quite a change in this attitude, a we take it to be one of the indica- ns that the turn in the road is com- ir."

Small Sales Reported

rders coming into the small tool rket are still indicative of buying for tual wants only. There have been no portant changes in the prices named ring the last few weeks, but one has to make many inquiries around the all tool market before finding out n prices are being shaved every time ere is anything like a good order com- out. Reports have it that several ms are considering starting again— ne of them having been closed down the last three or four months. Some the dealers, who were formerly pretty ll "in" on this business, are looking ward to increasing business as a re- su

Liquidation Still in Effect

me of the steel merchants, or the representatives of the larger mills, can give a good answer to the statement that there is no business moving. In this case bookings for the last few days resulted in a fair number of car lot orders, and one of the most significant statements was that some of the business had been placed for filling up some of the stock warehouses.

Inquiries at other places brought the same information, viz., that there was more of a tendency lately to purchase for stock than there has been for some time. Here is the way one of the dealers stated the case: "There is one thing to be thankful for, and that is that many of the dealers are now convinced that the market in a good many lines has gone the limit as far as declines are concerned. The 1914 level is being pretty well approached in many places, and as a result there is going to be some buying done."

Dealers are, in some cases at least, showing less tendency to be dominated by the buyers, and are naming a price and letting that remain as a final quotation.

There has been quite a drop in boiler tubes recently and buying is improving in this line. Some of the yards are carrying very heavy stocks of tubes, and for the next few weeks they are going to have a busy time of it. Of course their best move now is to get cleaned out as far as possible before there is another hitch downward in the market. Forced selling is the one thing that will help clear their stock out, and it is the one thing that will help to make the prices sag a little more.

There is considerable liquidation of stock going on in Toronto, and some of the sales being made are making it evident that prices are not holding firm in some of the lines.

One firm that was getting an exhibit ready for the Toronto fair, remarked on the difference that had taken place during the year. "Just a year ago we took a pile of twelve tons of black sheets and put them in our exhibit at the fair. The second day we were there a buyer came along and wanted to know if they were for sale. We informed him that they were, and he took the lot and never even asked the price. Although the figure today is cut in two it would be a hard matter to set up a pile of sheets and have buyers come along to take them regardless of price."

Nothing Happens Here

"Nothing has happened in the scrap business for some time." Such is the cheering message from one of the larger dealers. "We have been expecting some signs of improvements, but they have not come yet, and we will get them first, you know." This safe dealer some weeks ago drew attention to the fact that any improvement in the whole industrial situation would first of all be reflected in the condition of the scrap metal business. His word was "We get it first when it falls and we get it first when it comes back."

IS THE 75-TON LOCOMOTIVE COMING?

Henry Ford now proposes to revolutionize the locomotive industry. In his first official statement as president of the Detroit, Toledo, and Ironton Railroad, he says that he intends making sweeping improvements in locomotive design. He hopes to reduce the weight of locomotives considerably and in his opinion the present type are about two thirds heavier than necessary, eating up more fuel, and wearing out more rails than they should.

He also intends reducing the weight of freight cars, this in turn reducing the carrying charges. Asked if the 75 ton locomotive of undiminished power was an engineering possibility, he said that it was not only a possibility but that he was going to produce it.

"Storms will not be able to paralyzs railroads in the future" he added "because we will do our train despatching by wireless telephones." Speaking on the moving of freight cars, he claimed that the present movement of such cars was disgraceful. He pointed out that his railroad has increased the average of distance moved from 15.7 to 36.7 miles per 24 hours and he sees no reason why this figure should not be increased to 175 miles every 24 hours.

To show that he means business, Mr. Ford has placed his large staff of designers on the task of creating the 75 ton locomotive. The chemical laboratories are handling the burden of his work for it is upon the steel to be produced by an alloy process, that the hope of a light locomotive is based.

Strength must not be sacrificed for the sake of lightness, and it is the firm belief of those concerned in this development work that the object is to be attained.

TRADE GOSSIP

The next British industries fair will be held in London and Birmingham between the 27th February and 10th March, 1922. This fair is open to manufacturers in all parts of the British Empire and buyers from all over the world are attracted. It affords an excellent medium for bringing manufacturers in direct contact with buyers, as only bona fide manufacturers are permitted to exhibit, and buyers are admitted to the fairs by invitation only. The general public are not admitted. Full details can be obtained from H. M. Trade Commissioners at 248 St. James Street, Montreal, 260 Confederation Life Building, Toronto, or 610 Electric Railway Chambers, Winnipeg.

Building permits issued for new buildings and repairs in Montreal for the month of July, reached a total of $1,560,816.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	34 10

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 75
Steel bars, base, Montreal	3 75
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	2 10
Tank plates, Pittsburgh	2 20
Structural shapes, Pittsburgh	2 20
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$18 00	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	38 00	39 00
Spelter	7 75	7 50
Lead	7 25	7 50
Antimony	8 00	8 25
Aluminum	34 50	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$5 00	$4 75
Plates, ¼ up	4 50	4 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 20%.

Standard couplings, 4-in. and under, 20%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 50	$ 9 00
Copper, crucible	11 00	11 00
Copper, heavy	10 50	11 00
Copper wire	11 00	11 00
No. 1 machine composition	9 50	9 75
New brass cuttings	6 00	8 00
Red brass turnings	8 00	8 00
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 (
Nuts, square, tapped	add 2
Nuts, hex., blank	add 2
Nuts, hex., tapped	add 2
Copper rivets and burrs, list less	27
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8
Structural rivets, as above	8
Wood screws, O. & R., bright	67
Wood screws, flat, bright	67
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Ce
Set screws	Less 4(
Square and hexagon head cap screws	Less 3(
Round head cap screws	Plus 1(
Fillister head cap screws	Less 1(
Flat head cap screws	Net
Button head cap screws	Plus 1(
Studs	Less 2(
Semi-finished nuts up to and including 1-in.	Less 3(
Semi-finished nuts 1⅛ to 1½"	Less 3(
Semi-finished nuts 1⅝ to 2 in.	Net
Coupling bolts	Plus 1(
Taper pins	Less 4(
Planer bolts without fillet	Plus 4(
Planer bolts with fillet	Pus 5
Patch bolts	Plus 8
Hollow set screws	Plus 2
Thumb screws	Less 3
Thumb nuts	Less 6

BILLETS

F.O.B. Pittsburgh.

	Per gross
Bessemer billets	$43
Open-hearth billets	43
O.H. sheet bars	3
Forging billets	48
Wire rods	48

NAILS AND SPIKES

Wire nails, base	$4
Cut nails, base	
Miscellaneous wire nails	

ROPE AND PACKING

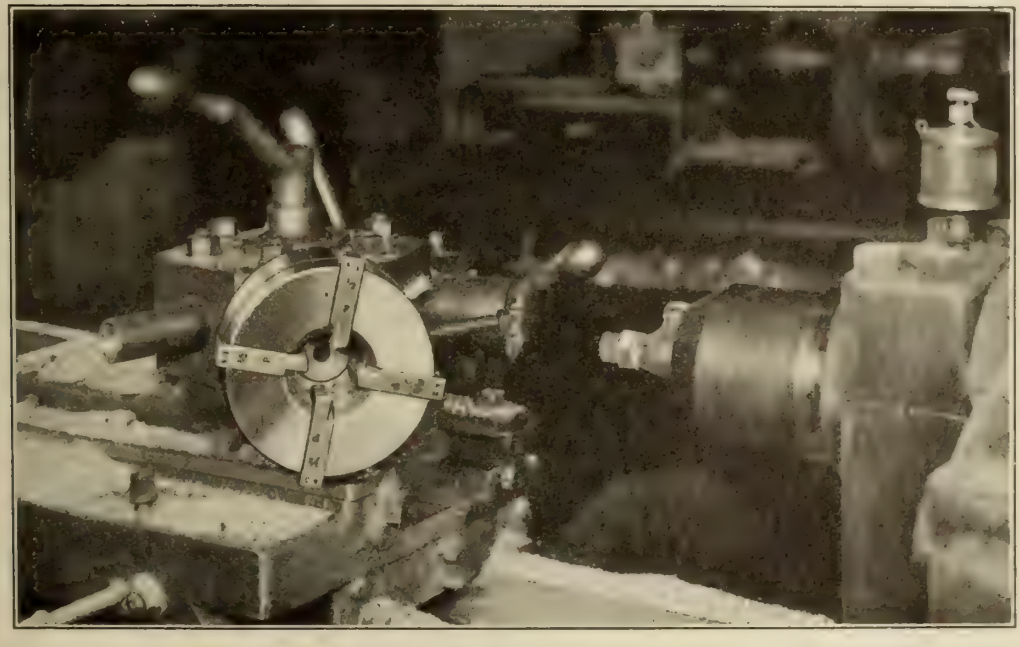
Plumbers' oakum, per lb.	0
Packing, square braided	0
Packing, No. 1 Italian	0
Packing, No. 2 Italian	0
Pure Manila rope	0
British Manila rope	0
New Zealand hemp	0

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	N

Right in the Lead

A Busy Corner
Of A Notably Successful Shop



The Geometric Die Head illustrated has just cut the ½-in. pipe thread on the bibb shown. The equipment of this shop consists of many standard and special Geometric Tools.

These people express themselves as very strong for the Geometric line, and are always glad to recommend the use of these Tools. They have themselves used Geometrics for a great many years.

If you can find a user of Geometric Screw Cutting Tools who is not satisfied with them, you will do us a great favor by telling us who he is and where we can find him.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N. B., Halifax, N. S.

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	45
Can. carbon cutters, plus	10
Standard drills, all sizes	45
3-fluted drills, plus	10
Jobbers' and letter sizes	45
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	10 to 15 off
Can. high speed cutters, net to plus 10	
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 6 00	$ 5 50
Sheets, blue ann., No. 10	5.25	4.50
Canada plates, dull, 52 sheets	7 50	13 00
Can. plates, all bright	14 00	.....
Apollo brand, 10¾ oz., galvanized	....	.....
Queen's Head, 28 B.W.G.	10 75	.....
Fleur-de-Lis, 28 B.W.G.	10 00	.....
Gorbal's Best, No. 28	....	.....
Colborne Crown, No. 28.	....	.....
Premier, No. 28, U.S.	8 25	8 50
Premier, 10¾-oz.	8 25	8 90
Zinc sheets	13 00	15 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	27 00
1¾ in.	29 75	24 00
2 in.	29 25	22 00
2¼ in.	33 00	25 50
2½ in.	44 75	28 00
3 in.	49 25	34 00
3¼ in.	.....	42 50
3½ in.	63 50	37 50
4 in.	85 00	48 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21	Atlas	19
Peerless	.22	X Empire	.15
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.16½		

Colored

Lion	.13½	Popular	.10
Standard	.12	Keen	9
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.17	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount f quantity.

RUBBER BELTING

Standard	10%	Best grades	.15

ANODES

Nickel	.55 to
Copper	.38 to
Tin	.70 to
Zinc	.16 to

Prices per lb.

COPPER PRODUCTS

	Montreal	Toro
Bars, ½ to 2 in.	$30 00	$34
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	32 00	38
Copper sheet, tinned, 14 x 60, 14 oz.	38 00	42
Copper sheet, planished, 16 oz. base	44 00	48
Braziers', in sheets, 6 x 4 base	36 00	41

LEAD SHEETS

	Montreal	Toro
Sheets, 3 lbs. sq. ft.	$ 9 50	$14
Sheets, 3½ lbs. sq. ft.	9 25	14
Sheets, 4 to 6 lbs. sq. ft.	9 00	13

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .2
Acid, hydrochloric	.0
Acid, nitric	.1
Acid, sulphuric	.0
Ammonia, aqua	.2
Ammonium, carbonate	.2
Ammonium, chloride	.2
Ammonium, hydrosulphuret	.7
Ammonium sulphate	.2
Arsenic, white	.1
Copper, carbonate, annhy.	.3
Copper, sulphate	.1
Cobalt, sulphate	.2
Iron perchloride	.1
Lead acetate	.2
Nickel ammonium sulphate	1
Nickel carbonate	.3
Nickel sulphate	.1
Potassium sulphide (substitute)	.2
Silver Chloride (per oz.)	1.
Silver nitrate (per oz.)	1.
Sodium bisulphate	.1
Sodium carbonate crystals	.1
Sodium cyanide, 127-130%	.3
Sodium hyposulphite per 100 lb.	6.
Sodium phosphate	.2
Tin chloride	.3
Zinc chloride, C.P.	.2
Zinc sulphate	.1

Prices per lb. unless otherwise sta

ATKINS

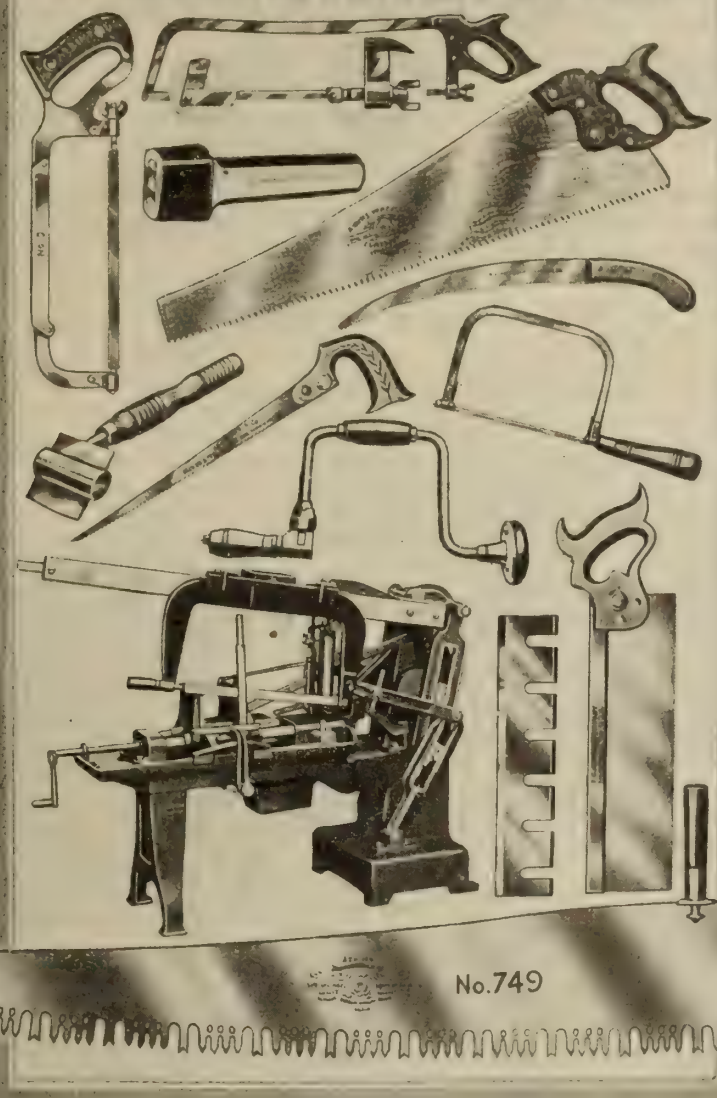
STERLING QUALITY

SAWS and TOOLS

A Perfect Saw for every Purpose

"Finest on Earth"

"Finest on Earth"



We make a complete line of Sterling Quality Saws, SawTools, Machine Knives and Mill Specialties. Your request for literature descriptive of our products will receive prompt attention. Write today to the nearest point named below.

You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

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E. C. Atkins & Company

Established 1857

Canadian Factory: HAMILTON, ONTARIO

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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



TRADE IN ENGLAND EXPECTED TO IMPROVE SHORTLY. NEW CONCERN FORMED

Work in the engineering trades in England has failed to show any change for the better. F. W. Field, H. M. trade commissioner at Toronto, speaking to Canadian Machinery on the subject, said that according to information received from London, a great deal of short time is being worked in the North and Midland districts.

It seems that in view of the uncertainties of the position with regard to coal and engineering labour, the commercial side of engineering is largely in a state of laissez faire and order books are closed, in spite of the fact that orders may be wanted at any moment. Firms are anxious to get a proper basis on which they can estimate their cost of production before quoting to customers on any contract for delivery of over three months, and the fact that production has been so largely diminished also renders them very chary about filling their books.

In these circumstances it is not surprising that the export figures for May showed a substantial reduction on those for previous months. It will be found, however, that considering all things the figures are really better than might have been expected, and it is anticipated that the first sign of stability in trade and a cessation of the continual labour unrest will soon develop a healthy condition with regard to export trade, and that the export figures will reflect this in no unmistakable manner.

Davy Brothers, Ltd., of Sheffield, have recently opened a new works, and although this extension occurs at a time of industrial depression, it will have its effect when conditions once more become normal. This firm has a large home and overseas business and build a great deal of machinery employed in Sheffield steel works, including the latest types of continuous rolling mill plant, as well as forging presses. Eventually there is to be a complete set of engineering works but for the present the building has been restricted to a series of light machine shops.

Power Presses and Machinery

The formation of many companies into "Nobel Industries, Limited," has resulted in the engineering branch of Kynoch, Ltd., Birmingham, one of the constituent companies, being afforded exceptional experience in special engineering work owing to the engineering requirements of other constituent companies. This special work, in addition to many years' experience in engineering, has tended to produce a department capable of meeting the diverse demands of overseas buyers.

A brief description of the engineering department, as it now exists, is given in order that overseas buyers may judge for themselves the extent to which the engineering department is capable of satisfying the requirements. The drawing office consists of a highly-trained staff of designers and draughtsmen under the control of expert engineers. A laboratory with a staff of metallurgists, who regularly analyse all metals to ensure correct mixtures and advise the most suitable material for different working parts, ensures a high standard of efficiency and durability. The pattern shop is equipped with up-to-date wood working machinery, and patterns of the greatest accuracy are made, including complete gear wheel patterns with true and accurately-pitched teeth. Iron foundries are fully equipped with melting cupolas and high-speed electric cranes. The foundries are divided so that all small castings which require minute attention are made in a specially equipped small foundry, whereas in the large foundry castings of all descriptions can be produced up to 40 tons each. There is also a non-ferrous metal foundry capable of producing castings in brass, gunmetal, phosphor bronze or manganese bronze in all sizes up to 2 cwts. each. The machine shops are well equipped with modern high-speed machine tools for large and small work, with ample electric lifting crane capacity, and possess special gauge and inspection departments to ensure accuracy. Wherever possible, machinery is done to jigs, specially constructed, to secure interchangeability of parts, and all parts are carefully gauged before assembling.

The main line of manufacture is that of power presses, in which Kynoch, Ltd., have had years of technical experience not only in design and manufacture, but also in actual running experience of their own and other well-known makes, which have from time to time been installed for the production of ammunition and other products manufactured in their factories. This enables them to offer power presses and other special machines embodying the latest improvments and refinements, from which have been eliminated deficiencies and weaknesses which have been disco experience.

In addition to presses, suita can be designed and supplied, he ganisation including a staff o in the manufacture of ferrous d ferrous sheet metal articles. range of designs and sizes o presses necessary to meet all h mands of the sheet metal wo dustry cannot be fully descri this concern specialise in the f

Blanking preses for cutting o ing and short drawing; drawing stamping presses of the incli geared and geared type, cam t gle type, and baling presses– ing yarn, hides, skins, hay, h cotton, wool and other materia

AUTOMOBILE INDUS HAS MADE RAPID ST

Export Trade Rapidly Growing Given Denote that Canad Contributed Greatly to Industry

Canada holds second place a countries of the world in p possession of automobile, h proximately one car to every of population. The automobil facturing industry has ma strides in Canada, and at t 1919, the amount invested wa imately $57,000,000. These fig been carefully compiled by th ion Bureau of Statistics, an 1,289 plants in which this ca invested, 1,236 made repairs, duced accessories, whilst 11 e the manufacture of automob tario led in the number of p 639; Quebec 165; Saskatche Alberta 98; Manitoba 84; Br umbia 84; Nova Scotia 49; N wick 34; and Prince Edward I

Ontario was in 1919, the vince manufacturing automo capital investment being $48, which about $35,000,000 was facturing plants. Just how f io has monopolized the indust from the fact that the investn other provinces amounts to than $8,000,000. That of Sas came next with $1,813,002.

The number of employees e the industry was 12,139 of w than one half were employe mobile plants. In the year view they were paid in wage aries the sum of $15,389,000. terials used in Canadian pl

? Who was the Third Man?

WHEN the retirement of Sir Robert Borden as Premier of Canada was first announced, three outstanding men were considered as his possible successors. Their names were displayed prominently in every Canadian newspaper. The present Premier was of course one of the men mentioned. Sir Geo. Foster another. Who was the third man? You would remember him no doubt if his name were displayed prominently in the daily press to-day—but he has retired from the political arena, and his name is seldom mentioned.

How easily names slip from the memory when they cease to be given publicity.

There is a lesson here. If you wish your name and the name of your products to be remembered, you must give them constant publicity.

Canadian Machinery

Power House

Canadian Foundryman

Marine Engineering

Each of these technical newspapers is a member of the Canadian National Newspapers and Periodicals Association.

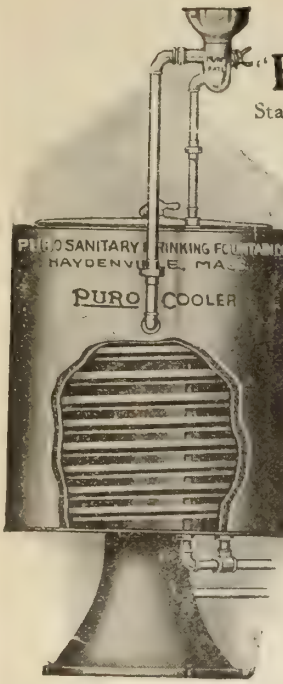
The prudent manufacturer of machine tools, power plant equipment, or industrial supplies of any kind places his name and the name of his products where they will be seen and remembered to best advantage: **in reliable technical newspapers.**

Reliable technical newspapers in Canada are those included as members of Canadian National Newspapers and Periodicals Association. Their circulation is bona-fide and their editorial practice is carefully guarded, in fact their whole policy must conform to the highest standards else they would not be eligible to membership in the association.

The MacLean Publishing Company, Limited

153 University Ave., Toronto

Eight Branch Offices



PURO SANITARY DRINKING FOUNTAIN

(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

888 F. St. Andre St., Montreal, P.Q. Canada



CLOSING TIME

Condensed advertisements for this section must be in our composing room Tuesday morning prior to day of issue. Display advertisements for this section must be in Monday afternoon.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

valued at $61,279,000, no less than $51,690,715 having been in the manufacture of automobiles. The selling value of the products at the works was $101,196,000 and the number of cars turned out being somewhat over 68,000, there being 21,000 other machines produced.

Export Business

The exporting of automobiles and their parts is also increasing, for whereas the exports in 1915 amounted to only $3,054,000, the figure up to the year ending March 31st, 1921, was $19,628,000. According to reports Australia and New Zealand are the best markets Canada has for cars, whilst the United Kingdom, India, South Africa and the Dutch East Indies also take a goodly number. The United States absorbs a considerable quantity of parts the value of these during the fiscal year 1919-20 amounting in value to $282,000. Altogether 21,128 cars were exported in the fiscal year ending March 1921 as compared with 12,750 in the previous year. The large increase in exports in the past fiscal year is to an extent explained by the coming into effect of the British preferential tariff at the end of 1919 which grants a preference of one-third provided that not less than twenty-five per cent of the labor on the finished car shall have been done within the British Empire.

Windsor and the surrounding communities of Walkerville, Ford City, etc., are the centres of activity, although Toronto, Oshawa, London, Chatham, Kitchener, Hamilton, Brockville, etc., are heavily interested.

TRADE REVIVAL EXPECTED BY FALL

British Manufacturers are Laying Plans For Future. Look for Keen Foreign Competition

British manufacturers expect a trade revival shortly according to "The Empire Mail". In several cases they speak of reorganizing for trade, and following are a few excerpts which show how the wind of industrial activity is blowing. They say that British manufacturers are actively formulating their plans for the future, paying regard not only to manufacturing economy but also to the most effective means of disposing of their goods. The recrudescence of trade, they realise, will be accompanied by the severest foreign competition, and under the handicap of a depreciated foreign exchange. British salesmanship will be taxed to the limit of its capability.

In another case they say that a very substantial improvement is looked for in the near future, and that there seems to be a general agreement among business men that three main obstacles stand in the way of a satisfactory revival of British trade. These are first of all the cost of industrial coal, secondly the crushing weight of taxation, due to the extravagant policy of the Government, and thirdly, the unrest among the workers, and their reluctance to face the inevitability of wage r tions. Trade will never improve a large scale until some means are f of stimulating demand both at hom abroad. A leading expert in the len industry says that market both of raw material and of fin cloth have sunk to below the cos production, and are to-day on a economic basis. The public that now, buys wisely. The same a to a very large number of other tries, and the lesson is plain, na that somehow costs of production be brought down to a level which ables the finished article to be sold price which buyers are prepared t . Wage adjustments have been a recently in a good many trades thr out the country. It is beginnin dawn upon some of the workers h they are likely to sink deeper and er into the mire of unemployme they continue to answer all reques reductions in wages with a stubbo fusal. The progress of their edu in this respect however is not as f it might be.

Confidence Returning

Confidence in the gradual recov British trade is now felt in most industrial centres according to a h statement. The coal peace has b a brighter outlook and the prom lower fuel costs. Wage readjust in some industries have also been ed, so that manufacturing costs v lessened and manufacturers will b to cheapen prices and at the sam more effectively counter foreign c tition. The improved prospects a flected by a greater volume of in from overseas, and fresh orders a ing booked, particularly in Sh Birmingham and the West of E

Trade Gossip

Major Chisholm, Canadian Trade missioner in Cuba, is in Canada a be available for consultation an after August 25. Major Chisholm i making a tour of Ontario, Quebe the Maritime provinces before re to Havana. Any firm desiring Major Chisholm regarding trade West Indies, Central America, Northern part of South America communicate with the office of and commerce. Major Chisholm Mexico in the autumn of last ye has just recently completed a tour embraced Jamaica, Venezuela, Co and Panama, being throughly f with the commercial conditions o countries.

A factory in Argentina is b marine gasoline and oil engine factory, which is the only one of i in the neighborhood, produces 15 per month, varying in size from h. p. The engines are of the t four cylinder type, and are said modelled after English pattern steel is imported from England, a motors are sold direct to local boa builders.

Trade Gossip

A'd and Co. Toronto, are making an addition to their worsted spinning plant. This new building will be 107 ft. by 82 ft., and will be of fire proof structure, built of reinforced concrete, steel sash, wire glass, etc. Three stories are going to be erected, and although the building will be completed around the end of August, or the middle of September, the work in the new addition will not be commenced until the first of next year.

* * *

The Beveridge Paper Co., Montreal, have changed their name to the Beveridge Supply Co. The reason for the change is said to be the fact that for several years they have been running a supply department, and therefore feel that the word "Paper" does not sufficiently indicate the nature of their business.

* * *

The Refinite Co., of Canada, who have been incorporated, have established headquarters at 319 Continental Life Building, Toronto. Mr. E. G. Koyl is in active management of the business. This company have acquired all Canadian rights to Refinite and Booth water softening systems, and Refinite rapid pressure filters. As far as possible, the devices made in Canada, and Canadian materials are purchased for the making of the same.

* * *

The Abitibi Power and Paper Co. have started three additional newsprint machines, one of which is already in operation, this bringing the daily newsprint output up to well over 300 tons. When these additions are all in operation the daily production will be over 500 tons.

* * *

St. Ambroise de Chicoutimi, Inc., is about to erect a steel bridge costing about $20,000.

* * *

Considerable work is being done on new buildings in Montreal at present. About half of it is repair and alteration work, where over $50,000 is being expended.

* * *

Improvements and studio are planned by W. R. Barefoot, 1196 Bloor St. W., Toronto, these to cost around $15,000.

* * *

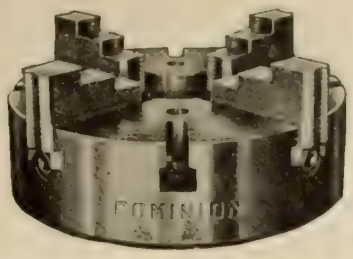
Last month, blast furnace A of the Ford Motor Co., Dearborn, Mich., broke all previous records for tonnage and coke consumed per ton of iron. Here are the figures:—Average tons per day, 509.8; coke per ton of iron, 1,981 lbs.; average silicon, 2.85 per cent; average sulphur, 0.03.

* * *

The Rolls-Royce Co., of America, East Springfield, Mass., have closed their plant until Sept. 6.

* * *

The production of soft coal in the United States is the lowest it has been in twelve years. The output for July is considerably below that of the month of June.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

DOMINION STEEL PRODUCTS CO. LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

PATENTS
Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

BLACK DIAMOND OVENS
"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet
Brantford Oven & Rack Co. Ltd
Brantford, Canada

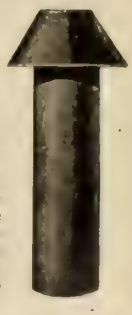
HAMILTON ENGINEERING SERVICE LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
195 KING WILLIAM ST. HAMILTON

BERTRAMS LIMITED
SCIENNES EDINBURGH
Rubber Mill Machinery

Oil Tempered Steel Springs
—for every purpose and the best for each use.
Special styles of all kinds to Order.
THE CLEVELAND WIRE SPRING COMPANY
Cleveland, Ohio U.S.A.



BOLTS AND RIVETS
We are equipped to fill the requirements of the Marine trade promptly. Square head, hexagon head and all kinds of Machine, Deck, Carriage Bolts and Rivets.



QUALITY PRODUCTS
LONDON BOLT & HINGE WORKS
LONDON, CANADA

Classified Opportunities

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

THIS COMPANY IS DESIROUS OF EXTENDing its business by acquiring additional capital. It is prepared to dispose of a part interest or the whole property. The plant is well situated on the main line of the C. P. Railway a few miles from Saint John, N.B., and includes Lands, Buildings and Factory, all in good condition, with ample room for expansion. It affords a good opportunity for building up a large industry.
Apply to
THE THOMPSON MACHINERY CO., LIMITED,
P.O. Box 76, Saint John, N.B. (c9m).

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

Used Belting, Pulleys, Etc.

We carry right in stock a large quantity of used Belting, Pulleys, Hangers, Shafting, etc., in good condition, which we sell at half the price of new. Inquiries solicited. In writing mention sizes wanted. L. S. Tarshis & Sons, 92 Wellington St., Montreal.

SUNCLO BRAND

WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT
Builders of Reliable Machinery.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

CLOSING TIME

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Canadian Machinery

RATE FOR CLASSIFIED ADVERTISING

Rates (payable in advance.): Two cents per word. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.

SALESMAN WANTED

WANTED — BY WELL-KNOWN AMER manufacturers of pneumatic tools enterp salesman for Canadian field. Reply givin experience, present connection, etc. All will be treated in confidence. Box 782N, dian Machinery.

J. RHODES & SONS, LTD., GR Ironworks, Wakefield, Eng., the lar manufacturers of Power Presses in Engl are open to appoint a commission Agen Canada for the sale of their Power Pre A real live Agent who thoroughly un stands the selling points of Power Presse required, and one having a show-room w be an advantage.

1 10-IN. MORRIS SAND PUMP, 125 FEE 10-in. spiral rivetted pipe for same. W McGovern, Ltd., Lumsden Building, Toront

FOR SALE

ELECTRIC STORAGE BATTERY LOC tives for sale. Two. 36-inch gauge. plete and in good condition. R. T. Gilm Company, Dept. "E," 211 McGill Street, Mo

USED MACHINERY FOR SAL

1—13" x 5' South Bend Engine Lathe.
1—18" x 8' Mueller Engine Lathe.
1—20" x 10' Whitcomb Blaisdell Eng Lathe.
1—24" x 10' Bertram Engine Lathe.
1—Power Hack Saw.
1—No. 3 Greenard Arbor Press.
1—Air Hammer.
CHAS. P. ARCHIBALD & Co.
285 Beaver Hall Hill Montr

Grey Iron Castings

Light and Medium-Bench and Floor Repeti Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT

CANADIAN MACHINE SHOP

—

Will handle medium Specialty Line — Manufacturing and Selling

—

Apply Quickly
Box No. 715F
CANADIAN MACHINERY

SURPLUS PLANT FOR SALE

LATHES

N 16 16"x4' Centres, Lodge & Shipley.
N 17 16"x4' Centres, Reed Prentice.
N 18 16"x4' Centres, Lodge & Shipley.
N 19 16"x4' Centres, Reed Prentice.
N 20 20"x3' 6" Centres, Reed Prentice.
N 21 14"x5' 6" Centres, C. M C.
N 22 14"x3' 6" Centres, C. M. C.
N 356—Brightside Roll Turning Lathe.

TURRET LATHE

N 31—3¼" No. 2A. Warner & Swasey.

AUTO SCREW MACHINES.

N 51—⅝" Cleveland Automatic.
N 52 1¼" Cleveland Automatic.
N 53—2" 6 Hole Turret, Cleveland Auto.
N 54 -1¼" 4-spindle Cleveland Automatic.
N 55—2¼" Gridley Automatic.
N 56 -4¼" Gridley Automatic.
N 57 - 2" Cleveland Automatic.

MILLING MACHINES.

N 72 Reinecker Plain Miller.
N 79 P. & W. Duplex Spindle Profiler.
N 82 Cincinnati Plain Miller, Lincoln Type.
N 83 Cincinnati Plain Miller, Lincoln Type.
N 84 Cincinnati Plain Miller, Lincoln Type.

RELIEVING LATHES.

N 01 Holroyd Universal
N 03 -Flather Plain.
N 04 -Armstrong Whitworth Plain.

RELIEVING LATHES.

N 01—Holroyd Universal.
N 03 Flather Plain.
N 04 -Armstrong Whitworth Plain.

GRINDERS.

N 12 Walker No. 3 Double Stroke Surface Grinder.
N 13 Walker 10" Single Stroke Surface Grinder.
N 15 Norton 10"x50" Plain Grinder.
N 16 B. & S No. 3 Universal Reamer and Cutter Grinder.
N 21—B. & S. Universal Reamer and Cutter Grinder.
N 22 B. & S. No. 2 Cutter Grinder.
N 26 B. & S. No. 11 Plain Grinder.
N 27 B. & S No. 10 Plain Grinder.
N 42 Heald No. 70 Boring Grinder.
N 41 Rivet No. 3 Boring Grinder.
N Landis 10"x20" Grinder.
N Landis 12"x42" Plain Grinder.
N Hand Grinder. National Acme.
N New Yankee Drill Grinder.

DRILLS.

N 66 Knight Drill No. 208.
N 67 Herbert Single Spindle Drill.
N Avery 15" Drill Press.

CENTERING MACHINES.

N Hendey Centering Machine.

FLUTING MACHINES.

N Holroyd ¼" to ½".
N Holroyd ½" to 1".
N Armstrong Whitworth ½" to 2".

BORING MILLS.

No. 306—100" C. M. C. Boring Mill
No. 310—72" Stirk Boring Mill.

PRESSES.

No. 319—Morgan Hydraulic Stamping Press.
No. 324—Morgan 1,000 ton Steam Hydraulic Press.
No. 328—Morgan 2,000 ton Steam Hydraulic Press.
No. 329—Morgan 600 ton Steam Hydraulic Press.
No 334—United Engineering 500 ton Steam Hydraulic Press.

ROLLING MILLS.

No. 320—Morgan Tyre Rolling Mill,
No. 322—Morgan Wheel Rolling Mill.
No. 350—Lamberton 12" Rolling Mill.
No. 351—Boonton 9" Rolling Mill.

STEAM ENGINES.

No. 321—1,000 H.P. International C. C Steam Engine.
No. 353—350 H.P. Porter Allen Steam Engine.
No. 355—1,000 H.P. Tod Reversing Engine.

CRANES

No. 323—Wellman, Seaver & Head Furnace Charger.
No 427—5-ton Whiting Travelling Crane, 48' span.
No. 431—15-ton Whiting Travelling Crane, 72' span.
No. 432—Wellman, Seaver & Head Low-ground Open Hearth Charger.
No. 433—Wellman, Seaver & Head 25-ton Crane, 37' 5" span.
No. 434—Wellman, Seaver & Head 15-ton Crane, 72ft span.

BOILERS AND BOILER EQUIPMENT.

No. 327—Smart Turner 5"x7½"x8" Boiler Feed Pump.
No. 454—Epping Carpenter Duplex Pump, 6" x 4" x 6".
No. 455—2,000 H.P. Cochrane Feed Water Heater
No. 456—500 H.P. Goldie & McCulloch Boiler.
No. 470—250 H.P. Goldie & McCulloch Boiler.
No. 472—100 H.P. Goldie & McCulloch Boiler.

FOUNDRY LADLES.

No. 417—10-ton Ladle.
No 526—20-ton Ladle.
No. 2091—3-ton Ladle.
No. 2093—2-ton Ladle.
No. 2065—Small Ladle, 23" dia. x 22" deep.

METAL TESTING MACHINES.

No. 424—A. W. Tensile, Bending and Compression Testing Machine.
No. 425—Brinell Testing Machine for hardness
No. 426—Scientific Materials Co. Microscopic Photographic Bench.
No. 531—Johansson Precision Blocks, No. 1206
No. 208—A. W. Measuring Bench in 1/10,000"

ELECTRICAL EQUIPMENT.

No. 435—40 K. W. Belt Driven Generator, 550 volts, D.C.
No. 485 to No. 487—300 K.V.A. Can. General Electric Transformers, 22,500 volts to 2,200 volts.
No. 488 to No 493—140 K.W. British Electric Transformers, 22,500 volts to 2,200 volts.
No. 494 to No. 495—350 K.W. Bruce Peebles Motor Convertors, 2,200 volts A.C. to 250 and 500 D.C.
No. 496—375 K. V. A. Steam Driven Generator, Swedish General Electric Co., 2,300 volts, 3 phase, 60 cycles. Complete with engine, exciter set and switchboard.

ELECTRICAL EQUIPMENT (Cont.)

No. 547 to No. 549—25 K. V. A. General Electric Transformers, 2,200/550. volts.
No. 558 to No. 560—250 K. V. A. General Electric Transformers, 22,500/110 volts.
No. 561 to No. 569—500 K. V. A. General Electric Transformers, 22,500/110 volts.

PUMPS.

No. 332—Deane 2⅞"x10" Triplex Hydraulic Pump, Gear-driven.
No. 333 Darling 5"x7"x10" Vacuum Pump.
No. 450 -Bawden 7"x9"x10" Pump.
No. 453 Smart Turner 11½x2¾ 'x4" Pump.
No. 553—March Deep Well Pump, 3' stroke x 8" bore.

STEAM HAMMERS.

No. 335 3-ton Bertram Hammer, Arch Frame
No. 336—1-ton Massey Hammer, Arch Frame.
No. 337 12-cwt. Massey Hammer, Arch Frame
No. 338 8-cwt. Massey Hammer, Arch Frame
No. 339—4-cwt. Massey Hammer, Arch Frame

SHEARS.

No. 349 Craig & Donald Shear, Capacity 3½" to 4".
Noi. 352—Long & Alstatter Shear, Capacity 6"x⅞" M.S.

ELECTRIC FURNACES.

No. 382—3-ton Heroult Furnace.
No. 383—6-ton Heroult Furnace.

MISCELLANEOUS.

No. 181—Amer. Tool Co. Oil Separator, No. 2
No. 187—Noble & Westbrook Stamping Machine.
No. 194—Automatic Machine Co. Threading Machine.
No. 196—Hoefer Tap Threading Machine.
No. 207—No. 2 Greenard Arbor Press.
No. 270 Tilghman & Brooksbank Sandblast.

PLEASE REFER TO MACHINES BY NUMBER

Large Stock of Small Tools, High Speed and Carbon Steels, Motors, Etc., of all sizes, A. C. or D. C. Current

Plant can be viewed at Longueuil Works—Full details on application.

ARMSTRONG WHITWORTH OF CANADA LIMITED

298 St. James Street -- Montreal

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Montreal, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Independent Pneumatic Tool, Chicago, Ill.

Analyses, Chemical
Toronto Testing Laboratory, Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Columbia Hdwe. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
[illegible] Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Otn.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can Steel Foundries, Montreal, Que.
Dom Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
[illegible] Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Can. Fairbanks-Morse Ltd., Montreal. Q.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio

Blocks, Chain (See Hoists, Hand)

For list of Dealers see the last page of This Buyers' Directory

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Machine and Carriage
Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, V
Armstrong-Whitworth of Canada Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toron
Gisholt Machine Co., Madison, W
Herbert Ltd., Alfred, Toronto, O

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt,
Can. Fairbanks-Morse Co., Ltd.,
Garlock-Walker Mchy Co., Toro
Gisholt Machine Co., Madison, W
Herbert Ltd., Alfred, Toronto, O
Landis Tool Co., Waynesboro,

Boring, Drilling and Milling Machines, Vertical
Armstrong-Whitworth of Canada Ltd., Montreal, Canada
Canada Machinery Corp., Galt,
Can. Fairbanks-Morse Co., Ltd.,
Garlock-Walker Mchy. Co., Toro
Herbert Ltd., Alfred, Toronto, O
McDougall Co., Ltd., R., Galt,
Oliver Machinery Co., Grand Rap
Petrie, Ltd., H. W., Toronto, O

Boring Heads
Aikenhead Hardware Ltd., Toron

Boring Tools
Armstrong-Whitworth of Canada Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chi
Gisholt Machine Co., Madison,

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolli
Ltd., Toronto, Ont.
Ontario Metal Products Co., L
onto, Ont.

Brass Valves
Puro Sanitary Drinking Foun
Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Foun
Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd
ton, Ont.

Bridges
Hamilton Bridge Works Co., L
ilton, Ont.
MacKinnon Steel Co., Sherbro

Broaching Machines
Bilton Machine Co., Bridgeport,
Garlock-Walker Mchy. Co., Tor

Bronze
Brown's Copper & Brass Roll
Ltd., Toronto, Ont.
Walker & Sons Metal Prod
Hiram, Walkerville, Ont.
Ontario Metal Products Co.,
onto, Ont.

Bronze, Phosphor
British Smelting & Refining
Montreal, Que.
Canada Metal Co., Ltd., Toron
Ontario Metal Products Co.,
onto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto.

Buffing or Polishing Machi (See Polishing and Buffing
Blount Co., J. G., Everett, M
Can. Hanson & Van Winkle
Toronto, Ont.
Ford-Smith Machine Co., Ham
Petrie, Ltd., H. W., Toronto,
U.S. Electrical Tool Co., Cin

Bulldozers
Bertram & Son Co., Ltd.,
Dundas, Ont.
Canada Machinery Corp., Gal
Garlock-Walker Mchy. Co., To

Burners, Oil and Gas
General Combustion Co. of
Montreal, Que.
Rockwell Co., W. S., New Yo

Burrs
Steel Co. of Canada, Ltd., Ham

Bushings
Fisher Motor Co., Ltd., Orill
Morrow Screw & Nut Co.,
Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., To

Calipers
Brown & Sharpe Mfg. Co., Prov
Starrett Co., L. S., Athol,

BUYERS' DIRECTORY

Car
Canada Foundries & Forgings Co., Welland, Ont.

Caulking Machinery (See Sheet Metal Working Machinery
Hill Co., E. W., Brooklyn, N.Y.
Bros. Boggs & Co., Ltd., Hamilton, Ont
Millinnon Steel Co., Sherbrooke, Que

Castings, Aluminum
Electric Castings Co., Ltd., Orillia.
Hanson & Van Winkle Co., Toronto, Ont.
Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Steel Corp., Ltd., Sault Ste. Marie, Ont
Electric Castings Co., Ltd., Orillia.
Hanson & Van Winkle Co., Toronto, Ont.
Metal Co., Ltd., Toronto, Ont.
Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Metal Co., Ltd., Toronto, Ont.
Hanson & Van Winkle Co., Toronto, Ont.

Castings, Marine
Steel Foundries, Montreal, Que
Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
& Sons, Ltd., W. H., Toronto.
Motor Co., Ltd., Orillia, Ont.
Die-Casting Corp., Syracuse, N.Y.
Foundry Co., Galt, Ont.
Brass & Metal, Ltd., Hamilton, Ont.

Castings, Ferro-Alloy
Steel Foundries, Montreal, Que.

Castings, Iron
Steel Corp., Ltd., Sault Ste. Marie, Ont.
Industrial Co., A., Fortierville, Que.
Machine Co., Bridgeport, Conn.
Boggs & Co., Ltd., Hamilton, Ont.
Hanson & Van Winkle Co., Toronto, Ont.
Electric Castings Co., Ltd., Orillia.
& Co., M. A., Cleveland, Ohio.
Ltd., John T., Toronto, Ont.
Foundry Co., Galt, Ont.
& Sons, Wm., Owen Sound, Ont.
Co., Ltd., R., Galt, Ont.
Foundry Co., Ltd., Ottawa, Ont.
& Sons Metal Products, Ltd., Walkerville, Ont.
Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Steel Foundries, Montreal, Que.

Castings, Malleable Iron
Malleable Iron Co., Ont.
& Sons, Ltd., Wm., Owen Sound, Ont.
Falls Malleable Castings Co., Niagara Falls, Ont.

Castings, Monel Metal
Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Brass & Metal, Ltd., Hamilton, Ont

Castings, Nichrome
Harris Co., Walkerville, Ont.

Castings, Nickel
& Van Winkle Co., Toronto, Ont

Castings, Semi-Steel
Mfg. Co., Thos., Montreal, Que.
& Steel Foundries, Hull, Que.
Foundry Co., Galt, Ont.
Steel Foundries, Ltd., Winnipeg, Man.
Engineering Works, Limited, Montreal, Que.

Castings, Steel
Foundries & Steel, Ltd., Hamilton, Ont.
Foundries, Montreal, Que.
& Sons, Wm., Owen Sound, Ont.
Ensemble Steel Co. of Can., Ltd., Toronto, Ont.

Cement Iron
Co., Jersey City, N.J.

Centering Machines
& Son Co., Ltd., The John, Dundas, Ont.
Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Co., Ithaca, N.Y.
Gear Works, Philadelphia, Pa.
Tanks of Canada, Ltd., Montreal, Que.
Co., Lisbon, Ohio

Chasing, Screw
Belt Co., Toronto, Ont.
Tap & Die Corp., Galt, Ont.
& Co., Montreal, Que.
Co., Ithaca, N.Y.
Tanks of Canada, Ltd., Montreal, Que.
Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dlokow, Fred C., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St Louis, Mo

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Garlock-Walker Mchy. Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Flue
Holden Co., Ltd., Montreal, Que

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Cutters, High Speed
Armstrong Whitworth of Canada, Ltd., Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Cutters, Milling
Armstrong Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island Que
Greenfield Tap & Die Corp., Galt, Ont
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Banfield & Sons, Ltd., W. H., Toronto.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.,

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Wellinger Co of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scotland.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings, Ltd., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings, Ltd., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York, N.Y.

Furnaces, Heat Treating Continuous
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Toronto, Que.
Rockwell Co., W. S., New York, N.Y.

Furnaces, Heat Treating Oil
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Toronto, Que.
Rockwell Co., W. S., New York, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Tempering and Hardening
Brown & Sharpe Mfg. Co., Providence, R.I.
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Toronto, Que.
Rockwell Co., W. S., New York, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Springfield, Vt.

BUYERS' DIRECTORY

field, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
ohannson Inc., C E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

ges, Measuring (See Tool Work)
Canfield & Sons, Ltd. W. H., Toronto, Ont.
Chesterman & Co., Ltd., J., Sheffield, Eng.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
ohannson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

ges, Recording
Bristol Co., Waterbury, Conn.
ohannson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
ohannson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ges, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ges, Standard
Armstrong Whitworth Co. of Can., Lt. Montreal, Que.
Skins & Co., Inc., E. C., Indianapolis
Johansson Inc., C. E., Ploughkeepsie, N. Y.

ges, Thread
Ackworthie Ltd., John, Birmingham, Eng.
Canfield & Sons, Ltd. W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

G, Coal Compressed
Air Liquide Society, Toronto, Ont.

G, Compressed
Can. Oxo Co. of Can., Toronto Ont.

Gears
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Morden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gages, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario
Philadelphia Gear Works, Philadelphia, Pa
Polson Engineering Works, Limited, Montreal, Que.

Gear Counters
Root Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lewis Gear Shaper Co., Springfield, Vt.
Pratt & Whitney Co., Ltd., H. W., Toronto, Ont.
Hilton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Gleason Works, Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Polson Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ed-Smith Machine Co., Hamilton, Ont.
Fisher & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario
Hobson Ltd., John T., Toronto, Ont.
Kilne & Co., A. B., Hespeler, Ont.
Low & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Monograll Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Pa.
Pratt (Hans) of Canada, Ltd., Montreal, Que
Polson Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kneely & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng.
Williams Machinery & Supply Co., A. R., Montreal Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y.

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton,

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow, Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation

BUYERS' DIRECTORY

Diamond State Fibre Co. of Can., Ltd. Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co Ltd Montreal

Japanning and Varnishing Ovens
[illegible] Oakland, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co. Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Sidney Machine Tool Co., Sidney, Ohio.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blaishill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton,
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill
Terry & Co, John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co Milwaukee, Wis
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co, John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que
Northern Electric Co., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto,

Nickel, Bars, Sheets, Wire, Etc
International Nickel Co. of Can., Ltd. Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products Ltd. Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton

Nitrogen
L'Air Liquide Society, Toronto, Ont

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal,

Nuts, Machine Screw
Torrington Company, Ltd., Upper Lachford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton

Nuts, S.A.E., Plain and Castel
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto

Oils
Canadian Oil Companies, Ltd., Toronto
Cateract Refining Co., Toronto, Ont

Oil Hole Covers
Can Winkley Co., Ltd., Windsor

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd Toronto, Ont
Brantford Oven & Rack Co., Brantford

Oxygen
Carter Welding Co., Toronto, Ont
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont

Packing, Hydraulic
Can. Consolidated Rubber Co Montreal, Que.
Graton & Knight Mfg. Co., Worcester, Mass.
Guildford & Sons, Ltd., Halifax.

Packing, Steam
Can. Consolidated Rubber Co., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd.,
Graton & Knight Mfg. Co., Worcester, Mass.

BUYERS' DIRECTORY

...ford & Sons, Ltd., Halifax, N.S

Pap Mill Conveyors
...Bros. Ltd., Edinburgh, Scotland
...Engineering Works, Ltd., ...real, Que.

Pates
...erstonhaugh & Co., Ottawa, Ont.
...& Marion, Montreal, Que.

Pen Wet and Dry
...Mfg. Co., Chicago, Ill.

Patte-Shop Machinery (See Woodworking Machinery)
...Machinery Corp., Galt, Ont.
...Machinery Co., Grand Rapids, Mich

Patte..., Wood and Metal
...Machine Co., Ltd., Montreal, Q
...Foundry Co., Ltd., Ottawa, Ont
...Pattern Works, Galt, Ont.

Pens..., Steel
...Steel Co., Sherbrooke, Que

Photograph Motors
...& Sons, Ltd., W.H., Toronto

...or Tin
...Smelting & Refining Co., Ltd ...real, Que
...Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
...ercial Camera Co., Providence, R.I

Pipe Bending Machines
...can Pipe Bending Machine Co., ...ton, Mass
...Fairbanks-Morse Co., Ltd., Montreal.
...wood Corp., H. B., Philadelphia
...Machinery Co., A. R., Toronto

...e Cutting and Threading Machines
...Fairbanks-Morse Co., Ltd., Montreal.
...Ltd., Montreal, Que
...Tap & Die Corp., Galt Ont
...& Co., A. B., Hespeler, Ont
...Machine Co., Inc., Waynesboro, Pa
...Machine & Tool Co., Detroit, ...gh
...Drill Co., Ltd., R., Galt, Ont.
...Ltd., H. W., Toronto, Ont.
...Tool Corp. of Can., Ltd., Brant... Ont

...of Canada, Ltd., Hamilton, Ont.

...d Nipple Threading Machines
...Tool Co., Inc., Waynesboro, Pa.

...ters' Tools
...Hardware Ltd., Toronto, Ont.
...Montreal, Que.
...& Son Ltd., Toronto, Ont.

...Threading Die Heads
...Tool Co., Inc., Waynesboro, Pa.

...oning Machines
...Tool Co., Cleveland, Ohio
...Street Machine Co., Madison, Wis.

...meter Parallels
...& Mfg. Co., Niagara Falls, Ont.

...n Machines
...& Son Co., Ltd., The John ...Ont
...Machinery Corp., Galt, Ont.
...banks-Morse Co., Ltd., Montreal.
...inery & Supply Co., Geo. F., ...Que
...-Walker Mchy. Co., Toronto, Ont.
...Ltd., John T., Toronto, Ont.
...Ltd., Alfred, Toronto, Ont.
...& Mfg. Co., Niagara Falls, Ont.
...Co., Muskegon, Mich.
...chinery Co., Grand Rapids, Mich.
...Machinery Co., A. R., Toronto,

...Machines, Rotary
...& Son Co., Ltd., The John, ...Ont
...Machinery Corp., Galt, Ont.

...Ra...
...& Son Co., Ltd., The John, ...Ont

...ne Brass Goods
...Drinking Fountain Co., ...Mass

...matic Tools
...soll-Rand Co., Ltd., Sher... Que.
...Pneumatic Tool Co., Toronto.
...-Walker Mchy. Co., Toronto, Ont.
...Pneumatic Tool, Chicago, Ill.
...matic Tool Co., Grand ...Mich

...ishing and Buffing Machines
...Ltd., John, Birmingham, Eng
...& Co., Chas. P., Montreal, Q.
...J. G., Everett, Mass.
...arpe Mfg. Co., Providence, R.I
...& Van Winkle Co., Ltd., ...Ont
...Machine Co., Hamilton, Ont
...-Walker Mchy. Co., Toronto, Ont.
...John C., Birmingham, Eng

...St...
...Portable Steel Co. of Canada, ...ilton, Ont

...ground Steel Parts
...Ltd., John, Birmingham, Eng
...Roller Co., Philadelphia, Pa
...Co., Ltd., Orillia, Ont

...resses, ...rbor
...Kalamazoo, Mich
...Morse Co., Ltd., Montreal
...Manufacturing Company, Ltd., ...Ont.
...neering Co., Sarnia, Ont.
...H. W., Toronto, Ont.
...& Co. of Can., Ltd., Chas. A., ...Ont

...resses, ...rop and Forging
...Bros. & Co., Ltd., Hamilton, Ont
...Canada Foundries & Forgings Co., Wel... land, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Terry & Co., John C., Birmingham, Eng

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
...ell & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill

Pumps, Industrial
Trahern Pump Co., Rockford, Ill

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can
Can Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
...ston Co., Waterbury, Conn
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis
International Business Machines Co., To... Ont

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto Ont.

Rheostats
Northern Electric Co., Montreal, Que

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque Ont
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John Dundas, Ont.
National Machinery Co., Tiffin, Ohio

Riveting Machines
Bilton Machine Co., Bridgeport, Conn
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven, Mich
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Schuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
...Consolidated Rubber Co., Ltd., Montreal, Que

Rudder Frames, Steel
...Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa

Rubber Machinery Makers
...Consolidated Rubber Co., Ltd., ...ieal Machinery Shops, Kitchener, Ont

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
...Chemical Co., New York, N.Y

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co., Chicago, Ill

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven, Mich

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd Montreal, Canada
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
...Fairbanks-Morse Ltd., Montreal, Q

Screens
Can. Wire & Iron Goods Co., Hamilton

BUYERS' DIRECTORY

Ont.

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Cleveland, Ohio.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stil & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, O

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt
Pratt & Whitney Co., of Canada, Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt,
Morrow Screw & Nut Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield
Starrett Co., L. S., Athol, Mass

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham
Archibald & Co., Chas. P., Montreal
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler,
National Acme Co., Cleveland,
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass

Taps and Dies
Ackworthie, Ltd., John, Birmingham
Butterfield & Co., Inc., Rock Island
Can. Fairbanks-Morse Co., Ltd.,
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler,
Morse Twist Drill & Machine
Bedford, Mass.
National Acme Co., Cleveland,
Pratt & Whitney Co., of Canada, Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven
Jardine & Co., A. B., Hespeler,
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland,
Victor Tool Co., Waynesboro, P

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound

Testing Metals and Materials
Toronto Testing Laboratory, Toronto

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island
Greenfield Tap & Die Corp., Galt
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland,
Pratt & Whitney Co., of Canada, Dundas, Ont.
Victor Tool Co., Waynesboro,

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro,

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland,
Geometric Tool Co., New Haven,
Greenfield Tap & Die Corp., Galt,
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland,
National Machinery Co., Tiffin,
Williams Tool Corp. of Can., Ltd., Bedford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn,

Tie Plates
Steel Co. of Canada, Ltd., Hamilton,

Tongs
Hepburn Ltd., John T., Toronto

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Rice Lewis & Son, Ltd., Toronto

Tool Holders
Armstrong Bros. Tool Co., Chicago,
Bilton Machine Co., Bridgeport,
Gisholt Machine Co., Madison,
Williams & Co., J. H., Brooklyn,

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., Dundas, Ont.
Canada Machinery Corp., Galt,
Williams & Co., J. H., Brooklyn,

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Toronto, Ont.

BUYERS' DIRECTORY

ols, Still (See Machinists' Small Tools)
Whitworth of Canada, Ltd.,
Canada.
Bros. Tool Co., Chicago, Ill.
, Edinburgh, Scotland.
Marchand, Montreal, Que.
Fairbanks-Morse Co., Ltd., Montreal.
& Co., Ltd., J., Sheffield,
Machinery & Supply Co., Geo. F.,
Que.
Tool Co., New Haven, Conn.
& Die Corp., Galt, Ont.
neering Service, Ltd.,
Alfred, Toronto, Ont.
Pneumatic Tool Co., Grand Haven,
Hillier Mfg. Co., St. Catha-
chine Tool Co., Racine, Wis
Machine Co., Lachine, Que.
Son, Ltd., Toronto, Ont.
Machine Co., Rockford,
L. S., Athol, Mass.
Co. of Can., Ltd., Chas. A.,
Ont.
Tool Co., Detroit, Mich.
chinery Co., A. R., Toronto,
chinery & Supply Co., A. R.,
Que.
neering Corp., Ltd., Toronto.
chine Co., Ltd., Montreal, Q.
Machine Co., Hamilton, Ont.
Bw
ctro Products, Ltd., Toronto.
W.B., San Francisco, Calif.
Co. of Can., Toronto, Ont.
Son, Ltd., Toronto, Ont.
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k Manganese Steel
oundries, Montreal, Que.
ctric Co., Montreal, Que.
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co, Montreal, Que.
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Cloth & Pulley Works, Toronto,
Bal of Canada, Ltd., Mont-
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n Systems (See Trucks)
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ucible Steel Co., Toronto
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an Tramways
t Co., Toronto, Ont.
& Hoist Co., Ltd., Niagara
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Works, Walkerville, Ont
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Fibre Co. of Can., Ltd.,
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John T., Toronto, Ont.
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Rubber Goods Co., Ltd.
O
& Rubber Co. of Can.,
Ont.
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Canada, Toronto, Ont.
nless Steel, Brass and
ne Fibre
Fibre Co. of Can., Ltd.,
O
ucts Co., Brantford, Ont.
Supply Co., Montreal, Que.
Products Co., Ltd., Ter-
onto
& Metal Co., Hamilton.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque Ont.

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Bristol Co., Waterbury, Conn.
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Can. Link-Belt Co., Toronto, Ont.

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Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
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Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

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Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
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Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co. Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

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MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
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R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

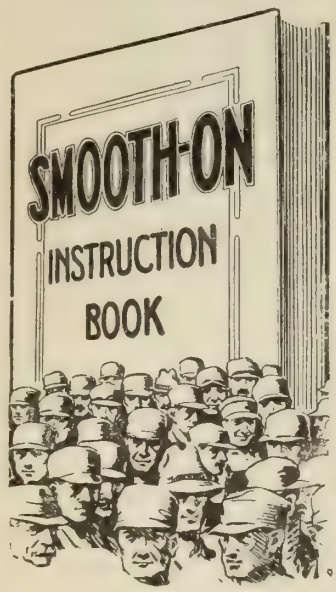
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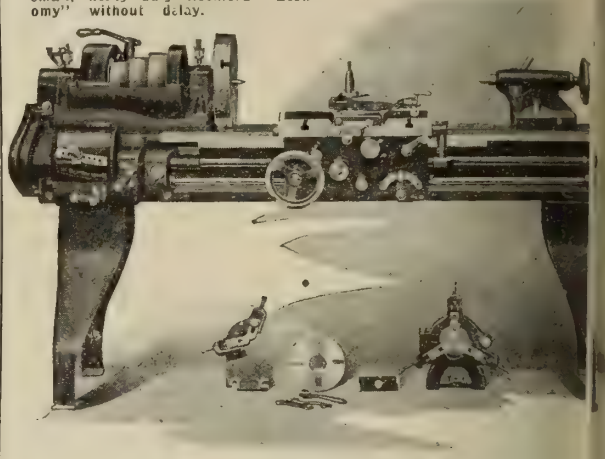
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Steinle Turret Machine Co.
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Victoria Foundry Co. ..

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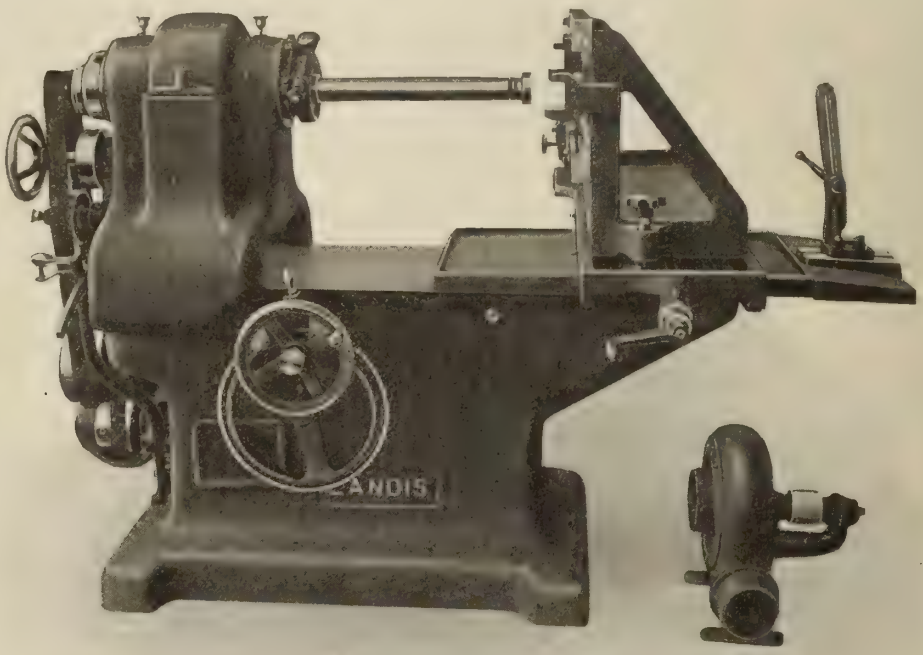
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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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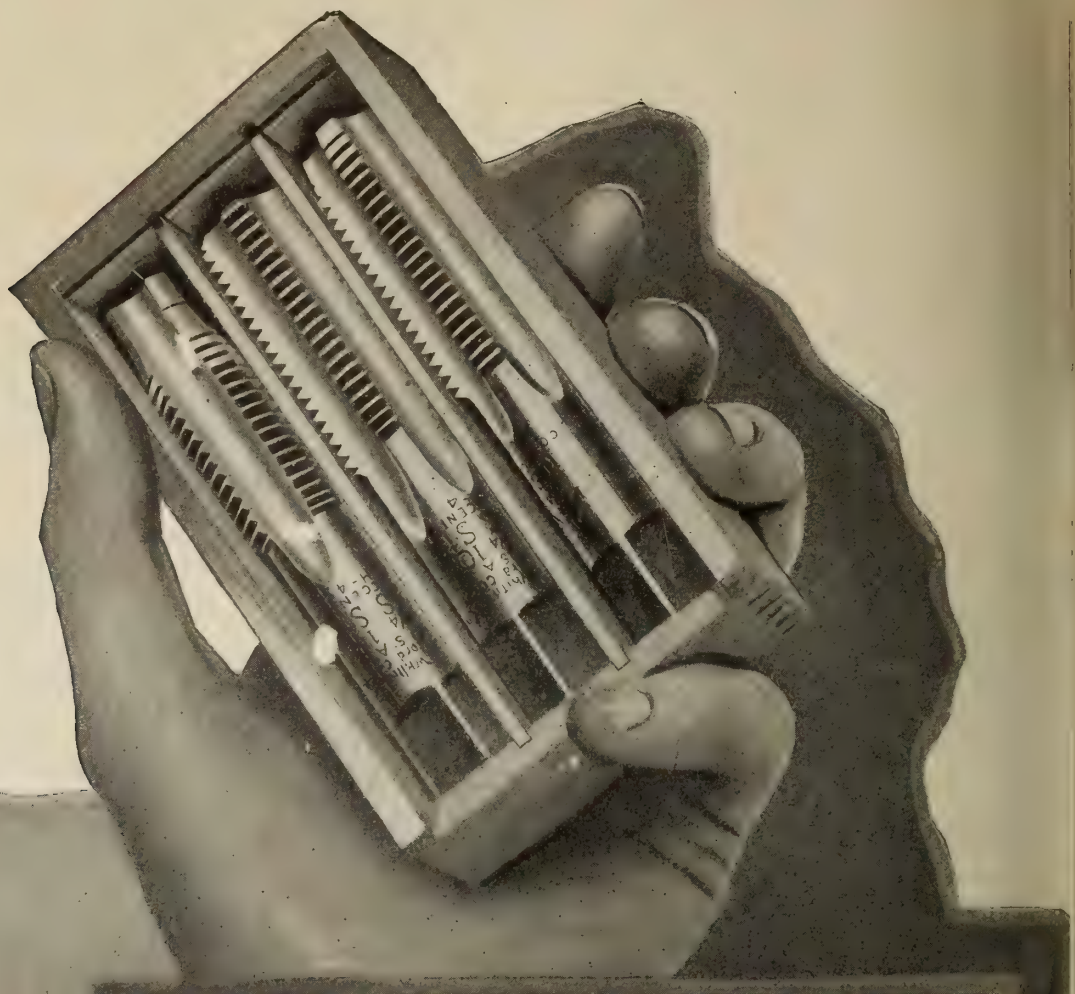
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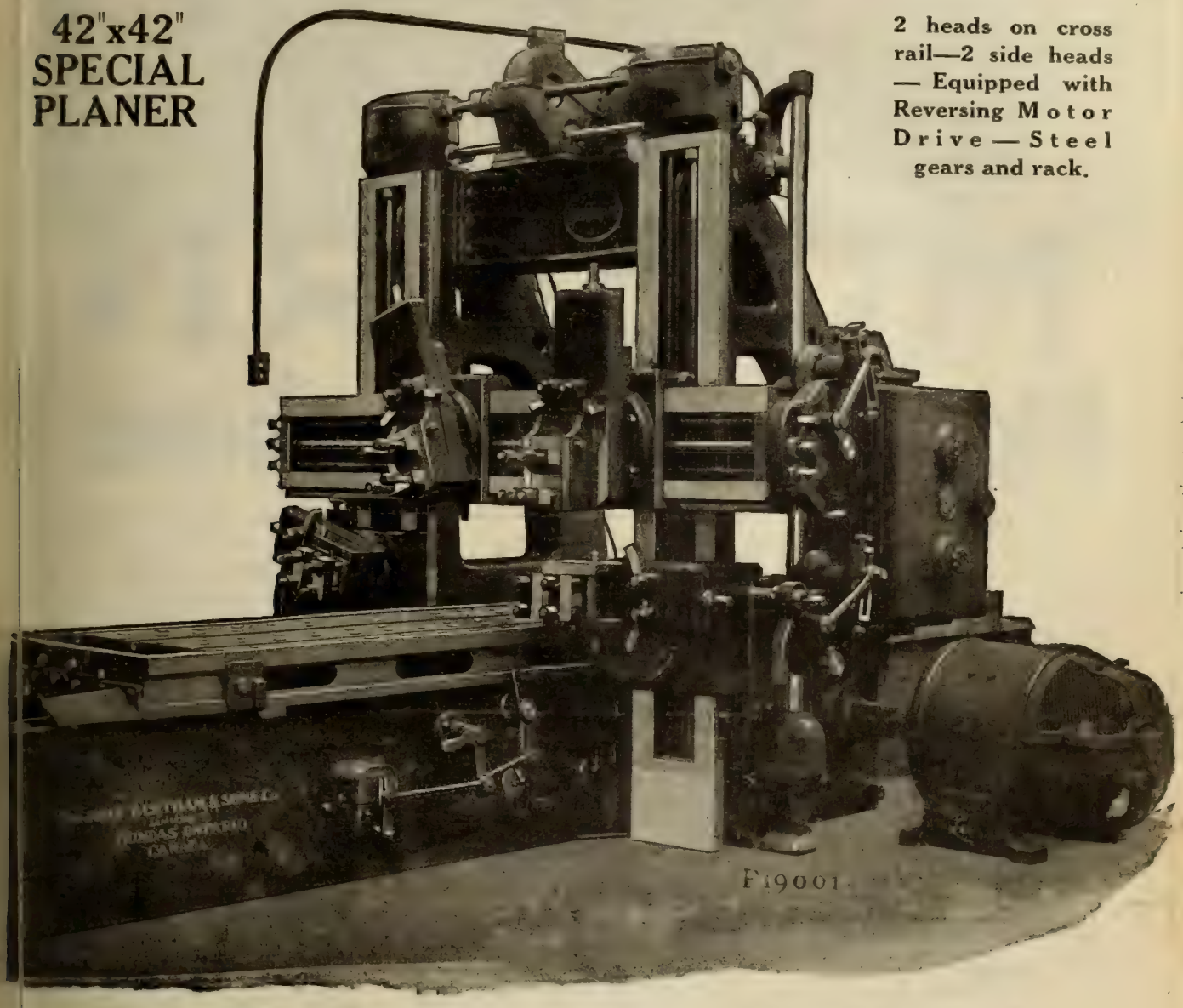
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The BERTRAM Page

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2 heads on cross rail—2 side heads — Equipped with Reversing Motor Drive — Steel gears and rack.



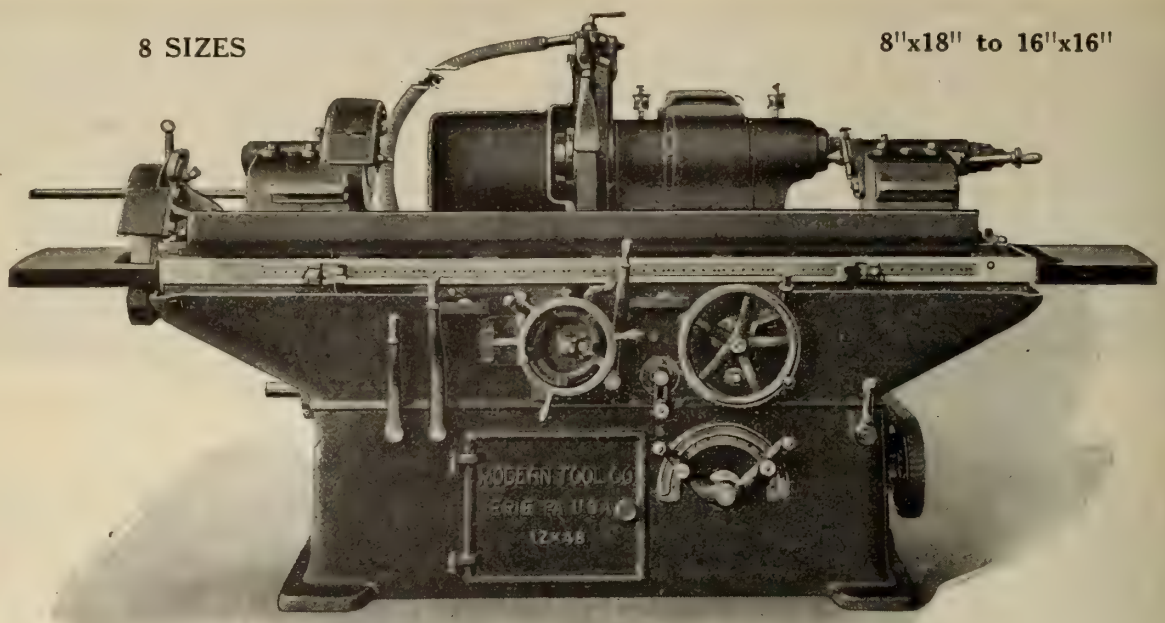
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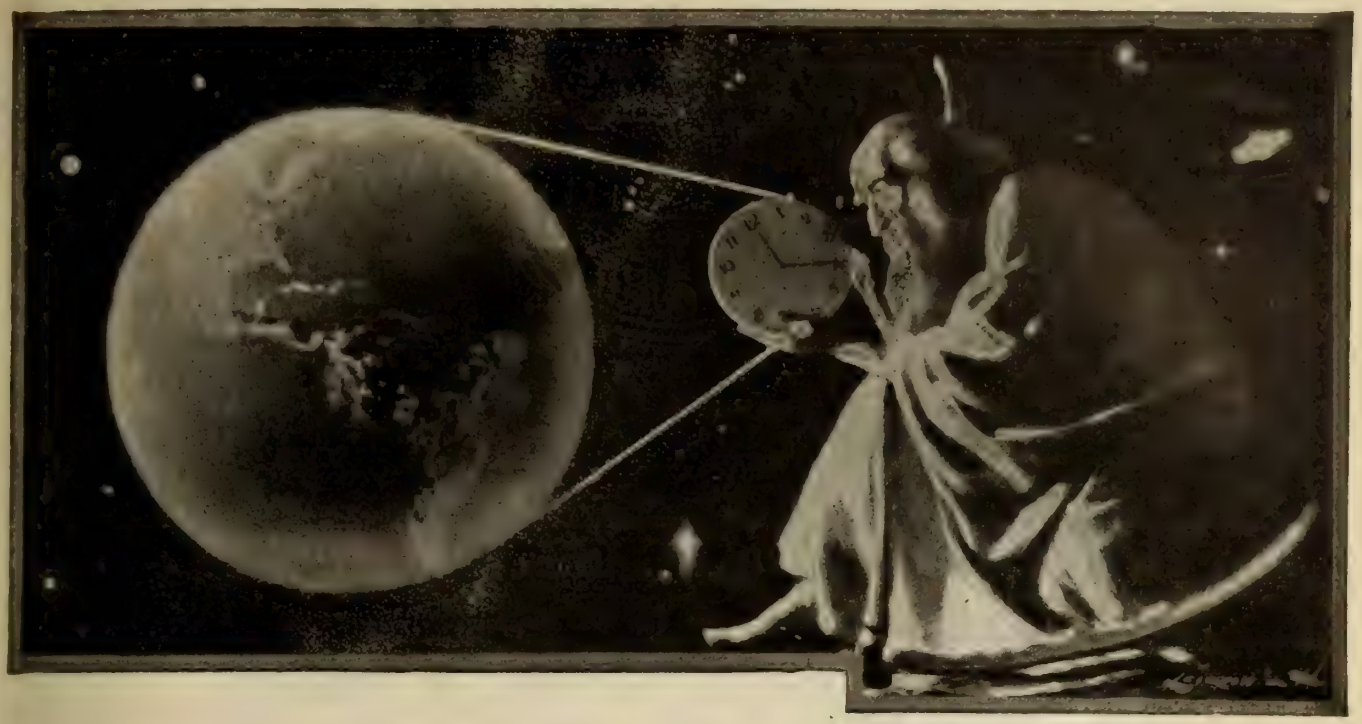
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Sales Agents in the United States and Canada: Walter H. Foster Co., 50 Church St., New York, N. Y.; E. L. Essley Machine Co., 551-557 Washington Blvd., Chicago, Ill.; Branches, Milwaukee, Wis.; Moline, Ill. Manning, Maxwell & Moore, Inc., Railway Exchange Bldg., St. Louis, Mo.; F. E. Satterlee Co, 120 Washington, N., Minneapolis, Minn.; Herberts Machinery & Supply Co., Los Angeles and San Francisco; Sherritt & Stoer Co., 2006-2008 Market St., Philadelphia, Pa.; English Tool & Supply Co., 930 Grand Ave., Kansas City, Mo.

Sales Agents in Foreign Countries: Yamatake Company, Tokio, Japan; Leo. C. Steinle, 53 Victoria St., London, S. W., England; Glaenzer & Perreaud, 18 and 20 Faubourg du Temple, Paris, France; Aktiebolaget Rylander & Asplund, Stockholm, Sweden; C. Civita & Co., Milan, Italy; J. Lambercier & Co., Geneva and Zurich, Switzerland; Rudel-Belknap Machinery Co, Ltd., Toronto and Montreal.



An Office Staff of 20 Persons —and no Time Recorder

you could borrow $12,500 for a year on what you lose

—our figures are not built on guess work or theory.

—it is our business to KNOW—

—it has been our business for 30 years to stop cost wastes for governments, railways, factories and business houses.

Minute and careful surveys in thousands of offices prove conclusively that the AVERAGE COST of being without a time recording system is as follows:

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The yearly loss at this rate is 1,500 hours, which figured at 50 cents an hour is $750. At 6 per cent. this $750 would obtain for you the use of $12,500 additional capital for a year.

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Perhaps you will say: "But some of my clerks work overtime—at balancing periods, etc." Of course they do. They do in all offices. But what means have you of giving proper credit where credit is due for this work—not perhaps in actual money but in establishing a reserve of merit for the next promotion?

An employer who neglects or refuses to use the International Time Recording System is standing in his own light. He can render justice neither to his own interests nor to those of his employees.

The World's Taskmaster

The world's work of every kind is set by the clock. It is begun by the clock; its progress, step by step, is measured by the clock, and its ultimate value, whether it be finished or unfinished, is fixed by the clock.

The clock takes the measure of all values. For this reason, the records produced by the International Time Systems are the most efficient records in the world. They are written directly, mechanically and unerringly by the steel hands of the World's Taskmaster—the Clock.

International SPEED ACCURACY ECONOMY Business Machines

INTERNATIONAL BUSINESS MACHINES CO., LTD.

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The quality of our product is of the very best—and is exclusively steel made by the Open Hearth Process, and can be furnished in all grades, from the softest rivet stock to high carbon special spring material. Order from us and you'll get both quality and prompt service. A trial is convincing.

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Chrome-Vanadium, Chrome-Nickel, Nickel.

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Open Hearth Quality (all sections from 12 lbs. to 100 lbs. per yard).

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Prompt Shipments from Stock

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NITRE CAKE

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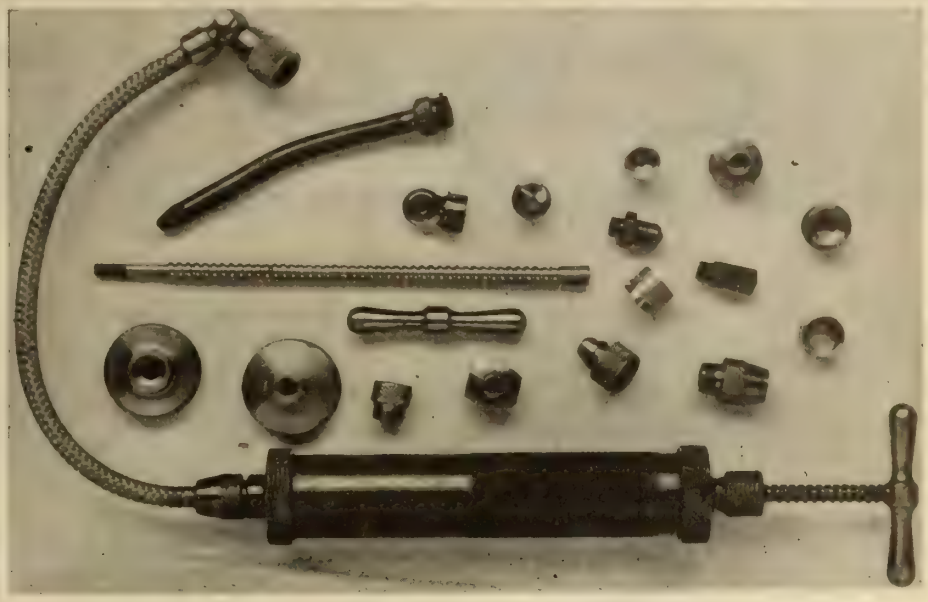
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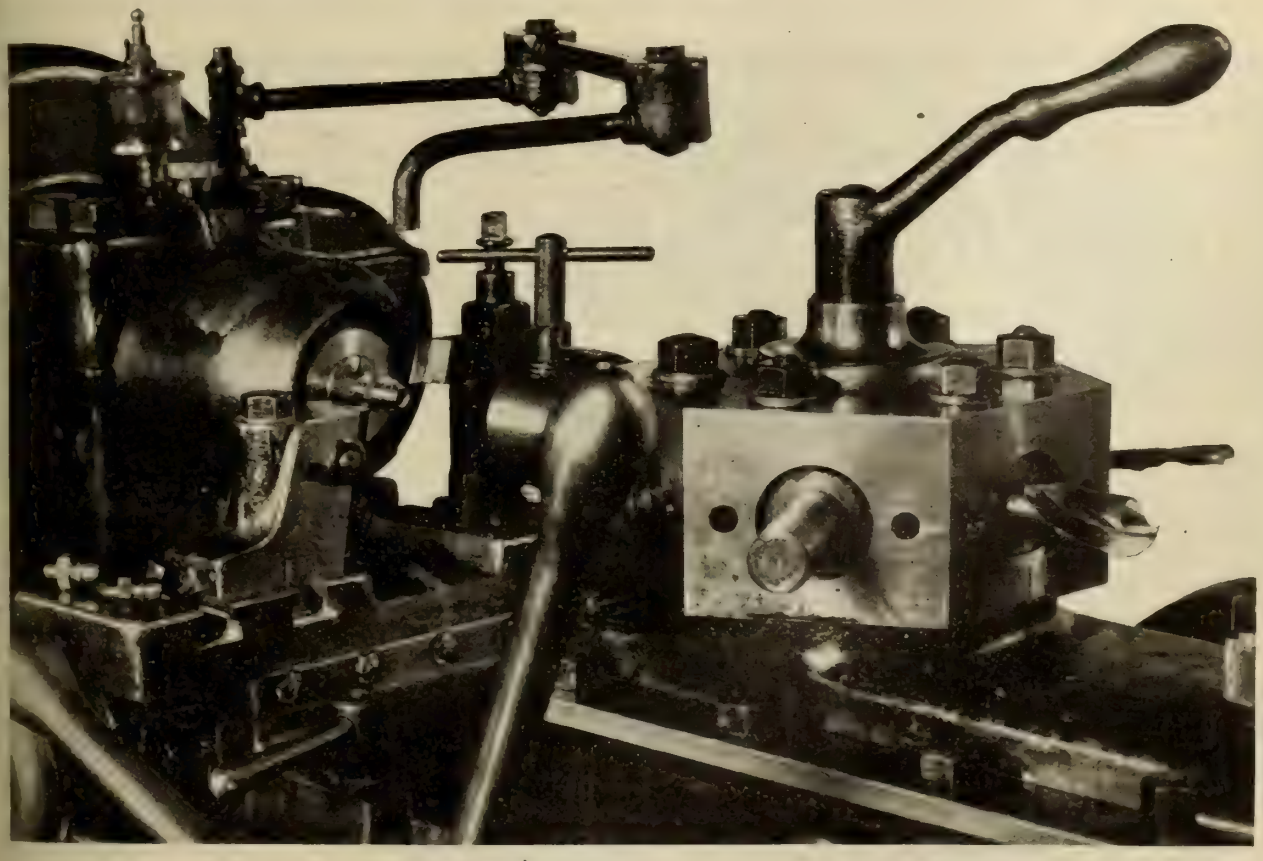
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New Lubricating System Parts all finished on



Warner & Swasey Turret Lathes

The Adkins Sales and Manufacturing Company, Canton, Ohio, investigated thoroughly before equipping with Warner & Swasey machines and tools to make the parts of their high pressure Grease Gun and Oiling System. They wanted speed and accuracy, and are well pleased with the good work and low production cost from their W & S Turret Lathes.



One of the Turret Lathes on one of the parts

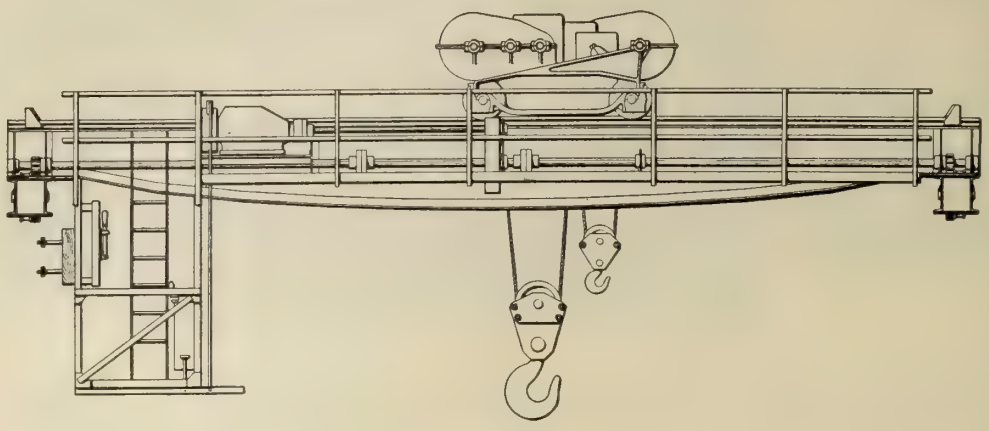
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The most completely equipped plant of its kind in Canada, covering two acres, with over 125,000 sq. feet manufacturing space.

This plant is at your disposal to manufacture, assemble and ship specialties of the following kinds:

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DRAWINGS	SMALL GEARS & PINIONS	BRASS, ALUMINUM or STEEL

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Every Commercial Purpose

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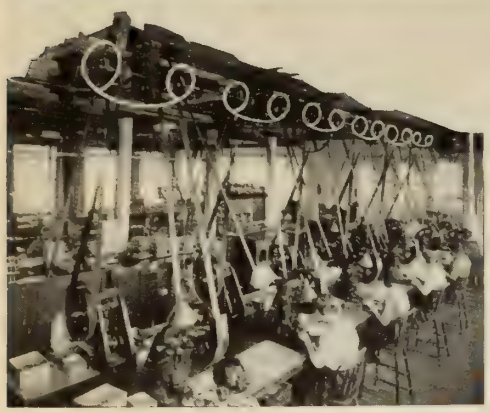
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Nova Scotia Steel and Coal Co., Limited

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THE JOHNSON FRICTION CLUTCH



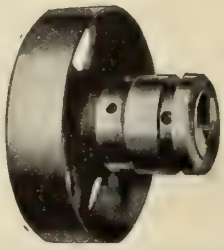
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

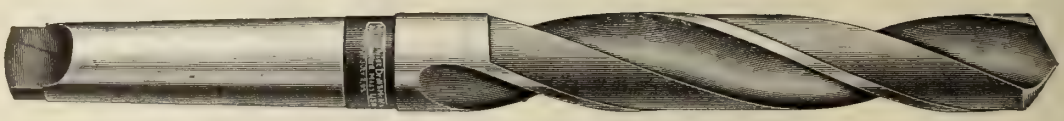
Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

"MORSE"



QUALITY

ALWAYS HAS MEANT, MEANS NOW
AND ALWAYS WILL MEAN

THE BEST

**Morse Twist Drill & Machine Co.,
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FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

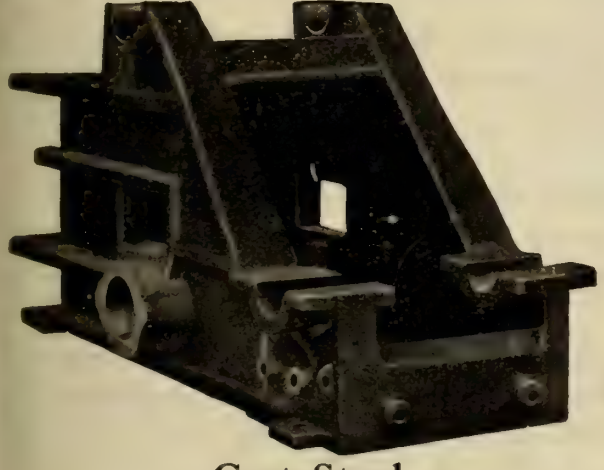
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Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

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Cast Steel
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Machinery Parts

of every description
in

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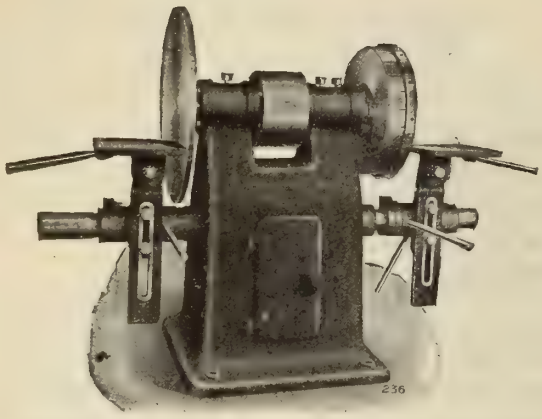
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Forged Shafts

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Hamilton, Canada

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DISC
Grinders



High-Class Made in Canada Machines

MACHINES which bear a reputation for doing quicker, better work, and whose upkeep expenses are practically nil, merit investigation.

Such machines are Ford-Smith Disc Grinders; every model of the Ford-Smith line—and there's a model for practically every purpose—is designed to give quality production as well as quantity.

Before leaving the factory all Ford-Smith Grinding Machines are subjected to a series of exacting tests, covering every detail of their construction. These tests prove that the mcahine is capable of filling all our claims.

Many manufacturing operations show possibilities of exceptional economies by the use of suitable grinding processes. Have one of our engineers call and see just what saving grinders would effect on your work.

Any information with regard to Ford-Smith Grinders will gladly be furnished.

Send for our latest Disc Grinder Bulletin.

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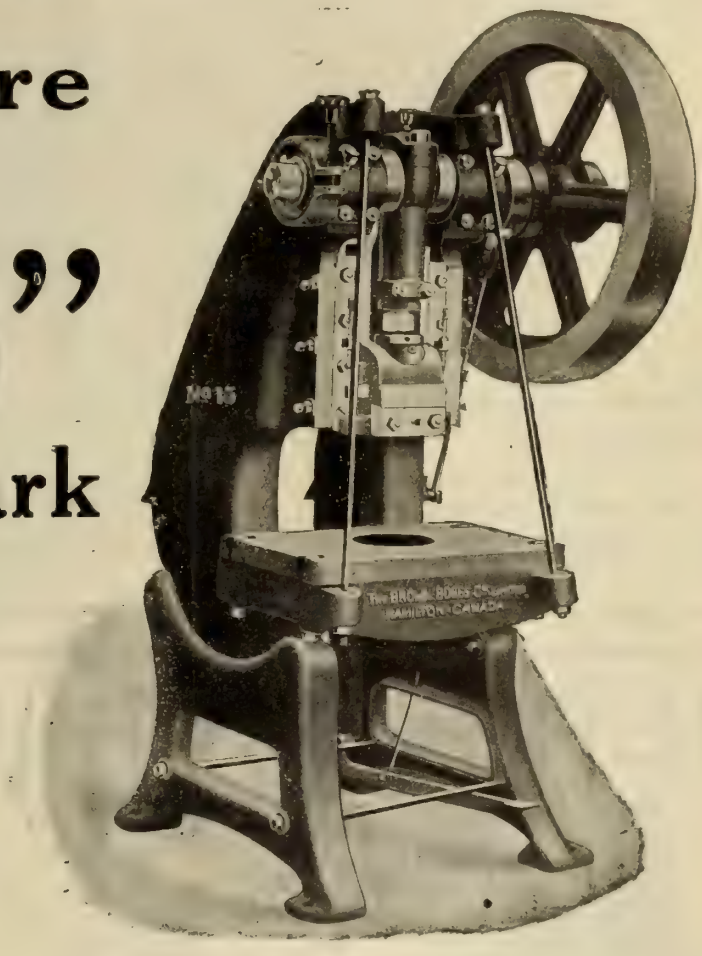
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It is a Guarantee of Reliability

The "B-B" trade mark on power presses, shears, tinsmiths' tools and canners' evaporators, and sheet metal working tools of every description, is an iron-clad guarantee that it will give satisfaction on the work for which it is built. And because every tool before it leaves the factory is rigidly tested, we *know* that its merit is beyond question.

We shall be glad to send you catalogs fully describing those machines in which you are interested.

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Heat Should be Inside

Not Outside

The value of a heat treating furnace rests in its ability to quickly develop and maintain an intense, uniform heat. But that heat must be *inside* and not outside.

BELLEVUE
FURNACES

are lined with heavy asbestos insulation in such a manner that external radiation of heat is reduced to a minimum. Bellevue Furnaces are simple and economical to operate. They are always under the accurate control of the operator. Built in seventy-nine different styles for every requirement of heat treating. Get our catalog now.

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GARLOCK-WALKER MACHINERY LTD., Toronto, Montreal, Winnipeg.

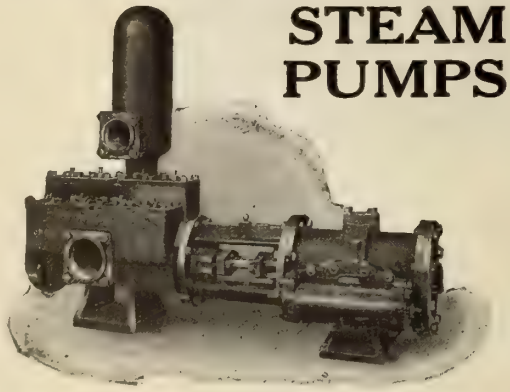


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For Oil or Gas.

HEPBURN

STEAM PUMPS



ONE of the many good things about the Hepburn Patent Feed Pump is its reliability. It has no Tappets—No Levers. Steam Cylinders are automatically self-drained. Long strokes ensure **steam economy.** This type is specially designed for hot water service. Made for high and low pressure.

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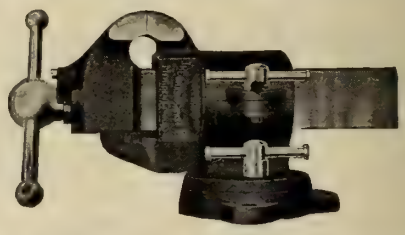
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THE PRODUCT OF MASTER MAKERS

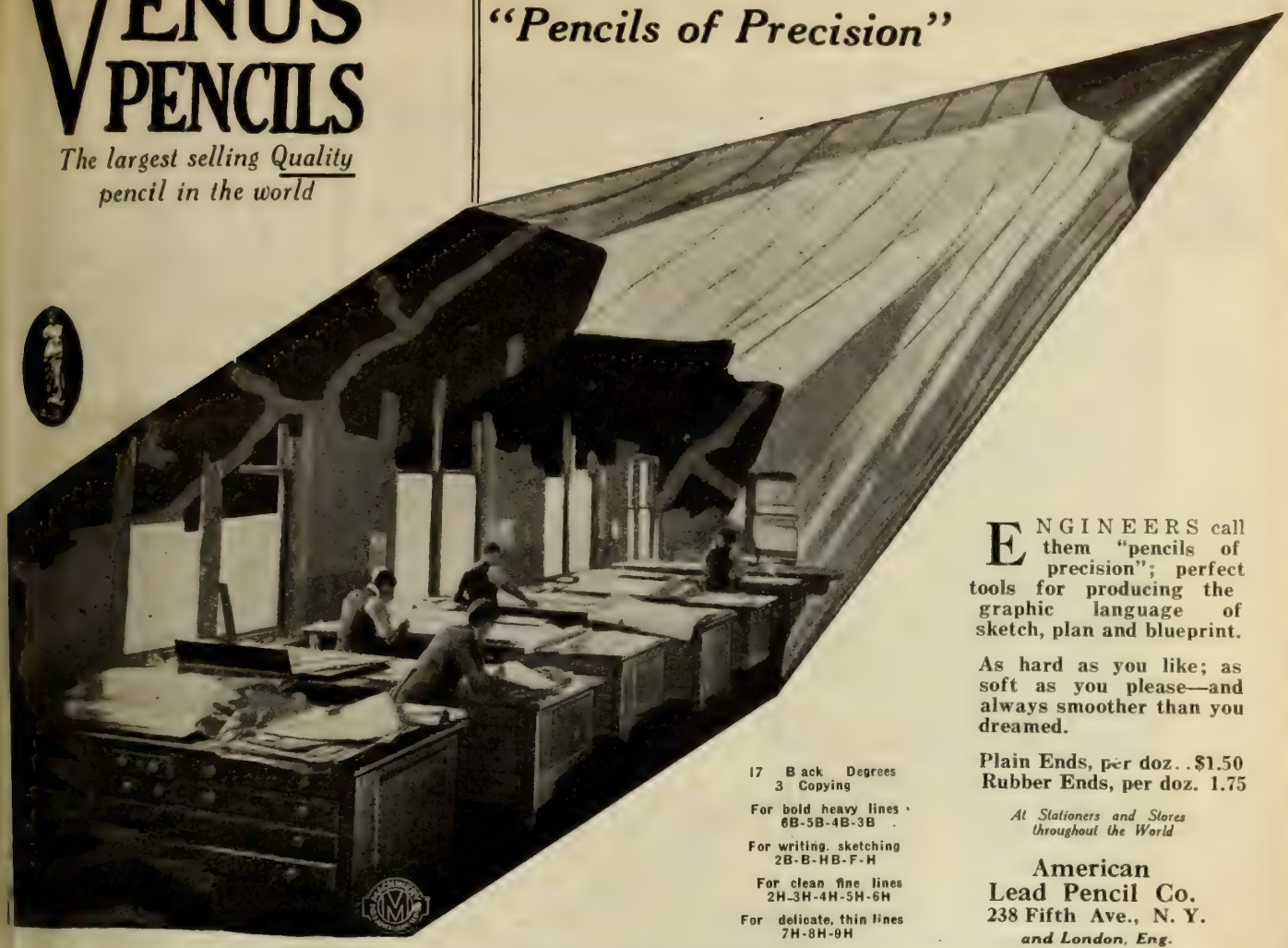
These old master makers had reasons for making us different from the rest of the family.
If you knew them we would be in your tool room.
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Master Vise Makers
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17 Black Degrees
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ENGINEERS call them "pencils of precision"; perfect tools for producing the graphic language of sketch, plan and blueprint.

As hard as you like; as soft as you please—and always smoother than you dreamed.

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There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

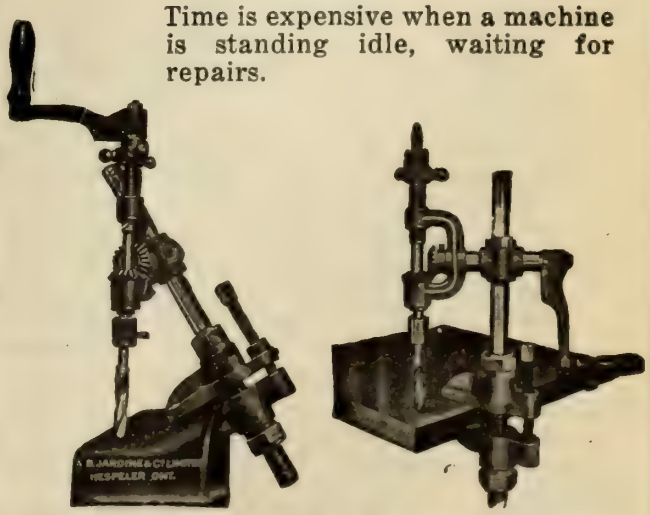
A. R. Williams Machinery Co., Ltd.

64-66 Front Street W., Toronto

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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



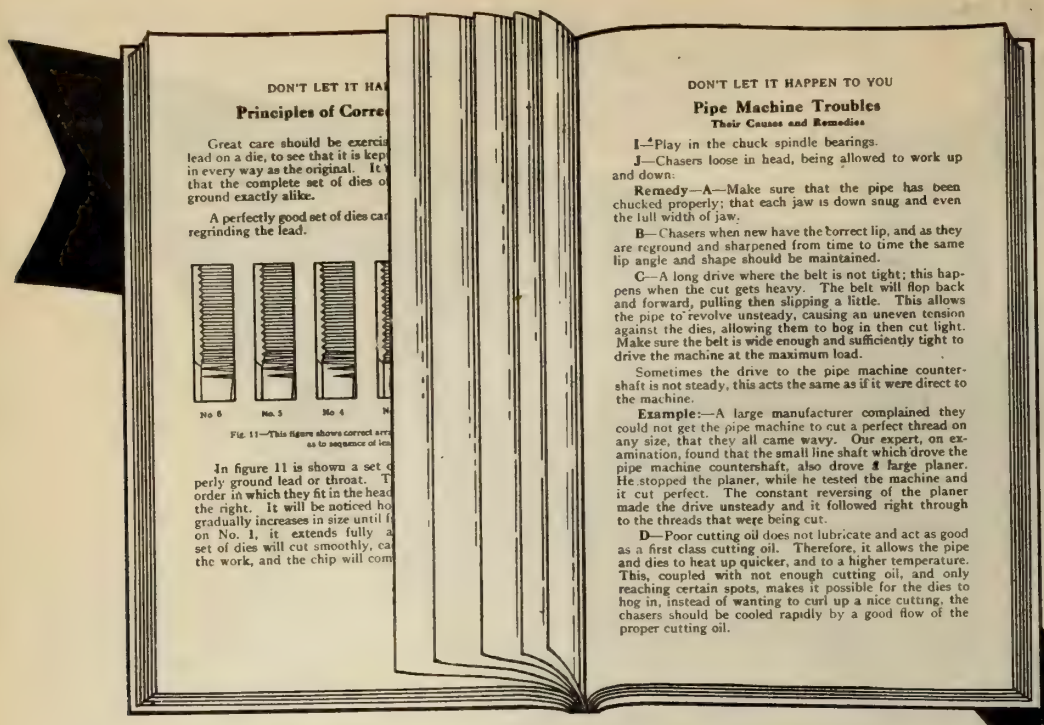
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO



The latest pipe machine hand book. 60 pages of valuable information. Close to 75 drawings and photographs. Send in the coupon today.

Questions and Answers to Pipe Machine Troubles

A valuable hand-book free for the asking-----

You'll find the answer to your pipe machine problem in the new Williams hand-book "Don't Let It Happen To You!" Whether it is how to grind dies, what kind of oil to use, or how to eliminate wavy, chattering threads, you'll find the practical answer in the new Williams 60 page hand-book entitled "Don't Let It Happen To You!"

The first chapter is an interesting illustrated short story that carries a smile and a moral for every pipe user. You will enjoy reading it.

A following section takes up the proper lip, clearance lead, chip space, etc., under the chapter heading "The Principles of Correct Pipe Threading."

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There are close to 75 drawings and photographs and the articles have been written by men of practical and long-time experience in the use of pipe machinery.

Clip the coupon. Mail it now for this book which is as valuable to a pipe machine user as a slide rule to an engineer.

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PRESSES Number 18

(Photograph by courtesy of our customer)

Blanking, cupping and stamping electric light wiring device parts in the Arrow Electric Company's plant at Hartford, Connecticut. Steel, brass, copper and pressed paper stock, 1-64 to 3-32 thick is used. The company began to install "Bliss" Presses about 10 years ago. It required a high rate of production on a variety of small parts. It now has in operation over one hundred "Bliss" Machines and is getting the production it wants.

BLISS 1857

E. W. BLISS Co.

BLISS 1921

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American Factories: BROOKLYN, N. Y., HASTINGS, MICH., CLEVELAND, O., SALEM, O.

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CINCINNATI, Union Trust Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. PITTSBURGH, Keenan Bldg.

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No. 7

Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

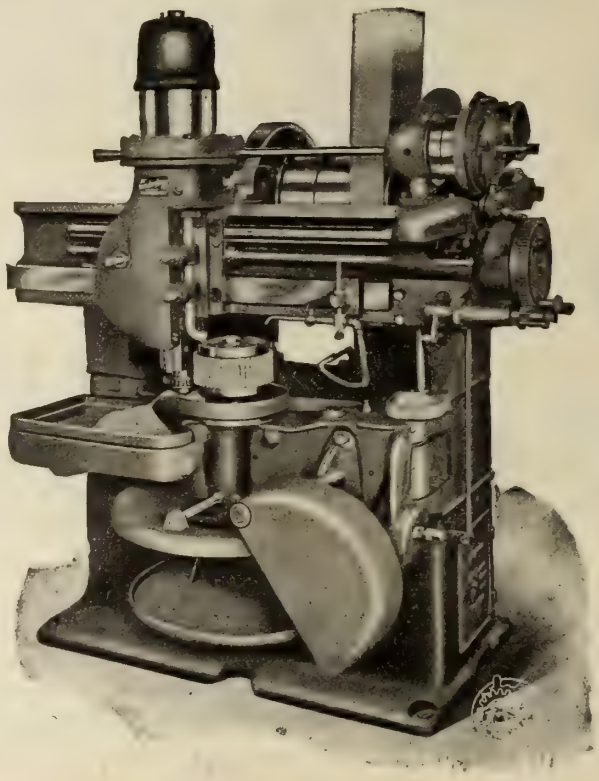
A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this little word "IF."

When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of Gear Cutting with the "IFS" Left Out.

Send for your copy to-day



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

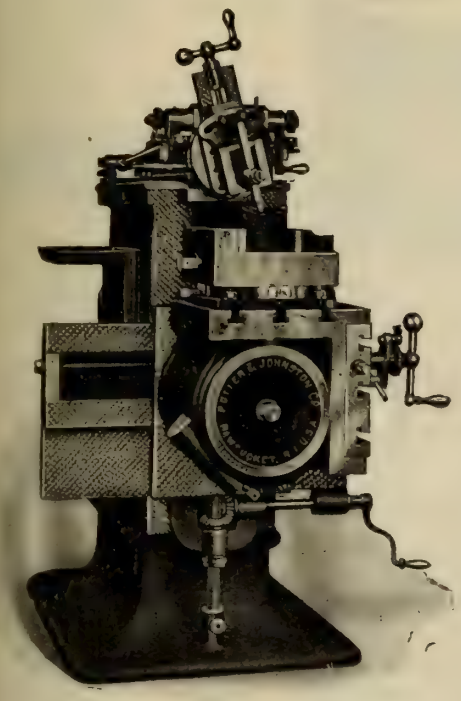
The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

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UNIVERSAL

Shaping Machines



15" TYPE—Swivel table
with auxiliary tilting side.
Power down feed on any angle.
Automatic Feed stop.
Graduated collars on tool head feed screw and table feed screw.
Swivel vise with graduated base.

24" TYPE—Swivel table with auxiliary tilting side.
Power down feed on any angle.
Automatic feed stop.
Graduated collars on tool head feed screw and table feed screw.
Swivel vise with graduated base.
Swivel table raised and lowered by power.

No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to Die Work, Tool Making and General Manufacturing.

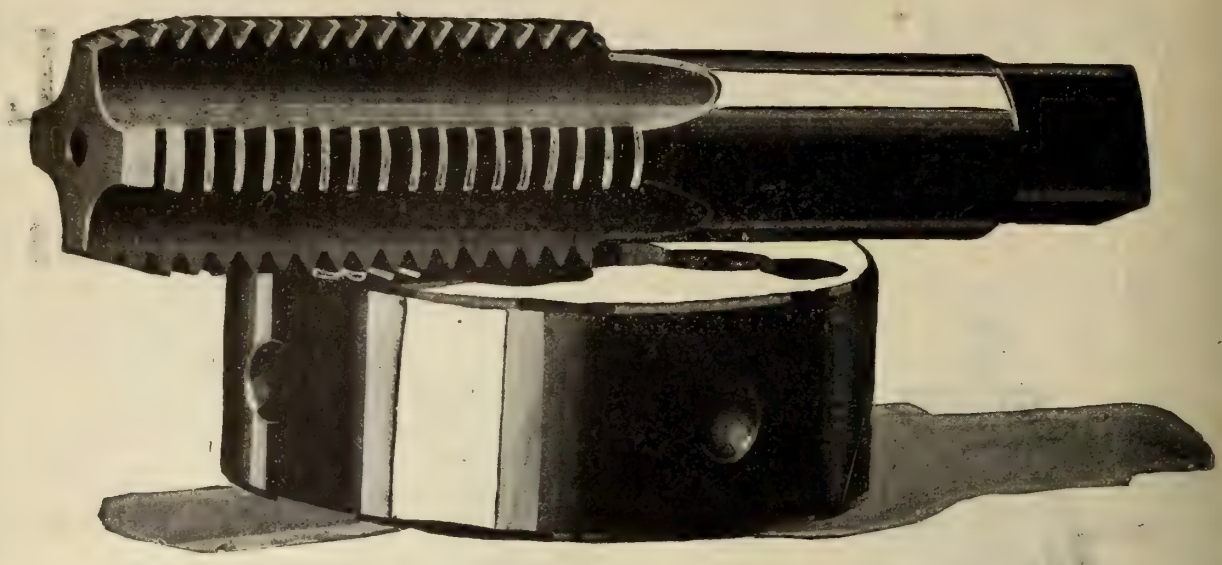
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BUTTERFIELD & COMPANY DIVISION

Union Twist Drill Co.

ROCK ISLAND, QUE. - - CANADA

BUTTERFIELD

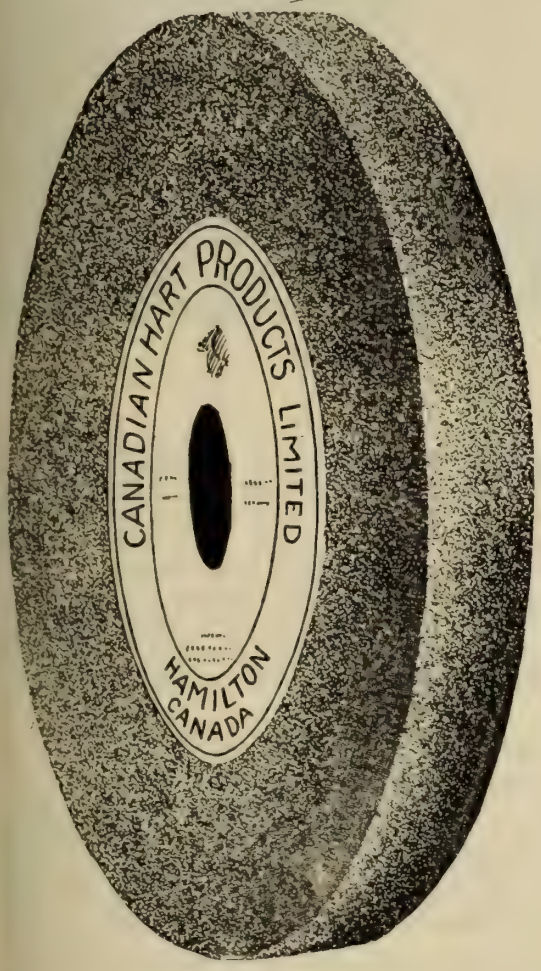
STORES:—220 King Street West, Toronto. 131 Paul Street West, Montreal.

AGENTS:—D. Philip, 138 Portage Ave., Winnipeg, Man. The Triangle Co., Standard Bank Bldgs., Vancouver, B. C.

FOREIGN REPRESENTATIVES:—Great Britain, Geo. H. Alexander, 83-84 Coleshill St., Birmingham, England; France, Italy, Belgium and Switzerland, Fenwick Freres, 9 Rue de Rocroy, Paris; Sweden, Norway, and Denmark, Ab. Sigfr. Anderson & Co., Malmo; Spain, Casamitjana Hermanos, Barcelona; Japan, Abe Kobei & Co. Yokohama; Greece, Stephen C. Stephanson, 11 Lycourgan St., Athens; Netherlands, Wynmalen & Hausmen, Rotterdam; Australia, H. R. Richardson, 82 Pitt St. Vickery's Chambers, Sydney; South America, Charles Dreyfus, B. Mitre, 785 Buenos Aires, R. A. South Africa, H. Parker Wood, Cape Town, Durban and Johannesburg.

CANADIAN HART WHEELS

Vitrified -- Silicate -- Shellac



Canadian Hart Vitrified Wheels-recommended for the majority of grinding jobs. May be used wet or dry; give better all-around satisfaction and have a longer life.

Canadian Hart Silicate Wheels-- can be made in twenty-four hours and are often substituted when it is inconvenient to wait the required length of time for Vitrified Wheels.

Canadian Hart Shellac or Elastic Wheels---indispensable for slotting work where a thin wheel is required or for work requiring a special finish. Can be operated wet or dry.

Tell us what you want to grind and we will tell you the wheel to use for the best results.



Canadian Hart Products

LIMITED

Hamilton - Ontario

Made in Canada

"There is the Only Heater I Will Recommend"



The President was talking—
"There, gentlemen, is the only heater I will recommend for our new foundry extension! We have tried every possible imaginable system and each time we have had trouble of one sort or another. Last fall, though, I put in a Skinner Bros. (Baetz Patent) Heater and now—well, our heating troubles are past! We now have the same even temperature all day long, sand doesn't freeze, and the foundry is quickly reheated when monitor windows are closed after pouring."

Simple and Economical

The heater is portable—requires no special foundations—installation cost is 15 to 50 per cent. lower than any other type—operating cost is equally low. No outside pipes or ducts required—performance strictly guaranteed.
Find out more about this heater. If you wish, we will send you names of users so you can make your own investigation.

Mechanical Details
Steam-Coil Type

Built as an individual enclosed unit with a series of pipe coils compactly mounted above a powerful fan-wheel. Coils are heated by exhaust or live steam. Cold air is drawn into the heater by the fan, impelled upward and around the coils, and, after being heated, is diffused through outlet hoods to every part of the open area. No pipes or ducts used. The fan is operated by any power available.



Direct-Fired Type

Where steam is not available, we supply our direct-fired type DF, which burns coal, coke or wood. Built on the same scientific principle as type SC. The fan is operated by any power available.

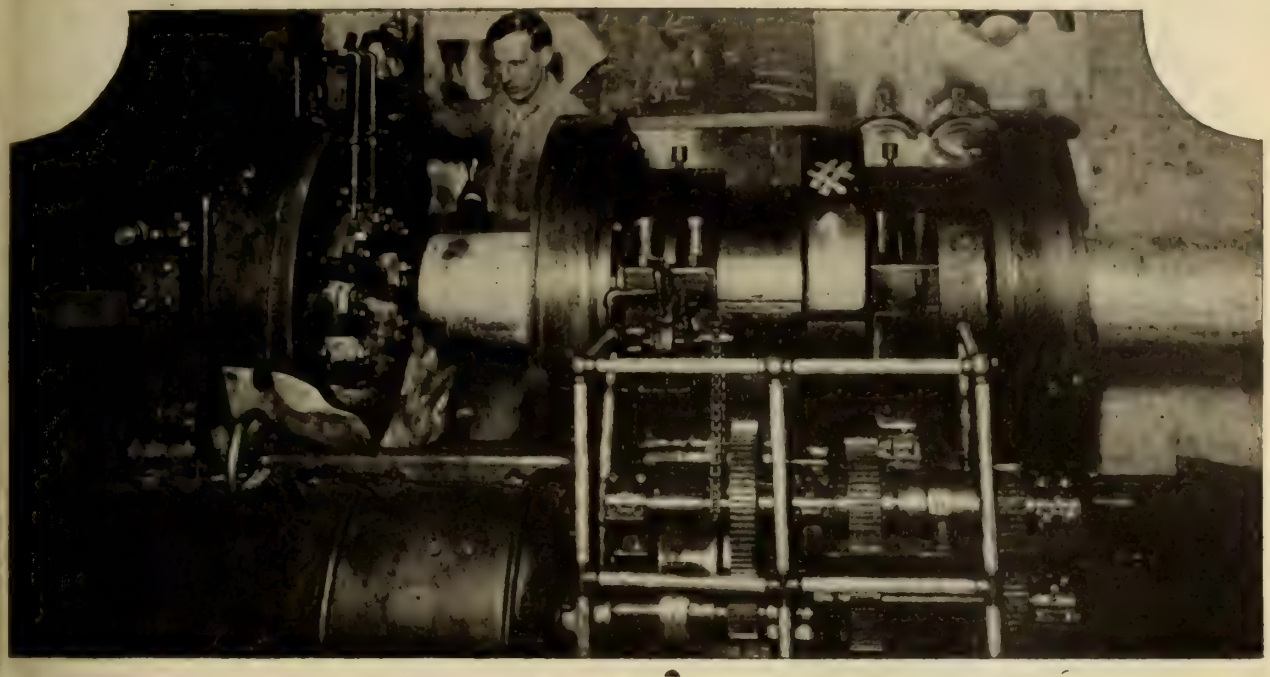
Skinner Bros. Mfg. Co., Inc

1436 South Vandeventer Ave. St. Louis, Mo.

Boston ..... 447 Little Bldg.
Buffalo ..... 704 Morgan Bldg.
Cleveland ..... 614 Marshall Bldg.
Chicago ..... 1506 Fisher Bldg.
Indianapolis ..... 325 Occidental Bldg.
New York ..... 1704 Flatiron Bldg.
Minneapolis .. 804 Metropolitan Life Bldg.

Skinner Bros.
Baetz Patent HEATING SYSTEM

Skinner Bros. Mfg. Co., Inc.,
1436 S. Vandeventer Ave., St. Louis, Mo.
Please send complete details on Skinner Bros. (Baetz Patent) Heaters to
Firm .....
Address .....
Building used for.....
We can / cannot use steam.



Landis Pipe Threading Machine

The Walworth Manufacturing Company, New York, were interviewed regarding the performance of their Landis Pipe Threading Die Heads and Machines. Here are two of the questions and answers:

Q. How long do your chasers run without regrinding?
A. Those on the machine shown have not been touched for a year.

Q. How long does it take to cut a thread?
A. Three inch pipe thread, 20 seconds; twelve inch, 3 minutes.

The operator claims his Landis is the best pipe threading machine made and that a day's work on it does not tire him.

Profit by the experience of hundreds of firms using Landis Threading machines. Avoid trouble and be assured of good threads, high production and low cost of upkeep by installing a Landis in your plant **now.**

Write for catalogue and send us your specifications. We will be glad to show you why the Landis pays.

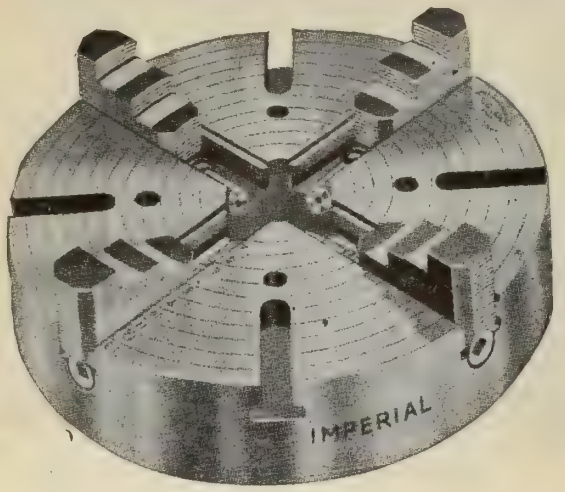
Landis Machine Company, Waynesboro, Pa.

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Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.

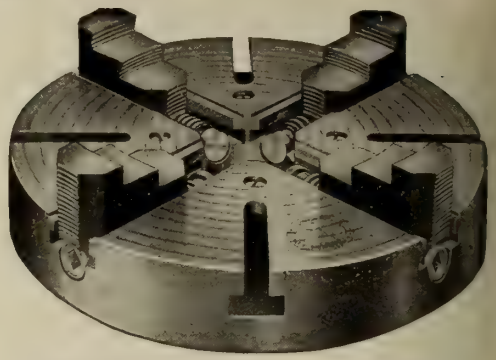


Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. The are a necessity with the modern machinery and high speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements strength and durability for which they are designe We make other types in steel also, including t Geared Scroll Chucks and the Geared Scroll Combi ation—all designed for heavy work and hard usage

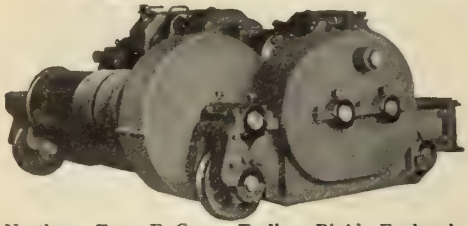
Union Manufacturing Compan
New Britain, Conn.
New York Office: 26 Cortlandt Street
Makers of a complete line of chucks

CANADIAN MADE CANADIAN MA D

Electric and Hand Traveling Cranes



Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons.



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.

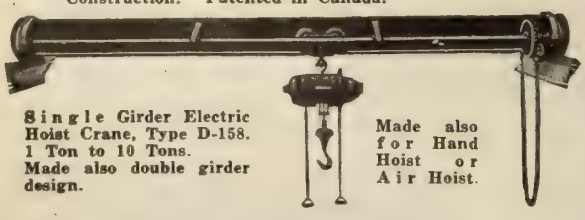


Type D Electric Hoists—½ to 10 Tons.



Type No. 20 Air Hoists.

Air Hoists, Trolleys and Tracks



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

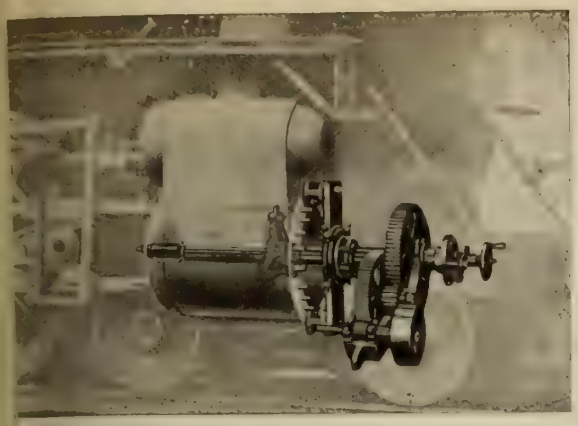
Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Northern Crane Works, Limited
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Boring Cylinder of Locomotive on the track with an "Underwood"

UNDERWOOD'S

Locomotive Boring Bar

h many improvements for doing heavy work and is quickly adjusted the cylinder with one or both cylinder heads off.

Accurate, easily operated, fast working machine. Write for catalog.

H. B. Underwood Corporation

1025 Hamilton St., Philadelphia

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WE DID IT FOR YOU YEARS AGO



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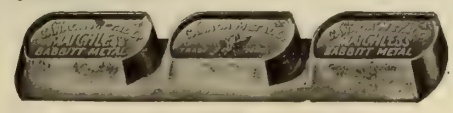


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THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings

Write For Prices

THE CANADA METAL CO., LIMITED

TORONTO HAMILTON MONTREAL
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'OLIVER" QUALITY

WOODWORKING MACHINERY





Again the "Hurry-up" call comes back to the Pattern Shop and woodshop. With the right machinery this can be answered.

"Oliver" high grade woodworking machines are doing big work in speeding up production for many representative plants and will do the same for you.

This is an "Oliver" No. 99 Single Cylinder Direct Motor Driven Surfacer. The motor operates at 3,600 R.P.M. and is coupled at end of cylinder. This type of motor drive is very efficient, safe to operate, is self contained and requires a minimum amount of floor space.

Oliver Machinery Co., *General Offices and Works,* Grand Rapids, Mich., U. S. A.

OURS IS A COMPREHENSIVE STEEL SERVICE

The selected raw materials are melted in our open hearth and electric furnaces under careful supervision.

We roll the ingots down into blooms and then into billets, slabs and bars, subject to rigid inspection standards.

And we---*anneal---heat treat---cold draw* to our customers' specifications.

All operations in connection with our manufacture are performed in one large plant and all details receive thorough attention.

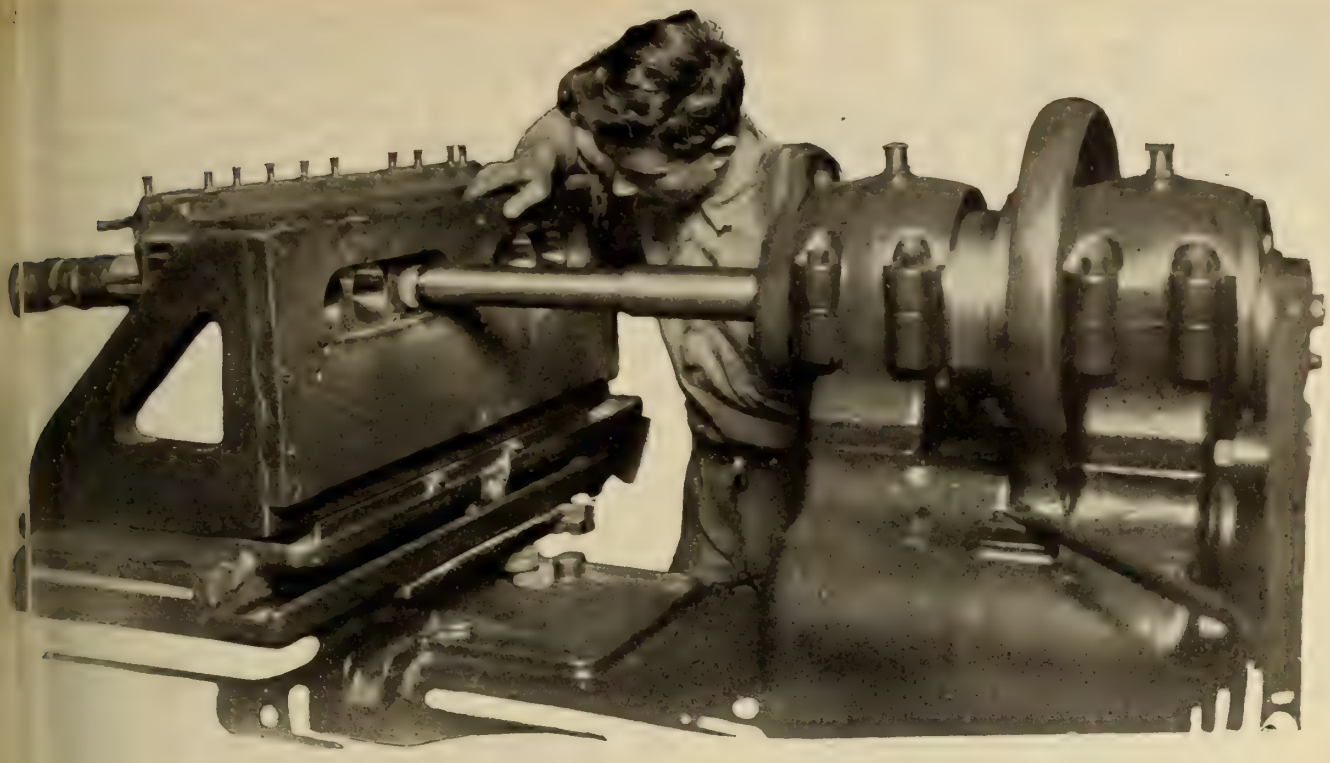
We also assist steel users in the working and treatment of our steels after they have left our plant.

It is our aim and earnest desire to serve our clients in every way a steel manufacturer can.

UNITED ALLOY STEEL CORPORATION

Canton, Ohio

Buffalo	Cleveland	San Francisco
New York	Detroit	Portland
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Giving Brand New Motor Advantages to an Old Block

Can you see what that means to every motor owner under the present conditions? Hundreds are anxious to have their cylinders ground and fitted with new pistons and rings, but delay because it is necessary to send the block to some distant point or in some cases out of Canada.

If your regular business is dull, why not install a Heald Grinder and get some of the profits in this new field that are just waiting to be picked up?

This is especially true in the Fall when motorists are having their cars overhauled after a hard summer's run.

The possibilities are unlimited, for here is a virgin field in many localities, while in a few spots where they are in a position to handle this trade they are working three shifts.

Inquire from the neighboring garages and your friends how much work they can give you. Investigate thoroughly and then remember that 90 per cent. of the manufacturers of automobiles use Heald machines exclusively for grinding.

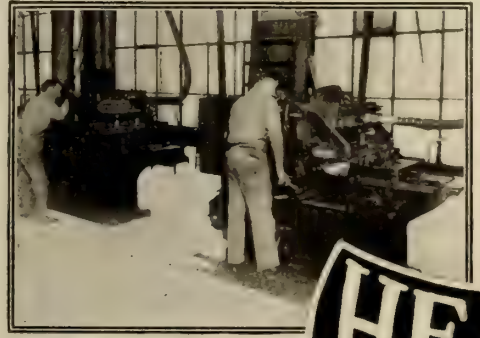
No other machine or method of finishing will give the quality, production or profit. Let us get together on the subject. It will be to our mutual advantage. Write, wire or phone.

The Heald Machine Co.

51 New Bond Street
Worcester, Mass.

IN THE PACKARD SERVICE SHOP

Since September of last year 1,820 car and truck cylinders have been reground on the Heald Machines in this shop.



ABOUT THE HEALD MACHINE

Simple — self-contained — moderate price—easy to set up—does not need a skilled mechanic to operate it, yet grinds accurately within one half a thousandth of an inch.

HEALD

BRANCHES AT:—New York—Philadelphia—Buffalo—Cleveland—Detroit—Chicago—Cincinnati.
CANADIAN AGENTS:—Geo. F. Foss Machinery Co., Montreal—H. W. Petrie Ltd., Toronto, Ont.

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QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

WRIGHT HOIST

For Dependable Service the Right Hoist is the "Wright" Hoist

One to thirty tons lifted with unbelievable ease and speed. Unlike most high speed products — they have long-lived, continuous service records — based on their unfailing dependability.



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LISBON, OHIO, U.S.A.

Canadian Distribution: The A. R. Williams Machinery Co., St. John, Halifax Toronto, Winnipeg, Vancouver, Montreal

Bilton

GEAR MILLERS

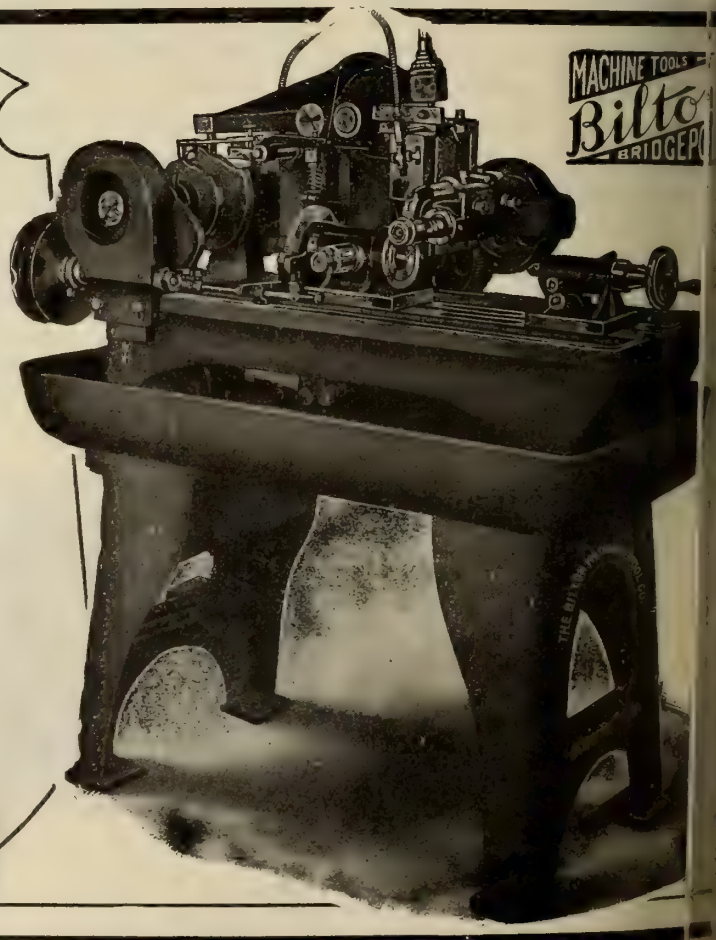
WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

Big business everywhere is adopting the Bilton for high production on accurate work.

May we send you our catalogue?

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Bridgeport, Conn., U.S.A.
Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co., Ltd.
M. Mett Engineering Co.



Buried in the Work and Broke!



ext time a tap breaks low the surface of a large sting, don't let some make-ift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

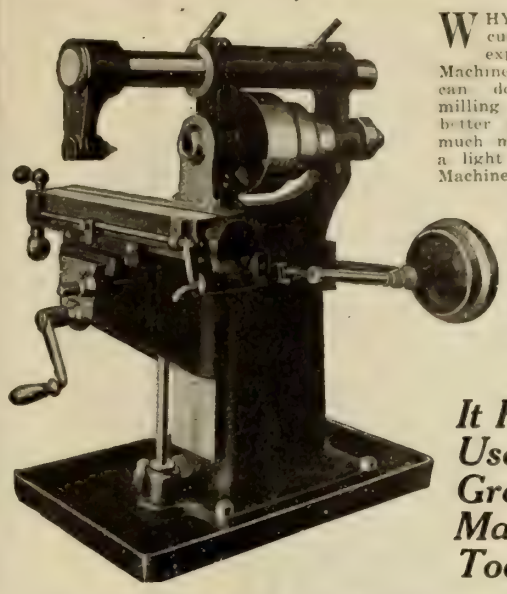
Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.

Hartford, Conn.

This Power Feed Miller $220



WHY buy a heavy, cumbersome and expensive Milling Machine, when you can do your small milling operations to better advantage and much more rapidly on a light Burke Milling Machine?

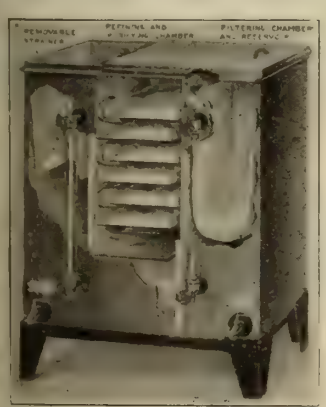
Catalog shows other sizes of Milling Machines with hand or power feed, with or without overhanging arm, either bench or column type.

It Pays to Use High Grade Machine Tools

THE BURKE MACHINE TOOL CO.

520 Sandusky St., Conneaut, Ohio, U.S.A.

Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons, Geo. F. Foss Machinery & Supply Co.



The Life Blood of the Factory

Dirty, gritty lubricating oil will junk your machinery long before its time. *Friction is production's worst enemy,* and the wear and tear caused by dirt and grit in oil slowly but surely wears out expensive bearings and other machinery parts.

Clean oil prolongs the life of machinery. Bowser Lubricating and Filtering Systems assure clean filtered oil on all bearings and restore the oil to its original lubricating quality. Try the Bowser Perfected Process of Seepage Filtration.

Installation takes a minimum of floor space.

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BOWSER ESTABLISHED 1885

THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

ARE YOUR TOOLS MADE OF "Red Cut"?

VANADIUM-ALLOYS STEEL COMPANY

Main Office and Works
Latrobe, Pa.

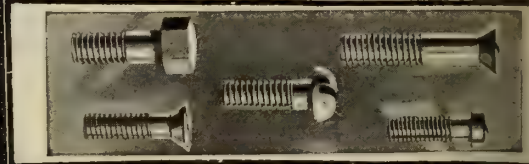
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Series



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

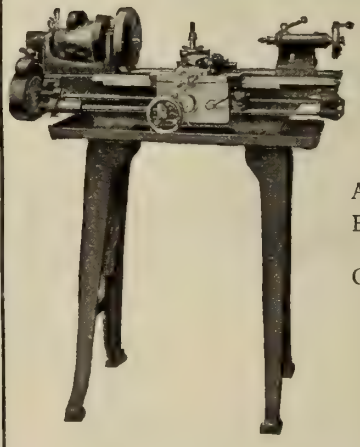
Write or Wire us.

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Codes: Liebers
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Asa S. Cook Co.
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"DALTON SIX"

The Small Lathe for the Big Job



Type B-6

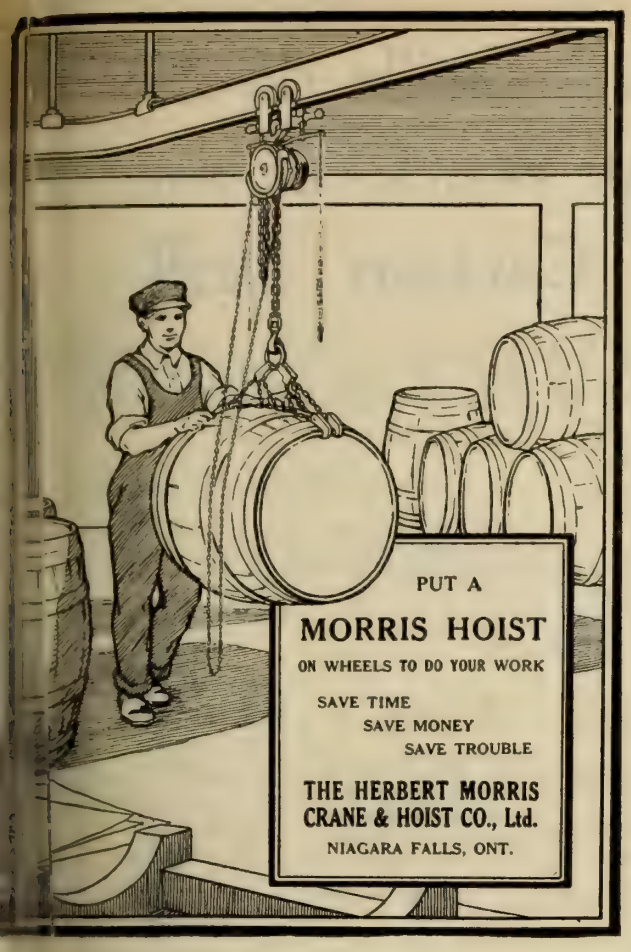
	Inches
Actual Swing	8¼
Between Centers	18½
Collet Capacity	¾

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Dalton Manufacturing Corp'n

Sound Beach, Connecticut, U. S. A.
Cable Address - - "Aledal Stamford"

Also Manufacturers of Type B-4 Lathes



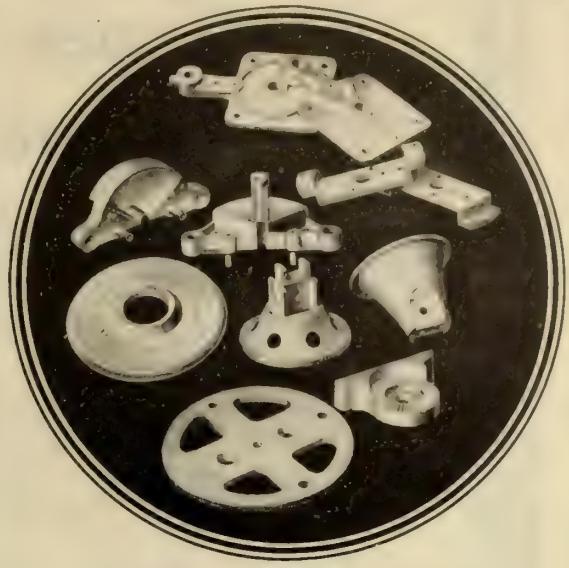
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Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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For Time Recording in Factories

Separate Catalogs on each Product

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Franklin Die-Castings Used in Electrical Appliances

A Help in Electrical Progress

In modern electrical progress, as in many other fields of industry, manufacturers quickly took advantage of the economy and speedier production possible with the die-casting process. Franklin Die-Castings are used by many of the best known manufacturers of telephones, telegraph instruments, electric fans, drills, cloth cutting machines and various other electrical devices.

In 1892 we originated the Die-Casting Process. For nearly thirty years we have been reducing the cost and simplifying the output in many fields of industry. The addition of a special process for the production of finished brass castings enables us now to offer parts in brass, bronze, aluminum, tin, lead, or zinc base alloys as conditions require, thus meeting a still wider range of work.

We quote from samples or blueprints

Write for booklet:

"Franklin Die-Castings in Many Fields."

FRANKLIN DIE-CASTING CORPORATION

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"Two Dogs" Drills do Six Times the Work of an Ordinary Carbon Drill

In a test, 432 holes, 11-16 in. dia. and 1 5-8 in. deep, were drilled in 6 hours using a "Two Dogs" High-speed drill without re-grinding. This test was on good mild steel at 370 R.P.M. and the time includes 144 changes of work.

A comparison of the cost of "Two Dogs" High-speed drills and ordinary carbon drills, will show the economy of using the drills which we recommend.

Made in England and milled from the best grade of Sheffield high-speed steel, "Two Dogs" drills will give you the utmost satisfaction.

The Canadian Fairbanks-Morse Co., Limited

"Canada's Departmental House for Mechanical Goods"

Halifax	Ottawa	St. Catharines	Winnipeg	Calgary
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Simple Design and Convenience of Adjustments

give operator every facility for ease of operation and Accuracy in Production

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Where Do You Use Grinding Wheels?

Norton **Alundum** *and* **Crystolon** grinding wheels are used today for thousands of jobs where other methods were formerly considered best.

With our several artificial abrasives to select from, each especially fitted for certain kinds of grinding, plus a long range of grit sizes and grades, chosen by us to give best service for each operation, manufacturers find that "grinding" is quicker, cheaper and generally more satisfactory for their work.

From our many years of experience we are familiar with these developments and are in a position to tell you whether or not grinding would be more practical and more economical for work like yours than your present practise would be.

Let us offer suggestions in your case. Explain your work to us; let us give you the benefit of our experience.

Perhaps Norton Alundum wheels, Norton Crystolon wheels or Norton Alundum polishing grain can reduce your manufacturing costs.

NORTON COMPANY OF CANADA, Limited

HAMILTON : : : : ONTARIO

Electric Furnace Plant: Chippewa, Ontario

CANADIAN AGENTS:

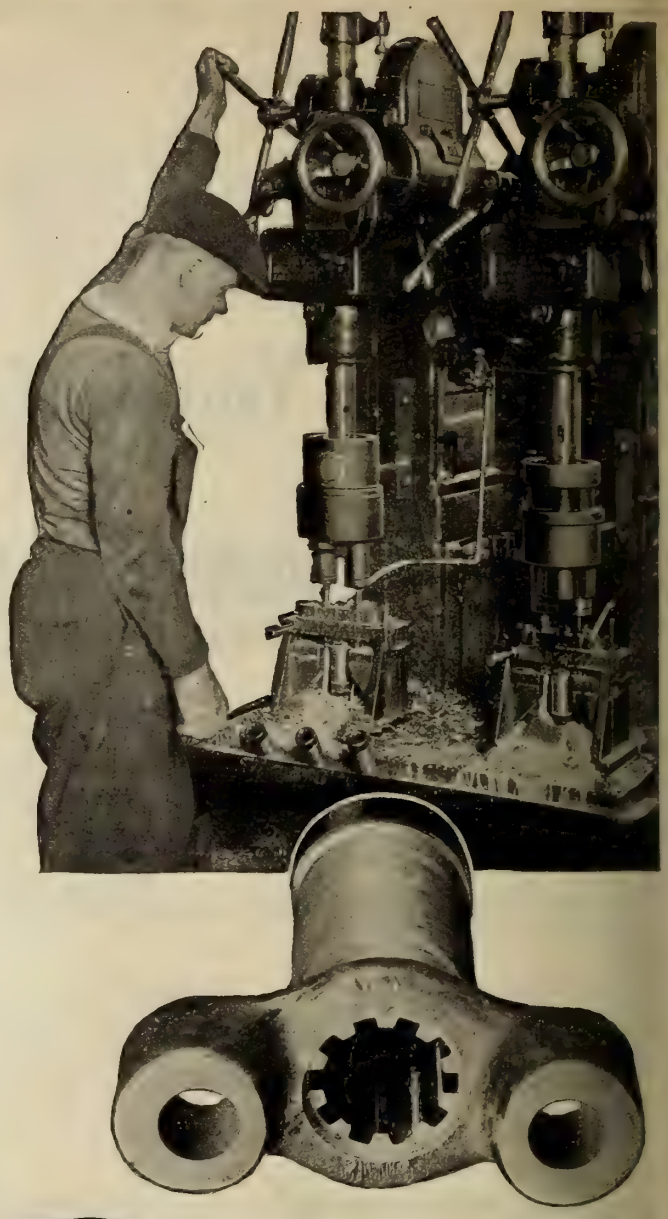
The Canadian Fairbanks Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec. Simonds Canada Saw Co., Vancouver, B.C.

Drilling and Reaming 160 pieces an hour

2 holes — 11/16" diameter — 7/8" deep

in each

That's what these Hoefer Multiple Drilling Heads are doing in the plant of the Peters Machine and Manufacturing Company at Cleveland, Oho. And it's a dependable, steady, day-in day-out performance, too. Do you wonder that these compact, sturdy little gluttons for work are paying heavy dividends on the investment they represent?



Is your drilling equipment equally efficient?

Make sure about it by consulting the nearest Hoefer Sales Engineer. His specialty is finding out ways of drilling two or more holes in the time formerly required to drill a single one. Hoefer Sales Engineers have unearthed unsuspected possibilities of reducing drilling costs in hundreds of machine shops. There may be such a possibility in YOUR drilling operations. A request for information involves no obligation.

37

Send for the Hoefer Catalog

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CANADIAN MACHINERY
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Magnetic Chucks Require Careful Mounting

Mounting Can Be of a Permanent or Temporary Character—Magnetic Holding Faces of Chuck Must Be Absolutely Correct

By F. HORNER.

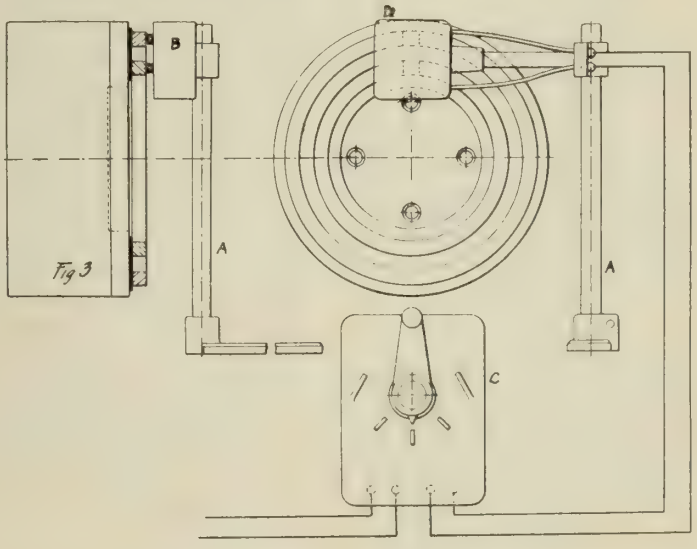
THESE somewhat delicate pieces of apparatus call for special treatment in regard to their mounting, whether it is of permanent or of temporary character. The permanent attachments comprise those of rotary work in lathes and grinders, where a face plate or adapter is employed. What may be classed as temporary mountings are those on the tables of planers, millers and grinders, where removal is necessary at intervals. In either case careful care is essential to obtain truth of the magnetic holding faces, both in the original setting, and in subsequent replacements. The absolute prevention of bruises, burrs, and any deformation by careful peening is imperative; so also is the cleaning off of dirt, grit and cuttings from the attaching surfaces of the work, or chuck or table as the case may be.

If any of these matters are neglected the work that is machined will not be parallel, and the attempt to work to fine limits will be defeated. On the grinding machine it is always possible to skim over the magnetic chuck and face up, but this should only be done at comparatively rare intervals, otherwise the metal of the face will soon become thinned and weakened.

A particular feature of magnetic chucks is the necessity for conveying the current without danger of interruption, and of making sure that access of water, oil, or dust and cuttings shall not cause failure, or short circuits, which would act disastrously during the progress of some operations. The importance of guarding against a breakdown applies both to the chuck body and joints, and to the leading-in connections, or running contacts as the case may be. The greatest risks of course occur when the chuck is used freely during tooling, the latter instance being that of submerged chucks, which are flooded entirely for grinding certain articles.

With regard to the preliminary question of attaching chucks, either by means of base plates, or direct to the table faces, the important point to observe is that no sharp corners are left on the meeting places to become burred up, and that the pulling together takes place equably without irregular strain caused by tight-fitting bolts. A fruitful source of straining is the fact that the holes are not drilled or tapped square, and the bolt or screw pulls to one side instead of proceeding straight in. The familiar practice of relieving the fit of sharp corners by chamfering the one, and grooving out the other, should always be adopted, to ensure that the fit shall be perfect on the flat faces. A further precaution lies in countersinking the screw holes before tapping, the removal of the metal at the mouth preventing the swelling up and around the hole. The screws must be a slack fit in their clearing holes, and the drilling needs to be fairly accurate in order that no screws shall bind sideways in opposition to others. The same remarks refer to the mounting of chucks on large running plates or gear rings, as in the heavier surface grinding machines.

When a chuck is merely bolted as required to the table of a planing, milling, or grinding machine, this has to be carefully inspected for burrs, and if



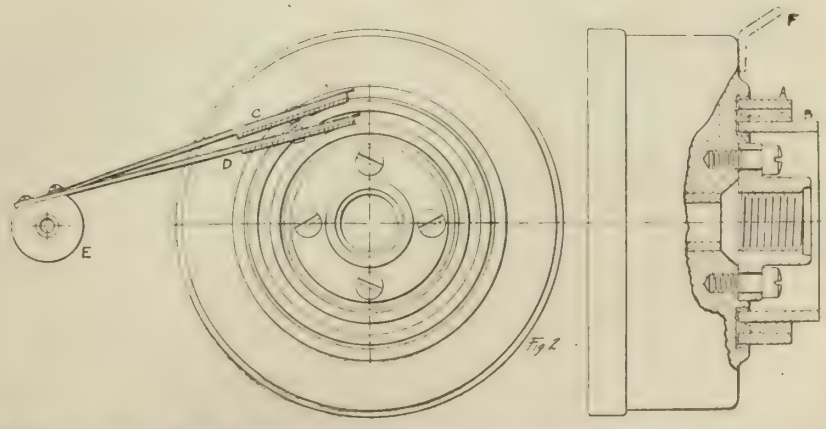


Fig. 3—Upper View. Brush gear and connections for face contact rings.
Fig. 2.—Lower View. Mounting and brush gear arrangement.

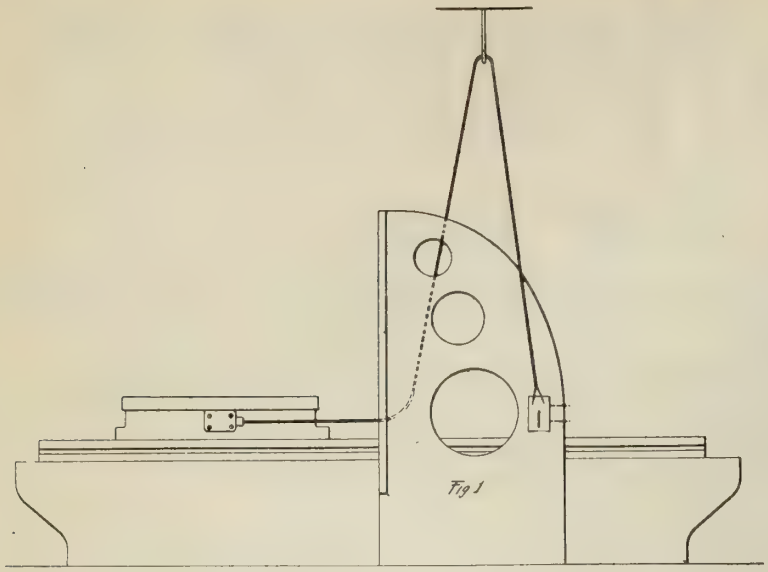


Fig. 1.—Method of suspending cable for planer chuck.

necessary touched off. The table must also be true in regard to the plane of movement. Without this accuracy, parallelism in the output is impossible, and in the case of swivelling or of tilting chucks, the angles ground will not be true as read off the graduations.

Conveyance of Current

The conveyance of current is variously effected, according to whether the chuck moves or not, and whether the movement is of a reciprocating or a rotary character. If there is no movement, as in some kinds of grinding machines, and in shaping machines, it is only necessary to bring a flexible cable in any convenient way to the chuck. But when there happens to be a reciprocation of more or less magnitude, the cable must be disposed to allow perfect freedom without possibility of interference with any moving part of the mechanism, or obstruction to the operator. A short reciprocation may be accompanied by slinging the cable from a stick clamped in a convenient manner on the top of the planer housings, allowing enough swing to and fro; or the current can be brought down from the ceiling or from a beam to the table end, a switch and flexible cable making connection to the chuck. When there is a considerable length of stroke the best plan is to provide a long cable, carry it up from the switch on the flank of a housing, and over an eye attached to a beam, as shown at Fig. 1. Protection against chafing is, if necessary, afforded by rubber covering on the lower portions.

When a chuck revolves, a rubbing contact becomes necessary to transfer the current, and there are several methods of arranging the details, some of open or unprotected type, some semi-protected, and others completely enclosed. Construction varies sometimes according to whether the chuck is on a horizontal or a vertical face, which has the result of modifying the spindle arrangements. Practice is also divided between making contact on peripheries or against faces, examples of both being shown. In Fig. 2 is shown the back of an O. S. Walker chuck, the contact rings "A, B," being bedded into the back face; while the strips carrying the brushes, "C and D," are mounted on a block "E," located conveniently at the rear. The switch is either placed close to "E" or is brought to the front of the machine for convenience. The block "E" requires to be kept clean, otherwise there will be a short-circuit. A partial protection against water is to screw a rim on the chuck, as indicated by the dotted line in Fig. 2, at "F." This, however, can be more easily done when the contact rings are of the face type, in which instance the rim does not come so near in the way of the brush strips. A specimen of mounting with face rings on a chuck made by Messrs. Humphreys & Sons, Oldham, England) is given in Fig. 3.

In this case a column "A" is utilized to clamp in any suitable spot, and receiving the carbon holder "B," the wiring is carried out by the lines, with connections to the demagnetizing switch "C."

The most effective device for guarding against breakdowns through access of grit or water or oil to the contacts is to transfer them to the tail end of the spindle, and convey a flexible lead through the hole in the spindle to a plug socket which is entirely covered in. The lay-out of a fitment by Messrs. Humphreys is illustrated in Fig. 4, which shows the plug socket at the front and the connecting cable going through the spindle and thence to the terminals "A,A." The latter are screwed into a drum carrying the two contact rings, "B,B," on which the carbon contacts "C,C," rub. The wires are brought through the open end of the guarding ring, "D," retained from movement by a peg resting against a part of the machine, and screwed into the hole shown in the section.

The fitting of the drum into the spindle end is effected by means of a pin shank as shown, with hexagon heads for loosening purposes. Ball races located at "E,E," allow of long-continued rotation with the minimum of friction and no trouble through heating. A simple design of gear is used on occasions where there is no need to afford the complete protection, the casing "I" being omitted.

Guarding the Contacts

The problem of guarding the con-

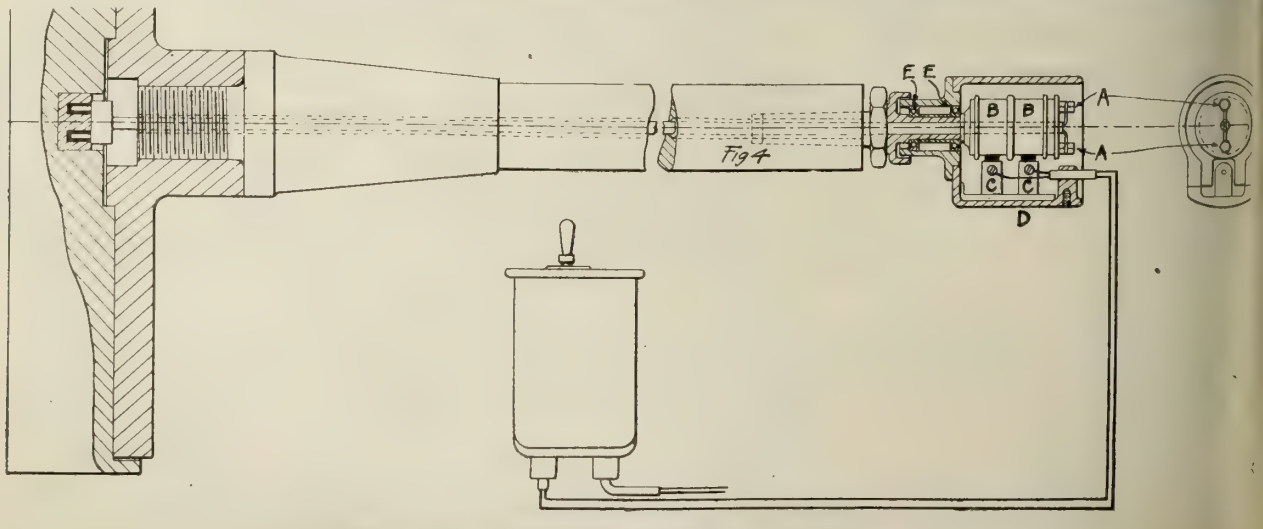


Fig. 4.—One method of guarding against breakdowns.

in he case of vertical-spindle grinding mines is complicated by the action of gr ity on the water that floods the ch k surface. Special deflecting or trping devices are incorporated to nto the water from reaching the underside of the chuck and the contact rings, wh dust and grit are also excluded, a recision which is equally essential for the safety of the bearing, and the annul race when such is used.

I the O. S. Walker rotary surface r er the protective arrangements oc- ins represented by Fig. 5. A deep gh "A" goes round the chuck rim and e vater which falls down this cannot wards to the contact rings because e presence of a deep annular rib ising up above the bottom of "A." ir ventilation of the chuck goes on picted by the arrows.

L ge chucks require special lubricat- g rovisions for the annular race, and is act can be adapted to secure im- ty from access of moisture or dust aking an oil-bath. The Blanchard ne offers a case of this sort as at Fig. 6; the oil bath, marked completely guarding the rings. The flange around the rim of the bl arrests the water or dust and deflect it into the annular groove of the sliding table lip, in which drain holes communicating with the catching tanks are made.

A istake which some toolmakers, or of magnetic chucks make, is that drilling in holes for the purpose of locating attachments of fixtures or stops. This practice is reprehensible because it runs the risk of producing a breakdown through access of water or oil, and serious injury may be caused to the parts. Some parts of the face or edge can be safely drilled into and tapped, but without an accurate knowledge of the thickness it is not safe to do anything in this way. A better method to adopt when one wishes to have extra stop or location devices, is to provide these outside the chuck, or in other words to arrange them off the machine altogether from an angle-plate or other fixtures, thus leaving the chuck unimpaired.

Another detail of the mounting ar-

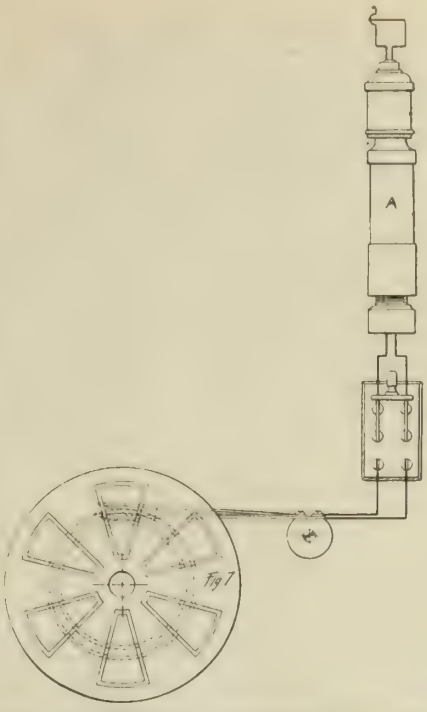


Fig. 7.—Wiring arrangements of chuck with resistance interposed.

rangement requires to be mentioned, beyond the necessary fuse which is placed in the circuit to prevent the burning out of the coils. This detail is the provision made for modifications in voltage. In cost cases chucks are wound for certain voltages, usually either 110 or 200. But a 110 volt chuck may be used on a 220 volt circuit by interposing a suitable resistance unit, as in the diagram of a Walker chuck given in Fig. 7, where "A" is the resistance. In the Heald chucks there is a special construction of the terminal or volt box, which has connections that may be changed by joining up the lead wires in different ways. This obviates the necessity for a resistance in the circuit.

IMPROVING LIFE BOAT SERVICE

Excellent results have been obtained by the British life boat service in the use of tractors in place of horses to launch the boats, but this is only one of several recent improvements. Many experiments have been made recently with mechanical devices for effecting communication between the life boat and the ship in distress. These experiments have lead to the adoption of a special line-throwing gun invented and made by a leading firm. The gun is able to throw a half inch line from 60 to 80 yards in all conditions of weather. The line is coiled in a tin cylinder which fits over the barrel and the end is fixed to a hollow steel projectile fired from the gun with a cordite cartridge. The whole contrivance is so light that it is not much heavier that a service rifle and can be fired from the shoulder with only a slight recoil. It is expected that this innovation will lead to the saving of many lives under circumstances when the lifeboat cannot approach the ship closely enough for a line to be thrown.

A British engineer has recently devised a small pump which consists of a piece of rubber tubing bent into a loop, with a wooden frame outside the loop and a circular cam inside. By placing the cam out of centre and revolving it the rubber tube is squeezed in a rotary direction giving a kind of "milking" action which will force liquid through it. One end of the tube then becomes the suction pipe and the other the delivery pipe of a very neat and efficient form of pump. The inventor after having made a pump out of a serviette ring and piece of rubber tubing, has taken out a patent for a regular engineering mechanism on the same principle. He proposes to use a flexible rubber or leather band suitably water-sealed on its width, in place of the tubing, and cast iron or gun metal casing with suction and delivery branches. This type of pump, has no valve and will therefore be suited for use in cases where pump valves are apt to give trouble.

The new line of electric furnaces which has recently been added to the products of the Westinghouse Electric & Mfg. Company is described and illustrated in catalog 9-C, which is being distributed. This type of furnace includes heats of 1,800 to 2,000 degrees F

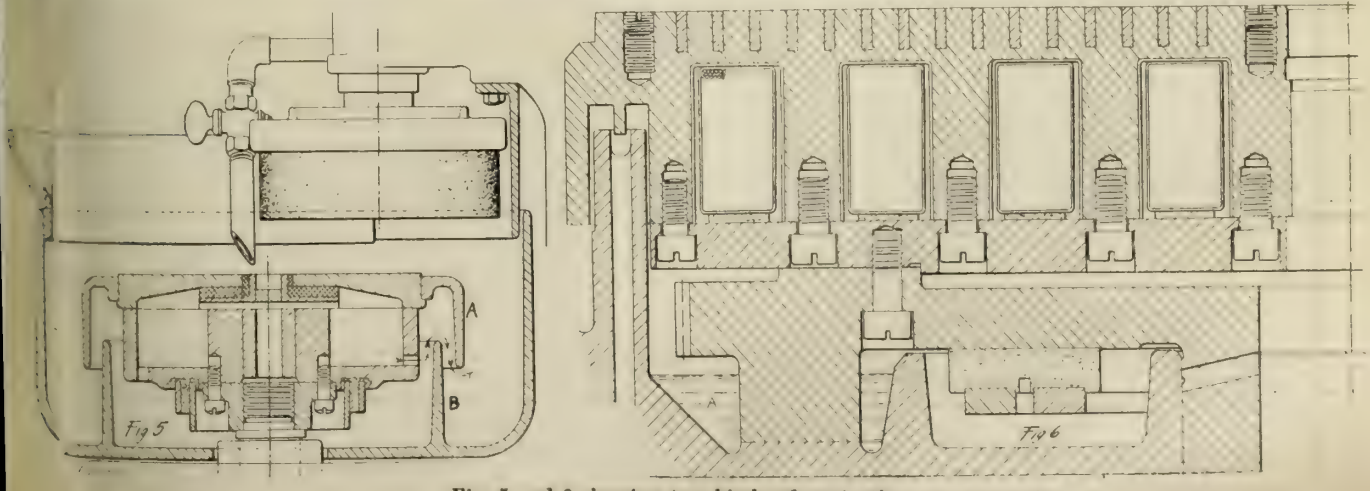


Fig. 5 and 6 showing two kinds of protective arrangement.

Selection and Proper Use of Cutting Tools

The Practical Side of the Subject of Cutting Tools—Their Selection—Use—Manufacture—Storage and Maintenance—Standard Tools and Their Design

THE SUBJECT of cutting tools has been dealt with theoretically and analytically in the article in July 21 issue. It is proposed to continue by considering the practical side of the question. If the previous article has served its purpose, it has shown those who are intimately concerned with the use of tools that tradition must go by the board—that efficiency in the machine shop largely depends on the character of the tools used—that the tool question is bigger than most people imagine, and that it will pay to sift the subject to its fundamentals, each shop deciding on a standard tool scheme to suit its own conditions and insisting on its being carried out.

It is impossible to go fully into the practical side of tool using—the subject is so vast and so varied; there are so many different conditions to be met. The shop where sewing machines are manufactured will need a widely different treatment to the shop where naval guns or armour plates are made. The principles underlying the tool question in these two shops, however, are essentially the same; the tool of ⅜-inch square section used in the one for taking minute cuts up to 1/16-inch in depth differs only in degree from the 3-inch by 2-inch tool used in the other. In this article it is only possible to consider the question as it presents itself to the average shop, where the tools used range from, say, ⅜-inch square cutters for turret lathe box tools to 1-inch by 1½-inch planer tools.

Assuming some such conditions, then, what scheme can be devised to ensure an adequate supply of efficient cutting tools that can be made at low cost and easily maintained in good condition?

*Courtesy of Alfred Herbert, Ltd., Coventry England, also Toronto, Canada.

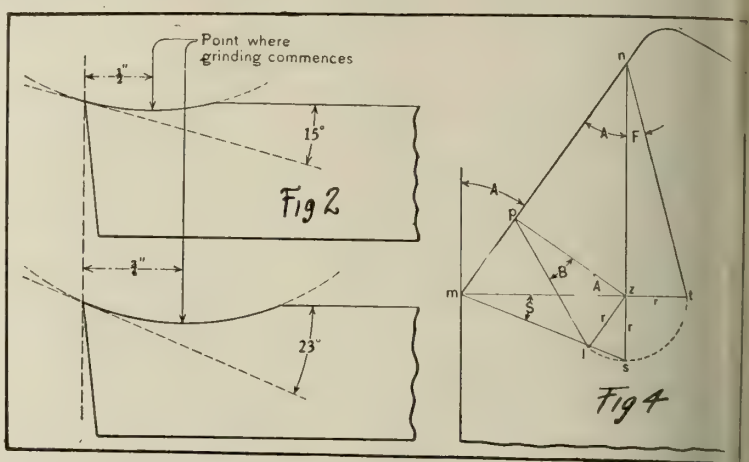


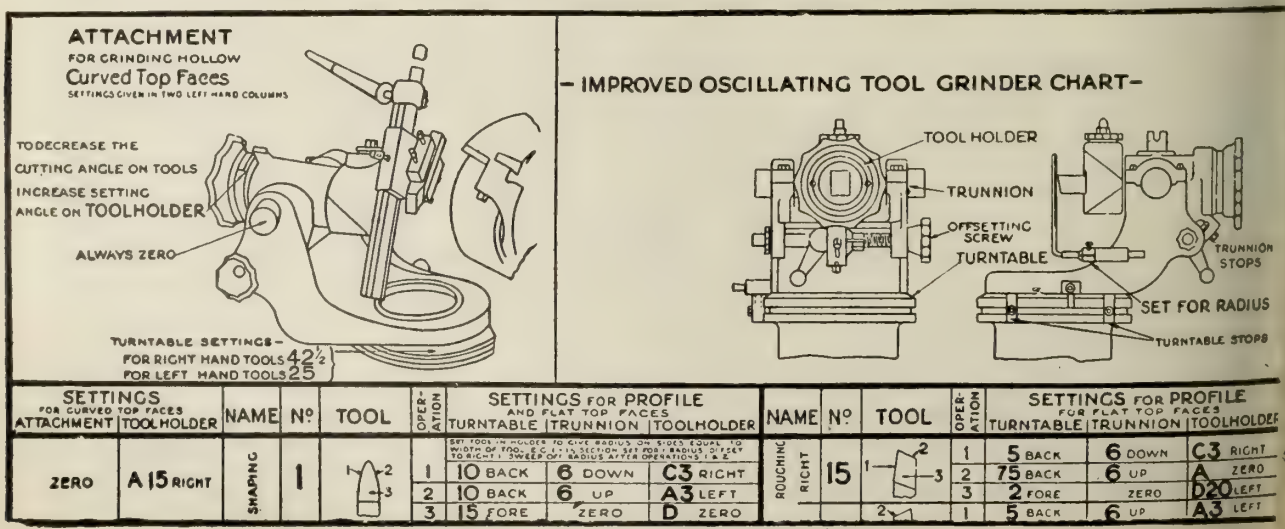
Fig. 2. Effect of commencing the grinding of a curved top face at diff nt distances from the cutting edge.
Fig. 4.—Showing style of gauge used.

An adequate supply means that no machine need ever be kept standing for want of a cutting tool any longer than is necessary to obtain a fresh tool from the stores.

Efficient cutting tools mean that for every operation on every machine there is a tool available that will give the desired result with the least expenditure of power, in the shortest possible time, and with the maximum of durability. Made at low cost and easily maintained means that the adopted system of tool making must be itself efficient.

In the Lumsden method of tool making the system of grinding is followed out by means of a chart shown in Fig. 1. This chart is based on the results of countless experiments and a wide experience gained in shops of all kinds. Of course it is not expected that the twenty five tools shown on the chart will cover every requirement, but it has been proved that it serves very well as the basis of a set of standard tools for any s p. Later on we will deal with each o separately, giving reasons for its x- istence, work for which it is suited n so on. Before touching on that pha o the subject, we will consider brie few points in the design of the grin machine used and its method of o a tion.

Briefly, the machine provides a m by which the entire nose of any sh e tool can be presented with ease t h flat face of an oscillating cup w It is absolutely necessary for eithe tool being ground or the wheel on v it is ground to be reciprocated a the face of the other; if not, the will rapidly glaze and refuse to cu this case the reciprocatory moveme done by power instead of muscula fort. All the adjustments of the too the wheel are easily made fron working position, and the operato



SETTINGS FOR CURVED TOP FACES ATTACHMENT	TOOLHOLDER	NAME	Nº	TOOL	OPERATION	SETTINGS FOR PROFILE AND FLAT TOP FACES TURNTABLE	TRUNNION	TOOLHOLDER	NAME	Nº	TOOL	OPERATION	SETTINGS FOR PROFILE FOR FLAT TOP FACES TURNTABLE	TRUNNION	TOOLHOLDER
						SET TOOL IN HOLDER TO GIVE RADIUS ON SIDES EQUAL TO WIDTH OF TOOL. E.G. 1" SQUARE SECTION SET FOR 1" RADIUS OF FEET TO RIGHT. SWEEP OFF RADIUS AFTER OPERATIONS 1 & 2.									
ZERO	A 15 RIGHT	SHAPING	1		1	10 BACK	6 DOWN	C3 RIGHT	ROUGHING RIGHT	15		1	5 BACK	6 DOWN	C3 RIGHT
					2	10 BACK	6 UP	A3 LEFT				2	7½ BACK	6 UP	A ZERO
					3	15 FORE	ZERO	D ZERO				3	2 FORE	ZERO	D20 LEFT
												1	5 BACK	6 UP	A3 LEFT

Fig. 1.—Showing a portion of the tool grinding chart.

t all times see what is happening with-
it stopping for inspection.

For all tools with flat faces no at-
chment, template or former is requir-
l, all the adjustments necessary being
tained in the universal tool holder. For
ose tools that have hollow curved top
es a simple attachment is used. This
secured in the tool holder of the mach-
, while the tool is reciprocated across
e corner of the grinding wheel, the
mbination of angular positions of tool
d holder giving any desired amount of
rvature.

The Toolholder

The tool to be shaped is gripped in a
iple chuck, which can be rotated
ough a complete circle on its own ax-
The barrel which contains the chuck
carried in two trunnion bearings, so
t the tool can be swung through an
of about 10 degrees up or down. The
unions have endwise adjustments in
ir bearings for use when grinding
ius tools in which the centre of the
ius does not coincide with the centre
the spindle. The whole tool holder can
ate on a vertical axis, enabling any
or the end of the tool to be present-
to the wheel at any pre-determined
le. An inspection of the line drawing
the tool holder in Figure 1 will reveal
unlimited application of these move-
nts.

The Tool Chart

is desirable that the instructions
gin in any tool grinding chart should
ot only intelligible but also incap-
ab of wrong construction by the most
perienced operator. For this reason
hart gives the settings of the tool
re there are no alternatives, so that
chart is followed the correct ang-
e given to the tool. In other words,
hart tells the operator what to do,
n from his point of view is what he
wants to know.

actual angles reproduced on the
are those given in the chart. The
oint where they appear to differ
the designation of the angles given
front of a tool; but even in this
he chart angles are the same as
actually given to the tool, if meas-
from the side instead of the front
tool.

naming of tool angles, such as a
angle, side slope, front slope,
ee, and so on, is liable to misin-
ation, and has been abolished in
art. Instead, each tool is sketched
tool faces numbered to corres-
with the sequence of the grinding
ons. Thus confusion is entirely
ited, and the chart can be easily
easily understood, and easily in-
ed on the machine.

Th are three angular adjustments
th oscillator, each graduated in de-
es These are designated as the turn-
ble he trunnion and the tool holder
espe ively. The positions of all three are
separ ely specified for each tool face
to be round. The turntable graduations
read many degrees "back" or "fore"
from the zero position. The trunnion graduations read so many degrees "up" or "down," thus indicating the actual movement of the tool nose from the horizontal. The tool holder has four arrow marks labelled respectively "A," "B," and "D." The barrel in which it rotates is graduated so many degrees "left" or "right" of the zero. The four marks A, B, C, and D correspond to the four sides of the tool; when arrow mark A is covered by the graduations the top face of the tool is uppermost provided the base is flat on the base of the tool chuck. The marks B and D then correspond to the two side flanks while mark C corresponds to the base, on which no grinding is done.

Curved Top Faces

The advantages of the hollow curved top face have been set out in the previous article. A curved top face can be ground by this oscillator almost as easily as a flat face. The profile of the tool, that is the shape from the top, is first ground without the use of the attachment. When a batch of similar tools has been thus "profiled," the tools can be finished with curved top faces by means of the curved face attachment furnished with each machine in very little more time than would be required if they were ground with flat faces.

The degree of curvature given to the tool, and consequently the rake at the cutting edge, can be varied by commencing the grinding nearer to or farther from the cutting edge. This will be readily comprehended by referring to Fig. 2. This method of increasing the keenness of the cutting edge, however, may not be desirable owing to the resulting length of the ground face from the tool nose. Another method is open in such a case, and that is swiveling the attachment slide more towards a vertical position, a method which causes the tool to be reciprocated more on the corner of the wheel.

When using the attachment the trunnion setting must be at zero, that is, the barrel in which the attachment is gripped must be horizontal. For right-hand tools the position of the turn-table has been found by experiment to give the best results when set at 42½ degrees back, so that the front and the side of

PROFILE.			RAKE.		
SIDE ANGLE / FRONT ANGLE	SIDE ANGLE	FRONT ANGLE	For STEEL with a Tensile Strength of	SIDE CUTTING ANGLE Toolholder Setting	FRONT CUTTING ANGLE Turntable Setting
For HEAVY Cuts on Rigid Machines Not Fully Loaded	TURNTABLE 55 BACK	85 BACK	20 TONS	D.18. LEFT	25 FORE.
			30 TONS	D.15. LEFT	21 FORE.
	TRUNNION 6 DOWN	6 UP	40 TONS	D.12. LEFT	17 FORE.
			50 TONS	D.9. LEFT	12 FORE.
	TOOLHOLDER C.6. RIGHT	A. ZERO.	FOR CAST IRON	D.6. LEFT	8 FORE
For HEAVY Cuts on Fully Loaded Mcs	TURNTABLE 45 BACK	75 BACK	20 TONS	D.22. LEFT	22 FORE.
			30 TONS	D.18. LEFT	18 FORE
	TRUNNION 6 DOWN	6 UP	40 TONS	D.14. LEFT	14 FORE.
			50 TONS	D.11. LEFT	11 FORE.
	TOOLHOLDER. C.6 RIGHT	A. ZERO.	FOR CAST IRON	D.7. LEFT	7 FORE
For MEDIUM Cuts on Average Machines	TURNTABLE. 35 BACK	65 BACK	20 TONS	D.25. LEFT	18 FORE.
			30 TONS	D.21. LEFT	15 FORE.
	TRUNNION. 6 DOWN	6 UP	40 TONS	D.17. LEFT	12 FORE
			50 TONS	D.12. LEFT	9 FORE.
	TOOLHOLDER. C6 RIGHT	A. ZERO	FOR CAST IRON	D.8. LEFT	6 FORE.
For LIGHT Cuts	TURNTABLE 25 BACK	55 BACK	20 TONS	D.28. LEFT	14 FORE.
			30 TONS	D.23 LEFT	11 FORE.
	TRUNNION 6 DOWN	6 UP	40 TONS	D.18. LEFT	9 FORE
			50 TONS	D.14. LEFT	7 FORE.
	TOOLHOLDER C6 RIGHT	A. ZERO.	FOR CAST IRON	D 9 LEFT	4 FORE
For SPRINGY Work	TURNTABLE 5 BACK	45 BACK	20 TONS	D 30 LEFT	3 FORE
			30 TONS	D 25 LEFT	2 FORE
	TRUNNION 6 DOWN	6 UP	40 TONS	D 20 LEFT	2 FORE
			50 TONS	D 15 LEFT	1. FORE.
	TOOLHOLDER C.6. RIGHT.	A ZERO	FOR CAST IRON	D.10 LEFT	1 FORE

Fig. 3.—Chart showing variations of tool No. 4 with the settings necessary to give each shape and the class of work for which each is suited.

the wheel make equal angles with the tool. When grinding left-hand tools, owing to the position of the tool nose relative to the movements of the wheel, the turntable should be set at 25 degrees back. These two settings need never be altered for any shape of tool.

The tool is secured in the holder of the attachment in such a position that the cutting edge is parallel with the slide. A tool having a curved cutting edge is set so that a tangent with the average centre of the cutting edge is similarly parellel to the slide. The slide is set to 15 or 20 degrees (see chart, Fig.1) from the vertical, and clamped in that position. Grinding takes place without the oscillating motion of the wheel.

The wheel in then advanced and adjusted sideways until it just touches the tool at a point distant from the cutting edge an amount varying with the size of the tool and the degree of curvature required. This amount is decided by the position where the deepest part of the grinding will ultimately be. For a small tool, say ¾-inch by ½-inch, it can be about ⅜-inch; for a large tool, say 3-inch by 2-inch, about 2-inch will be necessary. A good rule to follow is to make the length of the top face equal to the width of the tool. In any case it will soon be seen as grinding proceeds whether the desired effect is obtained or not, and correction made accordingly.

The tool is then passed up and down across the corner of the wheel by means of a lever at the top of the slide. While grinding proceeds the wheel should be fed alternately forwards and sideways by means of the two hand wheels which control these movements. Grinding continues until the cutting edge is reached. It should always be the endeavor of the man in charge to have tools ground in batches; this decreases the cost of making the various settings, and encourages greater efficiency in the operator.

The swiveling movement of the turntable on its vertical axis is extremely handy for grinding radius and round-nosed tools. To do this the tool is set so the centre of the desired radius is exactly over the axis of the turntable; then with the wheel stationary or oscillating but slightly the turntable is rotated back and forth until the desired curve merges into the sides and end of the tool. To facilitate setting, a radius gauge is provided. The procedure is as follows: First grind the end of the tool with the necessary clearance, then the side of the tool, also with clearance. Run the wheel back and reset the tool in the chuck, using the radius gauge to determine the forward position of the tool nose.

Next adjust the barrel of the chuck sideways in the trunnion bearings, using the graduated scale to bring the centre of the desired radius over the axis of the turntable. Set the turntable to 90 degrees back, bring the wheel up till it just touches the tool, and set the stop which limits the forward movement of the wheel. Run the wheel back again, then commence grinding, swiveling the turntable and feeding the wheel forwards till the stop is reached, when in will be found that the radius is completed.

Standard Tools

In deciding on the set of tools incorporated on the chart, the authors have had in mind the elimination of forging as far as possible. Sixteen out of the twenty-five tools shown can be roughed to shape from a piece of straight bar. Four of the remaining nine need only bending, a very simple operation. The two tools for finishing fillets, Nos. 24 and 25, need only forging when the radii are larger than, say, half the tool width. The twenty-five tools shown cover the majority of the requirements of the average shop, as will be seen later when their purposes are described.

Tools numbered 1 to 14 can be ground with a hollow curved top face, and it is strongly recommended that they should be so ground, for the reasons previously advanced. The requisite settings for grinding these tools to such a shape that they will be suitable for machining mild and the lower carbon steels are given on the left of the chart. These settings replace those otherwise used for grinding the top face flat, and do not affect the shaping of the top profile.

All the other settings given have been chosen, as the result of a very wide experience, to give a tool suitable for 30-ton steel, with the exception of the last four, which are intended for special purposes. The resulting rake of the top face, can, of course, be varied to suit the material to be machined, the keenness being increased for softer materials and decreased for harder materials.

The No. 1 is a round-nosed tool intended mainly for planing and shaping. The top face slopes away from the point, there being no side cutting angle at all; it also has clearance on both sides of the tool, so that it can be used for feeding in either direction. It is in addition useful tool for necking the journals axles and shafts. The roundness of th nose can be varied to suit different co ditions. For instance, for turning a sle der camshaft between the cams th point should be made fairly slende say ⅛-inch radius, whereas when tur ing railway carriage axles, where cha ter is not likely to occur, the nose c be much blunter, say ¼-inch up to ½ inch radius, depending on size of to This tool is preferably made from ste of a depth about one and a half tim its width.

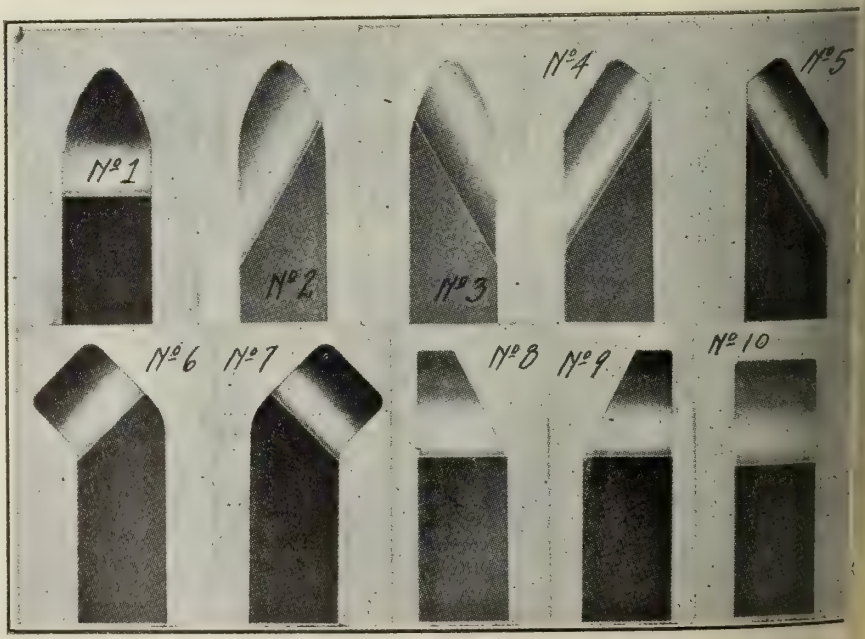
Grinding Instructions

Set the end of the tool blank by mea of the radius gauge to give a radi equal to the width of the tool sectio

Adjust the trunnion to the right amount also equal to the width of t tool.

The two sides of the tool should ground complete in two distinct op ations. In grinding face 1 the toolhol is rotated till the base of the tool is permost. Set the turntable to 10 degr "back," and grind the side of the t away for a length equal to the t width; then, without altering any justment and while the tool is still contact with the wheel, unclamp turntable and slowly sweep it round the left till the tool leaves the wh Repeat this operation on face 2 wi out removing the tool from the toolh der; this time, however, the base of tool will be downwards.

Note particularly that to obtain correct clearance on the two sides trunnion is set to 6 degrees "down" the toolholder to C.3 degrees "rig for face 1. Both these settings are versed for face 2, that is, the trunnio set to 6 degrees "up" and the toolhol to A.3 degrees "left." The point sho be just touched up, giving 6 degrees clearance, the settings being (tho this is not given in the chart):—



Photographs of tools from No. 1 to No. 10.

Turntable.	Trunion.	Toolholder.
90 back.	6 up.	A zero

The point can be rounded off later by and on a plain grinder, although on rge tools, which require a large radius the point, it can be done in the os-llating grinder by setting for the de-red radius. The top face is then ground give the desired rake—in the chart is is given as 15 degrees, as any great-keenness would cut too deep into the ol. It is, therefore, strongly recom-ended that this tool be always ground th a hollow curved top face, as a keen-rake is obtained without weakening tool.

For hard materials such as cast iron, flat top face with 10 degrees rake is ter, the settings for Operation 3 be-

rntable.	Trunnion.	Toolholder.
0 Fore.	6 up.	A zero.

Tools Nos. 2 and 3 have a similar pro-to tool No. 1, the difference lying in the rake of the top face. This has as well as front cutting angle, so tools can only be used for feeding one direction. These are general pur-e tools for right and left-hand rough ning, though they are preferable to 1 for shaping and planing steel n the feed of the tool is in one di-ion only.

e tools are shown in the chart with sides rounded, this being the form t suitable for ordinary purposes. re they are used for heavy roughing reference to tools Nos. 4 and 5 (this, ever, is not recommended) the round-of the non-cutting side can be left the end of the tool being ground off degrees "back" and 6 degrees clear-, No. 2 tool being ground with the face upwards and No. 3 with the top downwards. This agrees with the in that for heavy cutting as much as possible should be left on the nose to absorb the heat, but will on-ply to tools of larger section than, ¾-inch by 1-inch.

erally speaking, these tools should ade of steel with a depth about nd a half times its width, though me small American lathes it will und necessary to employ a section to one. Grinding instructions as ol No. 1 will apply, with the ex-n of grinding the top face.

n grinding these tools with a hol-rved top face, they should be set attachment at an angle of 30 de-with the slide, as this setting the curvature run away from the g edge in a manner suitable for dinary purposes. On small tools, based only for light cuts, this angle decreased with advantage to 20 even 15 degrees. When the non-cutting not rounded the settings to be stead of those given in the chart

Tool o.

	Turn-table,	Trun-nion,	Tool-holder.
2, 4. 2.	80 back	6 up.	A zero
3, 5. 1.	80 back.	6 down.	C. zero.

Tools Nos. 4 and 5 are those strongly recommended for nearly all rough turning and planing because they adapt themselves so readily to the most efficient form for cutting all kinds of materials. On the standard tool chart the forms of tools given are those suited for general work, but full instructions will be given for arriving at the form most suitable for definite individual conditions.

The cutting edge, numbered 1 in the diagram, can be ground to any angle from 5 to 55 degrees and can be made of any length, according to the depth of cut.

The variations to which these tools are subject are given in the diagram and chart, Fig. 3, with the kind of work for which each is suited.

The cutting edge, whatever the form and rake of the tool, must be approximately horizontal, and in Fig. 3 the angles specified ensure this. For those who are interested in knowing the means whereby the various settings for the rake angles suited to different materials are ascertained, the following formulae and its explanation may be cited.

Refer to figure 4, which shows a tool with the cutting edge at A degrees to the side of the tool. The line pz drawn in a horizontal plane at right angles to the cutting edge gives the rake of the top face as B degrees, shown in triangle zpl. Then a vertical line from horizontal line pz to the top face is zl. The horizontal lines zm and zn are drawn perpendicular to and parallel with the side of the tool. Then the angles which these two lines make with the top face are respectively the side and the front cutting angles which can be set on this machine by means of the toolholder and turntable adjustments.

The lines zlzs and zt are all equal as represent the vertical line from point z to the tool face. Call them r, then:

$$\frac{r}{pz} = Tan\ B.$$

$$r = pz\ Tan\ B \quad \ldots(1)$$

$$\frac{pz}{mz} = Cos\ A \quad \ldots\ldots\ldots(2)$$

$$\frac{pz}{nz} = Sin\ A \quad \ldots\ldots\ldots(3)$$

$$Tan\ S = \frac{r}{mz}$$

$$\text{Substituting (1)} \quad = \frac{pz}{mz}\ Tan\ B.$$

$$\text{Substituting (2)} \quad = Cos\ A\ Tan\ B.$$

$$Tan\ F = \frac{r}{nz}$$

$$\text{Substituting (1)} \quad = \frac{pz}{nz}\ Tan\ B.$$

$$\text{Substituting (2)} \quad = Sin\ A\ Tan\ B.$$

Thus angle F, the front cutting angle, is also determined in terms A and B.

The same problem can be solved graphically by drawing the diagram (Fig. 4) to the correct angles, then measuring angles S and F with a protractor to the nearest degree. Nos. 4 and 5 tools should have shanks of sections with a depth one and a half times the width.

Grinding Instructions

The tool blank needs no special setting in the holder beyond the elementary one of placing the base of the blank flat on the bottom of the holder.

Grind side angle 1 to the requisite inclination of the cutting edge, then turn the tool over and grind front angle 2. In a small tool or one to be used for light cuts only, make face 1 quite short and grind face 2 till it almost joins it. When grinding a curved top face, the cutting edge, whatever its inclination, must be set parallel to the attachment slide.

The setting of the machine toolholder is given as A.20 right or left—this is correct for most tools. Very small tools can be ground with the slide set nearer the vertical, while for very large tools the angle can be increased to, say, A. 30, beyond which it is not desirable to go. The point of the tool can be radiused by hand, though, if desired on large tools, it can be rounded on the machine, with 6 degrees clearance, setting to the desired radius by means of the radius gauge and carefully noting the position of the centre of the tool width, in order to offset the tool correctly. One point that should be rigorously watched in making these tools is that the cutting edge must be long enough for any depth of cut it may be called upon to take, while at the same time it should not be made any longer than is necessary.

These Tools Nos. 6 and 7

These tools are precisely the same in principle as Nos. 4 and 5. They are bent for the purpose of reaching outside the tool rest in those cases where the saddle cannot be brought close enough to the work to employ a straight tool. The blank should be bent to an angle of 45 degrees. As the use of bent roughing tools is limited to special and but few cases, it is not necessary to consider variations in its angles, as the expense of providing tools with the possible variations would not be justified. Generally speaking, any variation desirable can be obtained by inclining the tool in the tool rest. A section of 1 to 1½ will be found generally suitable for this tool.

Grinding Instructions

These will be generally as specified for tools Nos. 4 and 5. The rake of the cutting edge can be varied to suit different materials, the angles given for the top tool but one in Fig. 3 being all the variations necessary.

Tools Nos. 8 and 9 are intended for fine finishing cuts on lathes, planers or shapers. Sides 1 and 2 are ground with clearance, so the corner between them should always be the leading corner. These narrow finishing tools will rarely if ever be used in the larger sections; on the other hand, the broad

finishing tool, No. 10, will rarely be used in the smaller sections. Theoretically, the width of the cutting edge should be about twice the intended feed, but as this cannot be readily determined, it will prove a good rule to make the cutting edge half as wide as the tool shank. These tools will give the greatest satisfaction if made of a section having a depth twice the width.

Grinding Instructions

First grind the end of the tool, this being the cutting edge, giving it 6 degrees of clearance. The front edge of the tool can next be thinned down to half the width of the shank by grinding off at 25 or 30 degrees with the side.

For cutting steel, it is strongly recommended that these tools be ground with hollow curved top faces, the tool being set in the attachment at right angles to the slide, top face turned towards the wheel. The toolholder setting of A. 15 right will give the right amount of curvature for all tools up to ¾-inch by 1½-inch. Larger tools can be ground at a toolholder setting of A.20 right. For cutting cast iron a flat top face with 10 degrees rake is best; this is obtained with settings for operation 4 of

Turntable.	Trunnion.	Toolholder.
10 Fore.	Zero.	D zero

Tool No. 10 is a broad finishing tool, and will generally be made of square section steel, 1½-inch by 1½-inch a larger.

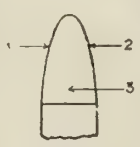
This tool will be generally more us for planing than for shaping or turnin Grinding operations are generally sir lar to those given for tools Nos. 8 and Sides 2 and 3 are, however, both grou with clearance, so that the tool can fed in either direction. For cutting st it should be ground with a hollow cur top face. For cutting cast iron, it sho have a flat top face with 10 degrees rake, the settings for operation 4 be

Turntable.	Trunnion.	Toolholc
10 Fore.	Zero.	D ze

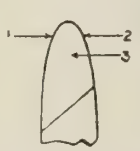
Tool No. 11. This is a tool for a sp-

Continued on page 64

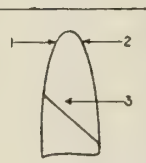
No. 1 – Shaping

SETTINGS for Curved Face. ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL HOLDER
ZERO	A 15 Right		Set tool in holder to give radius on sides equal to width of tool e.g. 1"x1½" Section set for 1" Radius, offset to right 1" Sweep off radius after operations 1&2			
			1	10 Back	6 Down	C 3 Right
			2	10 Back	6 Up	A 3 Left
			3	15 Fore	ZERO	D Zero

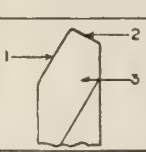
No. 2 – Round Nose Roughing R.H.

SETTINGS for Curved Face ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
30 Right	A 20 Right		Set tool in holder to give radius on sides equal to width of tool e.g. 1"x1½" Section set for 1" Radius, offset to right 1" Sweep off radius after operations 1&2			
			1	10 Back	6 Down	C 3 Right
			2	10 Back	6 Up	A 3 Left
			3	10 Fore	ZERO	D 15 Left

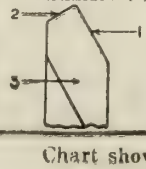
No. 3 – Round Nose Roughing L.H.

SETTINGS for Curved Face ATTACHMENT	TOOL HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
30 Left	A 20 Left		Set tool in holder to give radius on sides equal to width of tool e.g. 1"x1½" Section set for 1" Radius, offset to right 1" Sweep off radius after operations 1&2			
			1	10 Back	6 Down	C 3 Right
			2	10 Back	6 Up	A 3 Left
			3	10 Fore	ZERO	D 15 Right

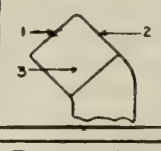
No. 4 – Straight Roughing. R.H.

SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
55 Right	A 20 Right		1	35 Back	6 Down	C 6 Right
			2	50 Back	6 Up	A Zero
			3	15 Fore	ZERO	D 22 Left

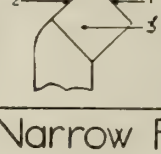
No. 5 – Straight Roughing. L.H.

SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
55 Left	A 20 Left		1	35 Back	6 Up	A 6 Left
			2	50 Back	6 Down	C Zero
			3	15 Fore	ZERO	D 22 Right

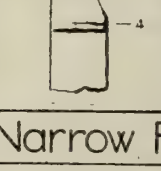
No. 6 – Bent Roughing R.H.

SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
45 Right	A 20 Left		1	45 Back	6 Down	C 6 Right
			2	45 Back	6 Up	A Zero
			3	18 Fore	ZERO	D 18 Left

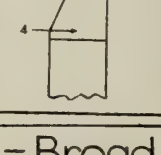
No. 7 – Bent Roughing L.H.

SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
45 Left	A 20 Left		1	45 Back	6 Up	A 6 Left
			2	45 Back	6 Down	C Zero
			3	18 Fore	ZERO	D 18 Right

No. 8 – Narrow Finishing R.H

SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
ZERO	A 15 Right		1	90 Back	6 Up	A Zero
			2	ZERO	ZERO	C 6 Right
			3	25 Back	ZERO	A Zero
			4	15 Fore	ZERO	D Zero

No. 9 – Narrow Finishing L.H.

SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
ZERO	A 15 Right		1	90 Back	6 Up	A Zero
			2	ZERO	ZERO	A 6 Left
			3	25 Back	ZERO	C Zero
			4	15 Fore	ZERO	D Zero

No. 10 – Broad Finishing

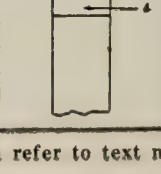
SETTINGS ATTACHMENT	TOOL-HOLDER	TOOL	OPERATION	SETTINGS TURN-TABLE	TRUNNION	TOOL-HOLDER
ZERO	A 15 Right		1	90 Back	6 Up	A Zero
			2	ZERO	ZERO	C 6 Right
			3	ZERO	ZERO	A 6 Left
			4	15 Fore	ZERO	D Zero

Chart showing tools No. 1 to No. 10. For further information refer to text matter.

Making Connecting Rods for Marine Engines

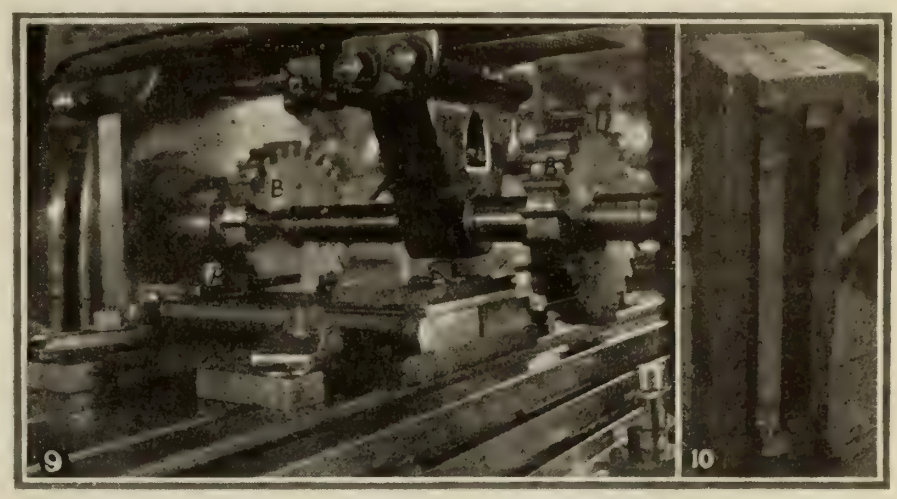
Some of the Principal Operations Including Grinding—Milling —Machining Register on Rod—Finishing Wrist-pin and Crank Pin Holes.

By ROBERT MAWSON

WHEN you manufacture connecting rods in any appreciable quantity, you must, to economically produce these rods, provide suitable jigs and fixtures. The data to follow shows how one firm manufactures marine engine connecting rods with considerable success.

The concern I refer to is the Murray & Tregurtha Corp., Alantic, Mass., who have been engaged in the manufacture of marine engines of various sizes, both light and heavy duty, for over thirty years. Their experience in this respect will no doubt be welcome.

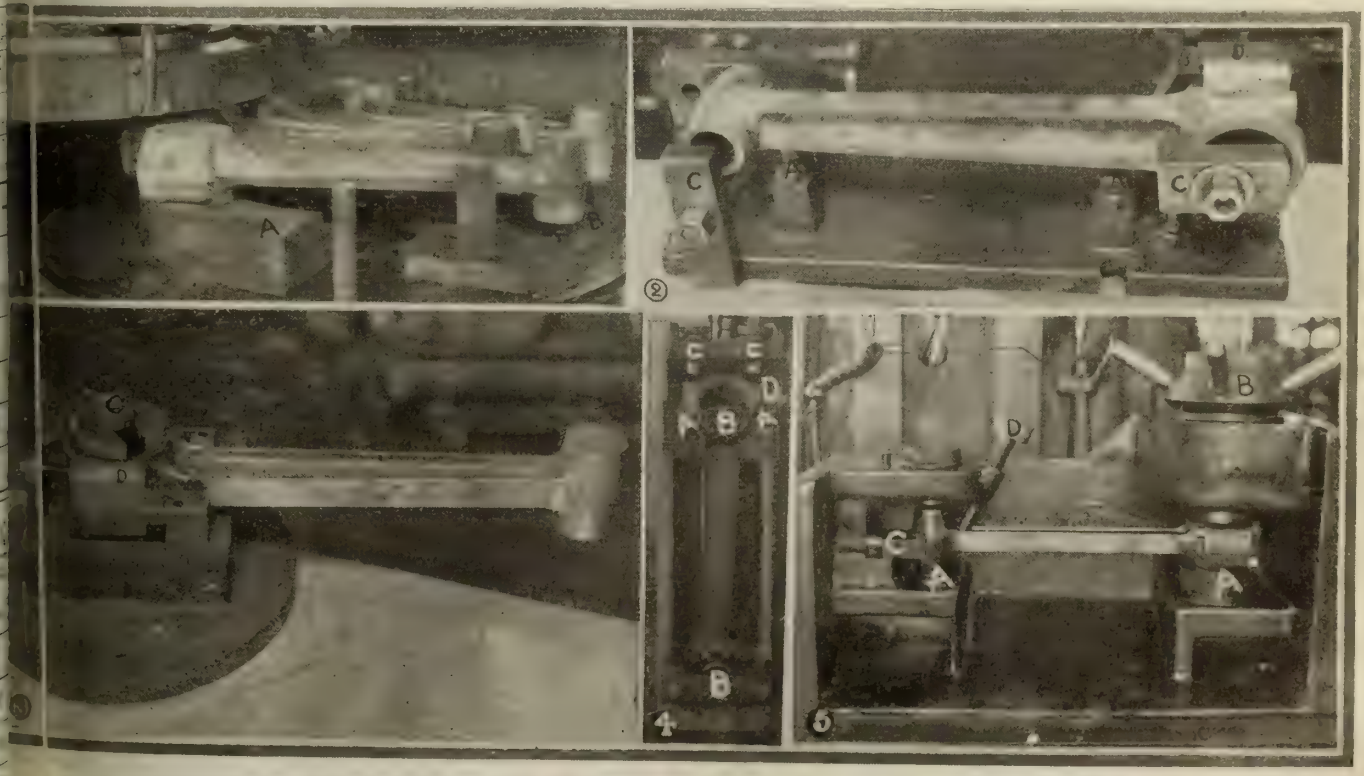
The rods used on what are known as the high-speed engines are made of a machine-steel drop forging and are not all accurately machined, but heat treated to obtain a long-lived element in service. After the rod forgings have been tested for straightness the first machining operation is grinding the surface for the upper and lower boxes on a duplex hard surface grinder as shown in Fig. 1. The machine is provided with a magnetic chuck table which is used to hold the rods and fixture in position during the operation. The rods are placed with their large end resting on the block A, and the fixture is designed to accommodate 5 rods at one time. The small end is located on screws B, so adjusted that the web of the forgings will be parallel. The revolving grinding wheel is then fed across the faces on both ends and the machining operation performed.



Figs. 9 and 10. Milling and drilling the heavy duty rods.

The rods are next turned over and the opposite sides machined in a similar manner. An interesting feature of this fixture is the manner in which the forgings are staggered so that the wheel travels the smallest distance to finish the surfaces.

The fixture illustrated in Fig. 2 is used when machining the faces of the bolt and nut bosses on the rods. The forging is placed on the locating set screws A, and in such a position that the surplus material on the portions to be milled is equally divided between the guide pads B. The two clamps C are then tightened by means of the studs



Figs. 1, 2, 3, 4, and 5 showing grinding jig, drilling jig, etc. Refer to text for detailed information.

shown against the rod to hold it firmly in position.

A pair of gang milling cutters accurately spaced are then fed across the forging and the surfaces machined. The rod is then reversed and the bosses on the opposite side milled. This same fixture is also used for a later operation of parting the rod, the slot D being employed to locate the slitting cutter in the proper position in relation to the large end of the forging.

Machining Register on Rod.

The fixture shown in illustration Fig. 3 is used for machining the register on the rod which is the next operation. The forging is located by means of the steel blocks A, the inside dimension being the same as the space machined on the bosses in the previous operation. The set screw B is tightened which forces the element back into the locating mediums. The open washer shown is then slid under the stud; the nut C is tightened, holding the rod securely. This fixture is used on a Bullard boring mill. After the fixture is in position the register D is turned to the correct diameter. The rod is then reversed and located in a manner similar to that described and the surface on the under side machined in like manner.

The holes at the large or crank pin end of the rod are then drilled for the next operation and the jig employed for this work is shown in Fig. 4. The forging is again located by means of the two steel blocks A that fit outside the machined surface previously described. The lower end of the piece rests against a block, and as the upper end also fits in contact with a height pad the rod is in a parallel position when in the drilling jig. Straps and set screws being fastened against the forging force it back to the pads and also hold it securely in position. Two holes are drilled and afterwards reamed, the tools being guided through the long bushings C so that the holes will be in the correct alignment and also parallel.

This tool is also employed as the milling fixture when machining the dovetail in the rod after it has been cut apart. For this operation the section D is removed and as the rod is located and held in the large part of the tool the taking away of the piece noted does not impair its usefulness when used for the latter purpose. A set of gang cutters are then fed across the joint face and the recess machined on the large end of the rod held in the jig-fixture. A simple fixture is employed to hold the cap to machine, the mating surface on the joint, but is not shown.

The rod is then reversed, located in a similar manner, and the bosses on the reverse side machined. The cut away section D is a guide for the operator who feeds the table upward until the milling machine arbor comes in contact with this section. When the table hits this section the cutter is in the correct relative position for machining the connecting rod bosses. The position across is determined by means of the notch which may be observed at the inner edge of the height block D, this notch being the stop for the edge of the form cutter.

The fixture, Fig. 8, is used for machining the sides and top of the web of the rods. This tool is designed to hold two elements and these are located in vee blocks at the small end. The open washer and nut A, one for each rod, are then tightened to hold them securely in the fixture. The web section is machined, using an end mill for the operation. The purpose of this work is to obtain rods of more nearly equal weight, also for appearance. The rods are then reversed, located and held in a manner similar to that noted, and the reverse surface milled.

The operation described does not follow any particular sequence, sometimes being the last and at other times the second or third. However, the fixture, as will be noted, does not depend on the machined holes for locating, the rod being held by its outside surface.

Two operations will now be shown, depicting how the heavy duty engine rods are machined.

These rods are forged from solid bars of open-heart steel, and fitted with a marine type of bronze box which are held to the rods by means of bolts.

The forgings, the fixture being designed to hold two, are placed in the tool in Fig. 9 so that there is equal amount of surplus material at each side to be removed. The straps A are fastened down onto them by means of the bolts shown, thus holding the rods securely in position. The inserted teeth cutters B are correctly spaced to obtain the proper length and these are then fed across and the ends machined.

The rod is then placed into the jig, Fig. 10, being located by sliding the element until it comes against a stop at the lower end. The rod rests against steel blocks at the upper and lower ends as may be observed, the holes to be machined will be sure to be central with the forging. Two screws A hold the rod in position for the drilling of the holes. After one side has been machined the rod is reversed, being located and held

Continued on page 64

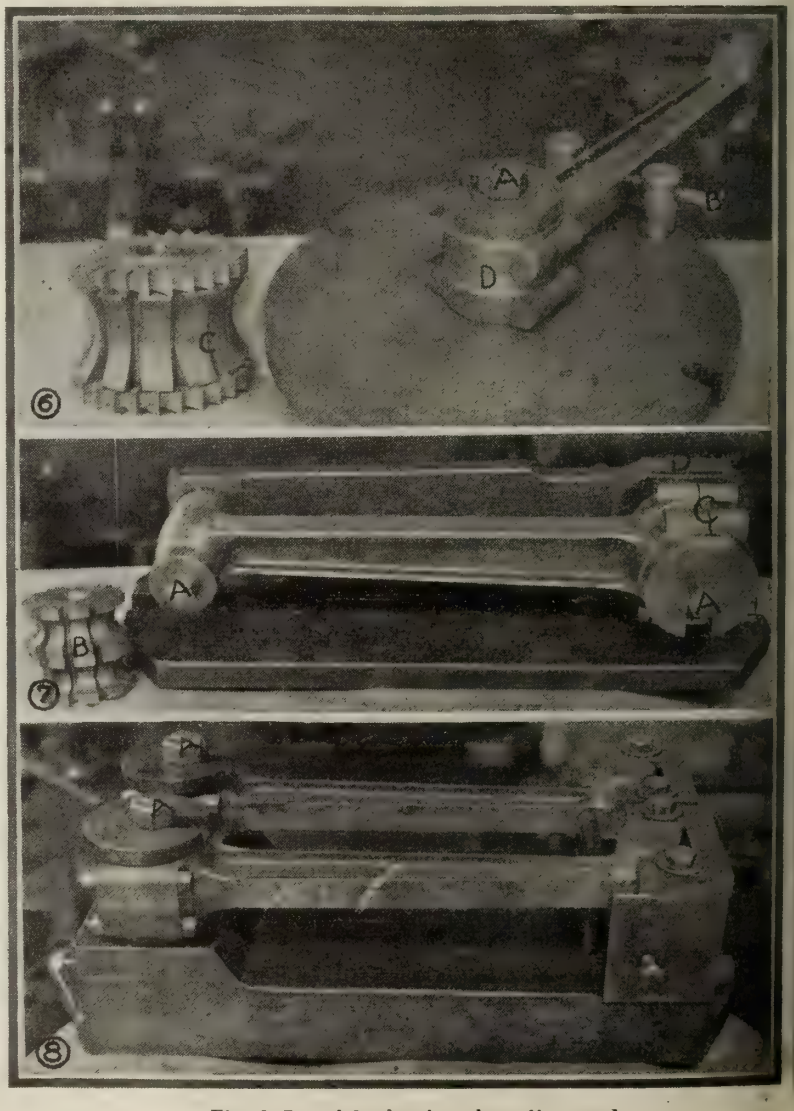


Fig. 6, 7, and 8, showing three jigs used.

Many Interesting Exhibits In Machinery Hall

No One Can Afford to Pass Up This Section of the Toronto Exhibition—The Various Exhibitors Have Spent Considerable Money and Thought on Their Displays

By J. H. MOORE

every exhibitor in the Machinery all at the Toronto Exhibition was sked what he desired most of all as the exhibition was concerned, uld loudly and emphatically state w Machinery Hall." There is no son but that the present edifice is quate. Not only is it too small, is so far out of date as to be y source of annoyance to those ex- itg. This is not said with the in- t of slamming the parties respon- for the exhibition, but rather to in in them the tremendous oppor- they are missing year after r Thousands of visitors refuse to s hrough the hall. Why? Simply e they think it will be very much me thing. This, of course, is not view to take of the matter, for ns are always made, and new ex- it are in place, but mechanics lves realize the limitations of h building. Suppose for a mom- new building at least three times e of the present one. Imagine nstruction after the plan of a one mill, with suitable transmission es. What would happen? Why, machine tool builder would be ng his neck to get in. Instead of they are almost breaking their year by year lugging heavy mach- nto the hall. At that it must not heavy or it will fall through the ut why go further, except to say that one exhibitor alone figures it will cost him at least $500 for the moving in and out of his exhibit. He is a local exhibitor at that. Many other firms would have larger machines in place were conditions suitable, and others again would have their machines in operation were facilities what they should be. The above is not penned in a knocking spirit, but rather in an attempt to create interest in a very necessary addition to Canada's greatest and best exhibition.

The exhibits this year are particularly interesting, and while we shall not attempt to give them in their order of importance, we shall endeavor to group them under various heads. Starting with machinery we find that

The P. B. Yates Machine Co., Hamilton

have a very nice exhibit which includes an open back nailing machine, containing several features of interest. They are also showing a single cabinet surfacer of interesting design, together with a type G-2, edging and ripping saw. Literature on all these machines is available. Naturally, we cannot go into mechanical details in the space at our command. In addition to the above they are showing a varied asortment of cutter heads, these including the square and round types, also special matching heads, jointer and ship lap heads. Another machine being exhibited is a type S-2 edge sander with tilting table, and this machine is so arranged that two men can work on it at one time. J. T. Donnolly and F. W. Mitchell are in charge of this interesting booth.

Messrs. Alfred Herbert Ltd.

are showing a very complete machine tool exhibit. Here are the various machines shown:—A No. 13 hexagon turret lathe, a No. 9 combination turret lathe, a No. 4 capstan lathe, a 16″ x 6 ft. Springfield 3-step cone lathe, a single spindle plain drill press, a No. 16 single spindle vertical milling machine, and a No. 1 Lumsden grinder.

In addition to the above they show another drill press with a geared spindle and automatic feed; a 16 x 2½ in. wet tool grinder , a ball bearing die grinding machine for grinding Coventry die chasers, a 3' 6″ radial drill, and a No. 2 Kearn's horizontal boring, facing, milling and drilling machine. Next comes a 13-in. Pollard pillar drill, a 22″ Pollard upright drill, a full display of tools, die heads, dividing heads, gauges, quick change chucks, drills, straight fluke drills, boring bars etc. They also show a new quick action vise, a universal vise, and a Herbert Morris two ton electric crane. In connection with the various machines, which are in operation, test jobs, or demonstration work is being run. One of these pieces, a distributor bush, is made from bronze and



A Typical crowd at the Toronto Exhibition.

is about 3½ O.D. and 5in. long over all. The work on this piece is turning, boring, facing, reaming, etc., and the complete part is made in 2½ minutes. The only way to understand this description properly is to go and see the piece being produced. Several men, all mechanics, will be on hand to answer questions and demonstrate the machines, these including Mr. Blair, Mr. Dowling, Mr. Thornton and Mr. Keith.

The A. R. Williams Machine Tool Co.

have a very fine exhibit including such tools as a C. M. C. shaper, a C. M. C. lathe, a small grinder, a sensitive drill press with sliding head, a C. M. C. column drill, a line of Williams' bench presses, a line of Starrett tools, a Williams' hand shaper, some C. M. C. wood working tools, and some bench grinders. They also show some gasoline torches, a small bench lathe, a very small bench drill press, and a No. 2B Hendey milling machine. The tools are nicely arranged and the majority of them are in actual operation. Mr. Cronk will be in charge.

Brown & Boggs, Ltd., Hamilton

with W. J. Graham in charge, have a very fine exhibit of presses and other metal working tools. Three inclinable bed presses are shown, from 1½ in to 4 in. strokes, also another solid bed press of 1½ in. stroke. All these presses have steel connections, not cast iron. A foot squaring shear, a steel brake for bending metals up to No. 10 gauge, also a complete line of tinsmiths groovers, rolls, etc., are shown. All presses are under power. This firm is featuring a new safety device, one of which is operated by electricity. Those interested in press safety will find that Mr. Graham will give them his best attention, as he is very much interested in this new safety device.

The Williams Tool Corporation of Canada, Brantford, Ont.

This company, formerly the J. H. Hall Co., have a very complete line of pipe threading machinery. Five machines are shown, these ranging from ¼ in. to 2 in. size up to the 2½ in. to 8 in. size. Large machines are made, but space does not permit their showing. This concern are credited with producing several of the largest pipe machines ever made in Canada, the size being 18 in. capacity. One of these went to the Crane, Ltd., Montreal, while another was sold recently to the Hydro-Electric Commission. Various photographs of the different machines are shown together with the potential die head used on such machines. This die has 20 streams of lubricant flowing on the work at all times. F. O. Chapman and R. Hall will be in charge of this exhibit.

Bond Engineering Works, Toronto

This concern are showing a full line of double power transmitting appliances, these including shaft hangers, spiro compression couplings, universal adjustable, ball bearings, friction clutches, Grundy flexible insulated couplings, ball bearing countershafts, pulleys, etc. A full line of stationary and swivel ball bearing truck castors is shown, also a double swivel truck castor. Transmission equipment in its many phases is shown, and Mr. J. D. Miller, who is in charge of this exhibit, will be assisted by Mr. Thring, and Stephen J. Miller.

Cowan & Co., Galt

are showing a varied line of wood-working tools, also racks containing wood-working knifes for planes and other such tools. A scroll saw is also in operation.

The Elliott Machine Co., Belleville

have a line of portable wood-working machinery, including scroll saws, floor and drum sanders, band saws, planers, etc. Mr. Glen Elliott, W. G. Elliott and Mr. Bradley will be in attendance.

The Webber Machine Co.

have a varied exhibit, this including a cylinder grinding machine as used on automobile work. They also show examples of work performed on various parts of an automobile such as pistons, rings, pins, drive shaft gears, etc. The reason the latter are shown is because they handle automobile repair work of all kinds.

The Cleveland Pneumatic Tool Co., of Canada

are showing a very complete line of pneumatic tools. These include chipping hammers and riveters, grinders, sand rammers, caulking and beading hammers, breast drills, rock drills, manifolds and all types of air hose couplings. They are featuring a manifold installation which shows the use of their two or three way fittings. All valves and couplings are connected, and even the tools are in place. This installation shows clearly the many ways in which such tools can be connected. Air drills of various kinds are shown, also a varied line of valves, armoured hose, etc. C. D. Garner, Canadian manager, A. W. Hughes, Toronto office, and R. E. Johnson are in attendance.

The Canadian Ice Machine Co.

have an excellent exhibit of refrigerating machinery, supplies, and materials. They show a double pipe ammonia condenser; a centrifugal motor driven brine pump; a York double cylinder ice machine; an oil trap, bent coils; a sheet of pure compressed cork, and other supplies in this line. Mr. Haine and P. G. Hender will be at this booth.

Jones & Moore Electric Co., Ltd., Toronto

are showing a varied line of motors ranging from 1-6 h.p. to 25 h.p. A shoe repair shop outfit in operation is also shown.

The Lancashire Dynamo and Motor Co., Toronto

are showing a complete line of motors from 1 to 25 h.p. A slow speed motor for commercial sewing machines is shown, and all motors are equipped with ball bearings. A feature of these motors is that they only require greasi twice a year. Motor starters a shown, also a disassembled mot which gives visitors a chance to see t interior parts. Various photographs installations are included in this e hibit. Mr. Powell, Mr. Steele and M Adams are in attendance.

Simplex Floor Finishing Appliance C Montreal

are showing a floor surface planer, al a sand paper machine for the sar purpose. These machines weigh in t neighborhood of 250 pounds, and t planer has a special feature insomu that it has curved blades, and is easi adjusted for various depths of cu Floors can be completed right up to t edges with either of these machine Mr. Ross, Mr. Grafton,and Mr. Vero neau will be at the booth. Canadian Mach inery was informed that these machin are completely made in Canada, ar that the hope of the exhibit was to i terest agents throughout the country these machines. In addition to t machines a varied line of floor polis ing materials is shown.

The United Shoe Machine Co.

have a full line of shoe repairing mach inery. The first machine as made t them is shown also the latest type now equipped with ball bearings. Th comparison is rather good. They als show a gasoline engine which is ofte used as a driving medium where ele tricity is not available. Mr. Hanson is i charge.

Superior Wrench & Tool Co.

are showing a varied line of patente wrenches.

P. B. Wallace & Sons

are displaying a complete line of sho machinery such as stitchers, roughers molders, etc., etc.

Railway & Power Engineering Co.

are representing a varied line of rail road and power equipment this includ ing armature coils, car ventilators, lo comotive sanders, electric sanders, lin material, trolley wheels, soldering ap paratus, car seats, seat covering, an in fact a full line of railroad supplies Mr. Foreman, Mr. Mitchell, and Mr Lyre will be at this booth.

The Dominion Steel Products Co., Brantford

have an interesting exhibit. They hav a 75 K.W. 375 r.p.m. high compressio oil engine in actual operation, and thi is said to be the first Diesel engine com pletely designed and built in Canada Mr. W. W. Brown, the designer, gave Canadian Machinery a complete descrip tion of the engine and while one can not go into a full talk on the matter i this small space, we can say that th exhibit is well worth a visit. Each cy linder is identical in assembly, and in terchangeability is an accomplished fact The writer saw the arrangements made and if desired one can disassemble any unit without disturbing its neighbor Even the governor and other smaller parts are arranged on the same princi- ple. The engine is very compact and is

completely self-contained. They are said to be fully efficient under both steady and variable loads, this being of considerable importance to any heavy duty engine. The electric generator is, as stated before, part of the complete outfit, and the crane can pick up the complete self-contained unit and place it into position wherever desired. Full details are given in the literature, which is given to those interested.

In addition to the engine, the concern are showing a complete line of cast iron and steel chucks of the design which has already been explained in our columns. These chucks are very neat and their strength is already well known. A varied line of Darling valves is also shown, this company being exclusive Canadian agents for this line. The valves vary in size from 4 in. to 24 in., and hydrants of the Darling type are also shown. In fact a section of one hydrant is supplied. The exhibit is rounded out by the showing of a motor driven two stage auxiliary air compressor. All these various items have to be seen to be appreciated, and either Mr. Brown or the other gentleman in charge will be glad to explain matters in more detail.

The Dodge Co., Toronto

have an interesting exhibit showing their line of wood, steel and iron pulleys, both solid and split. Hangers, pillow blocks, and bearings of all kinds are shown together with solid and split clutches, floor stands, wall brackets, conveyor rolls and every conceivable type of equipment for transmission purposes. W. B. Burrows; E. A. Foley, and S. M. Bowen will be in charge of this booth.

Welding Exhibits

The Carter Welding Co., Toronto

are showing a very complete line of Rego welding and cutting torches. A lead burning outfit, a balloon filling outfit, and racks containing all sizes of torches, regulators, filling rods, and general welding supplies are shown. Carbon burning outfits are included, and in fact the welder has been considered from all angles in the preparation of this exhibit. Mr. Carter and Mr. Sorely will be pleased to demonstrate any of the articles displayed.

Prest-O-Lite of Canada, Ltd.

with Mr. Gimble, Mr. Smuck and Mr. Judson in attendance, are showing a complete line of welding torches and general welding apparatus. These lines include soldering irons, soldering torches, brazing torches, small tanks for trucks using acetylene, preheaters, welding torches and the various filler rods used in welding. They also show how small towns can be fitted up with acetylene lighting where electric power is not available, or in case of unforseen trouble. They also show a cast iron cutting torch of notable design.

The Davis-Bournonville Co., Toronto

have a very fine exhibit of portable welding and cutting plants. A 50 pound capacity portable generator is shown, also a radiograph and an oxygraph. They have a full line of welding torches and are showing the non-flash back feature. They also have a flashlight generator, and have various men demonstrating the various exhibits. J. F. Crowley will be in charge, and will be assisted by F. Grimmer and H. L. Wilson.

L'Air Liquide Society

are showing a varied line of oxy-acetylene apparatus, this including gas cylinders of various sizes, torches of various kinds and complete outfits ready for work. A cylinder has been cut in half and those not familiar with the interior construction and filling of such a tank should view this sectional cut tank. Various men are in charge of this exhibit, and any of them will be glad to demonstrate the line displayed.

The Canada Carbide Co.

not only show a variety of their products, but have a model electric furnace installed. In addition to the above they are showing a very novel toy cannon which works by means of a granulated carbide and water. The gun will be demonstrated to anyone interested and the principle involved is worth while. Lantern slides showing the manufacturing process at Shawinigan Falls, also form a part of the exhibit. Mr. A. McMillan is in charge of this booth.

Miscellaneous

The Canadian Link Belt Co., Toronto

This company is showing a rather interesting installation, which they call "A Silent Chain paradox." A disk with nine slots revolves in front of a chain drive arrangement, and to the casual spectator certain of the chains do not appear to be moving although they are actually travelling at the rate of over 1000 ft. per min. The secret is that the sprockets used to drive these chains are all certain multiples of nine.

In addition to this drive, racks are shown which contain different kinds of malleable iron and steel chains, buckets, etc. There is also a rack containing their silent and roller chains, also photographs depicting the chains being made at their Toronto plant, also others showing actual applications of such chains. J. S. Stewart, E. C. Burton, R. C. Turner, and F. C. Conant are in attendance.

The Chapman Double Ball Bearing Co., Toronto

have a very neat installation, showing, as they term it "a near attempt at perpetual motion." This shows an arrangement of pulleys large and small, all mounted on Chapman bearings. A 1-20 h.p. motor drives the complete arrangement and the belt used is simply a stout cord. This exhibit shows clearly how friction can be practically eliminated by the use of proper bearings. In addition to the above a varied line of pillow blocks, hangers, typical line shaft drive, etc., are displayed. The Tranco elevating truck equipped with ball bearings and made by this concern is shown, also a style of roller bearings particularly adopted to the front axle of Ford or Chevrolet cars. Mr. Murray, C. J. Hocken, or G. Cole will be pleased to have you call.

The International Nickel Co.

have a very complete exhibit in the process building. The best method of describing the booth would be to itemize the various articles shown. The uses of "Monel" metal are featured, the following applications being exhibited. A steam table as used in hotels, cafeterias, etc., with a monel top; a sterilizer, a meat slicer, milk dispenser, all equipped or trimmed with monel. Then there is a 6" crane gate valve for superheated steam that is trimmed with monel, also a valve cut through the center for demonstration purposes. Around the booth is shown some representative monel castings rough machined, and polished. There is also a display of polished monel sheet, and various sizes of monel rod, tubing, etc. Chains, cutlery, screening, wire, and other products made from this metal are shown. Various pieces of electroytic nickel are displayed, also some samples of nickel salts, nickel shot, anodes, welding rod, monel bells, welded tubing, etc. As one of the attendants pointed out to Cana-



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No. 56—4 ¼" Gridley.
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No. 307—100" C.M.C.
No. 310—72" Stirk.

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No. 313—2 ton Jib, 19ft. Boom.
No. 317—2 ton Jib, 22ft. Boom.
No. 523—3000 lb. Jib, 22ft. Boom.

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No. 166—Knight, No. 208.
No. 167—Herbert Single Spindle.
No. 168—Avey Drill Press.
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ELECTRICAL EQUIPMENT

No. 382—3 ton Heroult Electric Furnace.
No. 383—6 ton Heroult Electric Furnace.
No. 435—Armington & Sims 40 K.W. Steam Driven Generator.
No. 496—Swedish General Electric 375 K.V.A. Steam Driven Generator complete with exciter.
No. 494—Bruce Peebles 350 K.W. Motor Convertors.

STEAM ENGINES

No. 321—1000 H.P. International Rolling Mill Engine.
No. 353—350 H.P. Porter Allen Non-Condensing Engine.
No. 355—1000 H.P. Todd Reversing Rolling Mill Engine.

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No. 188—¼" to ½' Holroyd Fluting Machine.
No. 189—½" to 1" Holroyd Fluting Machine.
No. 190—1½" to 2" Holroyd Fluting Machine.

GRINDERS

No. 112—Walker No. 2 Double Stroke Surface Grinder.
No. 113—Walker 10" Single Surface Grinder.
No. 116—B. & S. Universal Cutter Grinder.
No. 122—B. & S. No. 2 Cutter Grinder.
No. 127—B. & S. No. 10 Plain Grinder.
No. 132—Heald No. 70 Boring Grinder.
No. 134—Rivet No. 3 Boring Grinder.
No. 135—Landis 16"x20" Grinder.
No. 136—Landis 12"x42" Plain Grinder.
No. 183 — Ford Smith Tool Grinder.
No. 191—Holroyd Grind Relieving Machine.
No. 197 — Armstrong Whitworth Thread Grinder.
No. 200—Wilmarth & Morman Drill Pointing Grinder.
No. 312—Ford Smith Duplex Tool Grinder.
No. 341—24" Wheel Swing Grinders.
No. 2014—36" dia. Sandstone.

STEAM HAMMERS

No. 335—3 ton Bertram Arch Frame.
No. 336—1 ton Massey Arch Frame.
No. 337—12 cwt. Massey Arch Frame.
No. 338—8 cwt. Massey Arch Frame.
No. 339—4 cwt. Massey Arch Frame.

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No. 16—16" x 4' 0" Centres Lodge and Shipley.
No. 17—16"x4' 0 Centres Reed Prentice.
No. 18—16' x 4' 0" Centres Lodge and Shipley.
No. 19—16" x 4' 0" Centres Reed Prentice.
No. 20—20" x 3' 6" Centres Reed Prentiece.
No. 21—14" x 5' 6" Centres C.M.C.
No. 22—14" x 3' 6" Centres C.M.C.
No. 31—3¼" No. 2 A Warner & Swasey Turret Lathe.
No. 33—No. 4 Cataract Bench Lathe.
No. 356—33" Brightside Roll Turning Lathe.
No. 30—14" Springfield Ideal.

MILLING MACHINES

No. 72—No. 0 Reinecher Miller.
No. 82—Cincinnati Plain Slabbing Miller Lincoln Type.
No. 83—Cincinnati Plain Miller, Lincoln Type.

PRESSES

No. 319—Morgan Hydraulic Stamping Press.
No. 328—Morgan 2000 ton Press.
No. 324—Morgan 1000 ton Press.
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No. 334—United Engineering 500 ton Press.
No. 469 — Morgan Centering Press.

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No. 208—A. W. Measuring Bench 10 1/10000″

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No. 332—Deane 2 7/8″ x 10″ Triplex Pump.
No. 333—Darling 5″ x 7″ x 10″ Pump.
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No. 417—10 ton Ladles, bottom pour.
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No. 427—5 ton Whiting Crane, 48 ft. Span.
No. 431—15 ton Whiting Crane, 72 ft. span.
No. 433—25 ton Wellman Seaver & Head Crane, 37′ 5″ span.
No. 460—5 ton Whiting Hand Operated.

MISCELLANEOUS

No. 79—Pratt & Whitney No. 11 Duplex Profiler.
No. 181—American Tool Co. Oil Separator.
No. 187—Noble & Westbrook Stamping Machine.
No. 194—Automatic Machine Co. Threading Machine.
No. 196—Hoefer Tap Threading Machine.
No. 199—Taylor & Hobsan Etching Machine.
No. 270—No 284 Tilghman & Brooksbank Sandblast.
No. 305—No. 2B Platt Reeling Machine.
No. 573—Brown Radiation Pyrometer.
No. 570—Brown Recording Pyrometer.
No. 574—Shore Scleroscope.
552—Acetylene Generator 25 cu. ft.
553—Marsh Deep Well Pump.
531—Set No. 1206 Johannson Precision Blocks.
No. 524 — O. H. Charging Boxes.
No. 462—15 Ton Track Scale, Fairbanks.
No. 466—Berlin Band Saw.
No. 447—Jeffrey Single Roll Crusher.
No. 436—Ingersoll Rand Air Compressor, 732 cu. ft.
No. 412—Newton Circular Cold Saw.
No. 394—American Clay Mixing Pan, 7 ft. dia.
No. 393—American Clay Auger Machine.
No. 371—Crosseley 20 in. Pug Mill.
No. 365—Betts Horizontal Boring Mill.
No. 358—Crosseley Coke Grinder.
No. 2021—Buffalo No. 200 Hand Blown Forge.
No. 2022 — Buffalo No. 2 Blower.
No. 2025—Valley City Duplex Tool Grinder.
No. 2027—B. & S. No. 2 Universal Angle Vise.
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No. 2061—No. 2 Portable Hand Pump type Hauck Burner.
No. 2063—Chicago Pneumatic "Little Giant" Improved Air Drill No. 2.

dian Machinery, "Monel" is not a precious material as some think, but is a commercial metal that can be rolled, drawn, welded, cast, forged, brazed, soldered, machined and spun. C. A. Richardson is in charge of this interesting exhibit and will have E. A. Turner and G. M. Crossgrave assisting him.

Over in the process building the

Canadian Hanson & Van-Winkle Co., Toronto

have a very interesting exhibit. A complete plating set is shown, this including a motor generator set. All fittings are included and the compactness of the set is very apparent. In various portions of the booth are racks showing anodes, polishing wheels, canvas wheels, brush wheels, industrial brushes, plating and polishing chemicals, etc. A cleaning barrel and tank are also included, and of course the "Royalite" cleaner is featured. Mr. Elder is in charge.

Messrs Peacock Bros., Ltd.

have a very varied line this year including Weir boiler feed pumps, Foxboro instruments, Aldrich Vertical triplex pump, Hopkinson valves, Richardson automatic scales, a line of instruments made by the Precision instrument Co., and an interesting display of steam traps, radiator traps, and temperature regulators made by the Darco Co., Inc. They also show the Merco Nordstrom non-sticking plug valve which is something new to this section of the country, a simplex valve reseating machine, a line of safety lamps, a miner's air pick, and other varied lines. This is a very complete exhibit, and Mr. Kudera will be pleased to answer any question put to him.

The Black Donald Graphite Co., Calabogie, Ont.

are showing a complete assortment of their line of graphite products.

The Dunlop Rubber Co., Toronto

show an interesting exhibit of rubber belting, fire hose, etc. An installation of a Gibraltar conveyor under power is shown, this consisting of a large rubber belt to which cast iron buckets are fastened. Fire hose, garden and industrial hose are also part of the exhibit.

The Toronto Hardware Mfg. Co., Toronto

are showing a varied line of hot water tanks, elbows and fittings. It is a representative exhibit of such lines and Mr. Ince or Miss Hannon will be on hand to meet visitors.

E. Pullman Wipers and Waste Co., Toronto

are showing a full line of wiper cloths, knenser kloths, and mop cloths. The latter are featured because they come to the customer in large pieces allowing them to be cut up as desired. They are also very soft and absorbent, two essential features in cloths of this nature. Competent officials are in charge ready to explain the uses of the various kinds of cloths.

The Wayne Forge & Machine Co., Toronto

who are agents for the General Alloys Co., Chicago, are showing a line of industrial furnaces, carbonizing boxes, heat treating appliances, firebricks, steam boilers, etc. Literature on all the exhibits is available, and Mr. S. Watson and Alfred L. Watson are in charge.

The W. R. Sexton Boiler Setting Co., Toronto

are showing their line of Elkco fire brick, this including special as well as standard shapes. They also are exhibiting their nonpareil dumping grate bars, together with a few boiler settings.

The Geo. W. Cole Co., Toronto

are showing a very complete exhibit of their various lines, these including a miniature installation, boiler feeders, condensor traps, return traps, receivers, swing check valves, pressure reducing valve, etc. They also show a Kitt's pot trap, and a Kitt's pressure reducing valve. The exhibit is well arranged and G. E. Cole and J. E. Farrell will be in attendance.

Baines & David, Ltd., Toronto

are exhibiting all kinds of iron and steels, these being in the form of sheets, bars, etc. They are featuring the "Mowbray" line of tool steel, this being made in Sheffield, and they have a bar of 7" diameter material on exhibition as well as smaller stock in various forms. They are also showing their universal stair tread which is said to be non-slipping. J. S. Morrison and W. Jefferson will be in charge.

The D. K. McLaren Co.

have an interesting exhibit showing single and double belting and supplies for the textile trade in general. The belts include waterproof leather, balata, etc., and an interesting installation of two belts running through water is shown. Split pulleys, belt dressing, belt fasteners and other accessories are included. This booth is featuring a very neat case which contains a collection of card clothing belts for woollen and worsted carding. These show the different size and style used in the various operations and over 30 samples are shown. This in itself is worth inspection and W. S. Hamilton, who is in charge of the exhibit invites anyone interested.

Peckover Ltd., Toronto

are displaying a complete line of steel, including metal lath, plates, hoop steel, reinforcing sheets, bars, structural sheets, boiler tubes, and tool sheets. They also show the Feralum and Vulcanum slip roof tread. They are featuring the metal lath of which a great amount is being sold according to H. J. Peckover, and H. Raine who are in charge of the engineering dept of this booth. R. C. Peckover, J. G. Near and G. Jolly will be in attendance at the other section of the exhibit.

The Dominion Belting Co.

are showing a complete line of conveyor and transmission belting. This is the well-known Maple leaf cotton stitch belting. Belt fasteners, belt dressing and other supplies are also displayed E. Kinrade is in charge.

The National Electro Products

are showing a varied exhibit of their Hydrogen and Acetylene tanks, also a complete line of welding and cutting apparatus, supplies for same and so forth. A model sectional view of an acetylene cylinder is shown, also a portable oxy-acetylene outfit, together with a portable Hydrogen cutting outfit. A carbon removing outfit also a lead burning equipment are displayed. Mr. Burns and Mr. Copeland will be at the booth and demonstrations will be given upon request.

Canadian Atlas Crucible Steel Co.

have a good exhibit showing their line of tool steels in various forms. The steel is shown in bar form, also as used for axes, cant hooks, reamers, drills, milling cutters, dies, cutlery, auger bits, chisels, etc, etc. Mr. Ley, Mr. Rundle and Mr. Fraser are in charge.

The Clipper Belt Lacing Co.

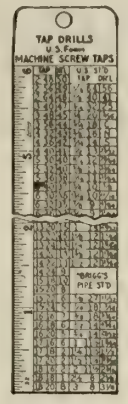
have a neat exhibit showing the many applications of their well known product. Mr. Logan is in charge of this booth and claims he is ready to meet all comers.

SOMETHING NEW IN WINDMILLS.

Many attempts have been made to solve the problem of efficiently utilizing the winds as a means of generating electricity. The difficulties arise from the extreme variations in the force of the wind and from the liability, even in windy regions, to periods of calm during which no power at all can be obtained. These conditions suggest that wind power should be used only as an auxiliary to some other source of energy, such as the burning of coal or oil. Now that fuel of all sorts has multiplied in price there is all the more reason for considering the possibility of turning the wind to account. Hitherto the usual plan has been to use a large slow-speed windmill to drive a dynamo at a high speed through gearing—a rather wasteful arrangement. During the war, however, there was in Great Britain a remarkable development in the design and construction of small high-speed dynamos on aeroplanes. These dynamos were direct-coupled to propellers or rather "impellers," driven by the wind created by the aeroplane in flight. A British firm has devised a scheme for fitting three or more of these wind-dynamos on the swivelling top of a vertical pole; with a vane to keep them in position against the wind. Each equipment gives 60 watts, and the arrangement forms a cheap and efficient auxiliary to the ordinary country-house lighting installation. The energy produced is, of course, stored in accumulators in the usual way. The operation of the plant is entirely automatic and it is so light and simple that it presents no obstacles in erection and maintenance.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

The contest page for August 11th issue was set up, yet by some mysterious process it got mixed in with the material for another paper, and for the time being was lost. When found, it was too late for use as the issue had gone to press. For this reason we will award two scales to the winners of the August 18th contest.

CONTESTS FOR SEPTEMBER 1st ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—A case where a hammer only is used.
2—Something that grows larger every year.
3—A product with hand or power feed.
4—Something that was thoroughly investigated.
5—How to get away from continual attention.
6—Something to watch for.
7—A product that can be secured throughout the world.
8—What to do if your regular business is dull.
9—Something that is portable.
10—How to avoid trouble.
11—Something that is accurate and easily operated.
12—A difference of importance.

By an accident, the contest page for August 11th issue was omitted, so that no comments are necessary in this panel.

Closing Date for This Contest is Sept. 22nd



WHAT OUR READERS THINK AND DO



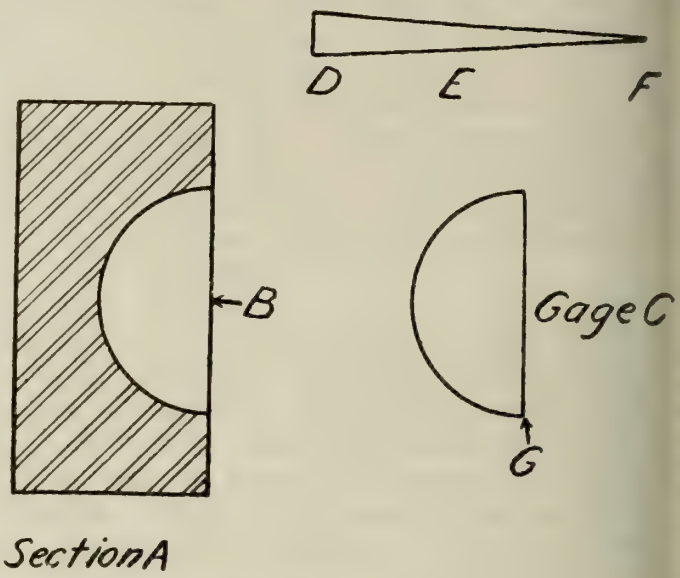
TWO STYLES OF CHUCKS

By J. Homewood

The two chucks shown, illustrate where the principle of the wedge plays an important part. The interior chuck is used on internally threaded work that is faced and requires another operation, requiring another setting to complete the piece. In order to do this operation on a solid arbor, where the face of the work would bind against the shoulder, the amount of effort necessary to remove the work after it is finished invariably results in damage as well as delay. The spindle (a) is hardened on the wearing end, in this case the threaded end; the sleeve (b) is also hardened on the face that bears against the work and ground in position. The taper pin (c) is driven to the tight position before the piece is screwed up to it. Upon the completion of the work the taper pin is slightly tapped to loosen it and the piece of work will be easily removed. The small pin retains the larger one.

The Exterior chuck is used on work that has been threaded on the outside and which also requires another operation to be performed and maintaining accurate relation to the first. The principle of this chuck is identical with that of the interior chuck, the loosening of the taper wedge releasing the thrust against the two faces of the work and the chuck.

The U. S. Light & Heat Ltd., has been incorporated to manufacture machinery, tools, etc., for generating light, heat, power, etc. The capital stock is placed at $40,000.



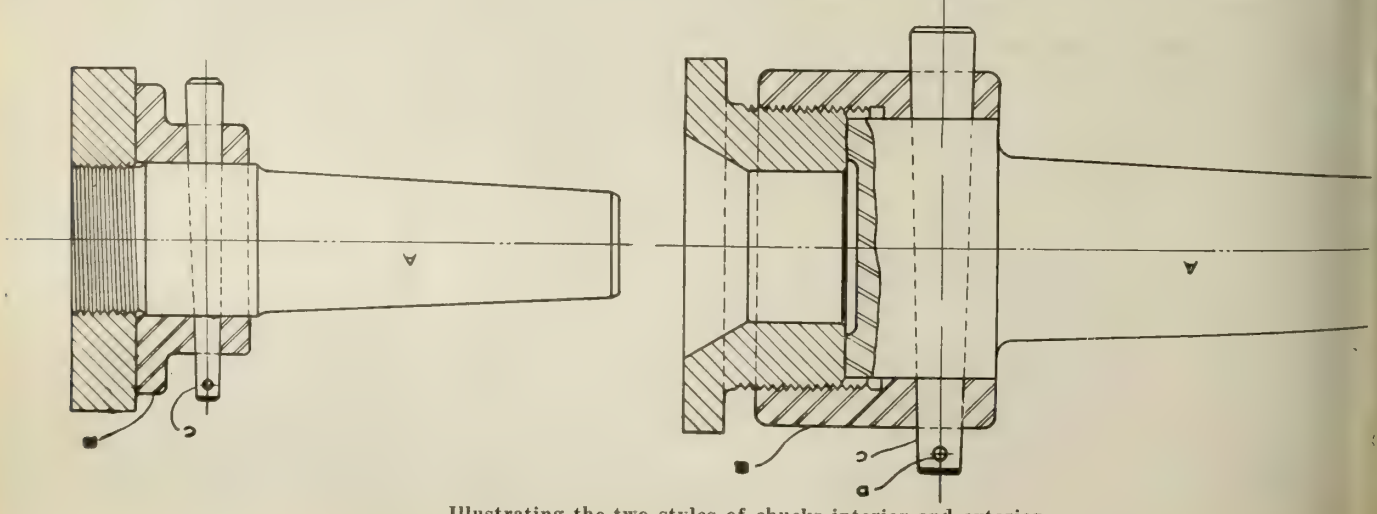
Showing how the radius was turned.

TURNING A RADIUS

By G. RUSSELL

A few weeks ago a job came into the shop to cut out a piece of steel shown in cross section A. The lathe was the only place available, so to save time in making a forming tool we used the following method. The work being roughed out in the usual manner we clamped the gauge C to the tail stock spindle taking care to have its centre. Using an ordinary boring tool and finding a piece of thin metal as shown at E we clamped the one end D in the tool post, setting the boring tool until it touched the point B. Then, bending the piece of metal until the point F just touched the gaug at G, we started the machine wih slow longitudinal feed, and worked th cross feed by hand keeping the point just touching the gauge all around t the centre line. This we repeated unt the job was to size, taking the hig spots off with a scraper. By this mear the work was finished in almost the tim it would have taken to make the formin tool.

Yukon and Federal authorities a carrying on investigations regarding tl construction of a 500 mile road fro Camp Mayo to Fort Norman.



Illustrating the two styles of chucks interior and exterior.



ROUTING THE WORK

THE up-to-date plant gives special attention to routing work. For example, F. L. Prentiss in a recent issue of "Iron Age" says that in a new plant at Youngstown, devoted to pressed steel work, everything has been planned for handling a large volume of material and handling it rapidly.

Tunnels under the press shop floors for handling both products and scrap reduce the amount of trucking on the floors of the shop by one-half, and congestion around the presses is avoided. As a general rule, the movement of material on the press shop floor is in a forward direction and the back-tracking will be done in the tunnels. There are five buildings, these consisting of a receiving building extending the length of the plant with four parallel connecting manufacturing buildings at right angles to the receiving building, and connected with it. The maintenance department, including the machine shop, tool room, die storage room, millwright department, and the factory offices, are centrally located in the open hollow square formed by the five main buildings.

Two tunnels are located under the heavy press shop, one directly in front of each line of heavy presses. An opening is provided in each press foundation which forms a recess in the tunnel, and in these recesses tote boxes are placed for handling parts or scraps which drop from the press. Hand or storage battery elevating platform trucks will handle these tote boxes to the press room floor and deposit them beside the press for the next operation, or will take them through the tunnel to the pickling department, which is located in the central court. Two elevators connect the tunnel with the press shop floor.

RECOGNIZING MERIT

Speaking on the subject of "Foremen," Wm. A. Ahern, says in "Industrial Management," that the qualifications of a foreman in a machine shop are three: knowledge of his trade; ability to route work and keep it moving; and ability to get along with his help so as to keep up production while keeping down labor turnover, the thing which is so costly to the factory through the necessity of continually breaking in new men who are not producers until after an unprofitable period of weeks or months.

"Notice that the second point calls for production" continues the writer, and that it does not specify that the foreman shall get his production by any one method; the method he chooses is up to him; and the third point likewise calls for getting along with his men, and does not specify any limitation as to how he shall get along with them. Perhaps he is not the kind of a chap who holds out his hand in greeting and slaps the new man on the back and tells him funny stories like a salesman,—that is only one method of getting along with men and it would not always work in a machine shop. What men want is results to themselves,,—they want things, conditions and advancements, not words or "bull." If you can give them the things without the words so much the better; that is one way of getting along with them, with an efficient use of speech. The best foreman I ever knew was a Bohemian who seldom said a word in the shop, partly because he talked with an accent. The time he might have otherwise used in talking he turned over to his brains and used them in thinking. And this is how he worked:

When you as a new employee first came in to the shop he heard your story as to what you could do, looked you over, looked through you, and then gave you a piece of work which had certain processes of more or less difficulty. Then he forgot all about you until you brought the finished work to him. He looked it over; measured it. If it was extremely bad he would say, without any expression on his face: "That is not very good." Then for your next job he would set you roughing out about three-quarters of the stock on a casting for a jig,—something that would not delight the heart of a mechanic.

If you brought him a finished piece that was fairly true to dimension but had a scratch on the surface, he would say nothing. But he would give you for your next job filing burrs from an endless multitude of milled pieces to teach you the value of smoothness. Suppose the job he gave you was well done. Then he wouldn't say anything either; but your next job would be a little bit more difficult and of a little finer grade of work. This is what a mechanic wants. If he is an old hand at the business he wants to have his skill recognized by having you depend upon it for a higher class of work. If he is a new man or an apprentice he likes to have the opportunity to do better and better work so that he will learn all the quicker. So every man went away from that foreman bench knowing that his accomplishme had been recognized, though the forema hadn't said a word.

INTERESTING DISCOVERY.

Great interest was caused recently London by a demonstration, given b fore the Institution of Electrical Engi eers, of a strange phenomenon alleg to be absolutely new to science. Wh an electric current is passed throu a half-conducting material, such as thographic stone, in close contact wi a metal, the metal and the stone sti together with a force which is out proportion to the strength of the cu rent passing from one to the other. T demonstrators, who came from Sca dinavia, showed how this phenomen could be applied in making a lou speaking telephone. By its help th made a violin reproduce music play in a distant room and "speak" wor spoken into a distant telephone tran mitter. The demonstration was, ho ever, followed by proof that the phen menon had been discovered many yea before in Great Britain and its applic tion to telephony had actually been d scribed before learned societies and in popular encyclopedia. The discovery Scandinavia was therefore a re-disco ery and the incident suggests that t past records of British research and i vention may contain more hidden iter capable of practical development in t light of the fuller knowledge now ava able.

REASONS FOR HEAT TREATING.

There are two reasons for heat-trea ing cast iron. The first is for the pu pose of breaking down the intern stresses that exist in the casting. accomplish this the casting is heated to 550° C., and kept at that temper ture for several hours. The exact tin necessary depends on the thickness the casting. The operation is oft practiced on pieces to be partly machi ed such as gas-engine cylinders, etc. T castings are placed in either a cast-ir or steel box, and lightly dusted ov with powdered coke or charcoal. T box is then firmly closed and careful luted up with fireclay. The purpose the second method is for softening t metal, especially castings of thin se tion which are liable to be chilled. F arriving at this result it is necessary carry the heating of the piece up 850° C. for one or two hours.—"Fo derie Moderne."



DEVELOPMENTS IN SHOP EQUIPMENT



SMALL ELECTRIC WELDER

Buckly, Saunders & Co., 8 Prince's St. Westminster, England, have placed on their own market a portable welding machine. The apparatus consists of two main parts—the welding machine proper, and a controller which contains mechanism to regulate automatically the stages of a welding operation. The tool includes two electro magnets, which enable it to cling tightly to a body of iron or steel and do its work on it in any position. Between the magnets is a chuck, operated by a solenoid, to hold a stud or other circular object which is to be welded on. A third adjustable leg is provided to steady the tool on a curved or irregular surface. When a stud has to be welded to a plate the tool is merely pressed against the last, and a switch closed to bring the magnets into action. A spring pushes the stud hard against the plate, so that when welding current is turned on the circuit is complete. A solenoid, acting against the spring, withdraws the stud and strikes the arc between it and the plate. At the end of a sufficiently long period the solenoid is short-circuited and the spring presses the glowing end of the stud against the plate with sufficient force to ensure a weld. The controller mechanism regulates the time during which the arc is in play, and the operator's part is limited to closing the switch and so bringing into action the clockwork which, by means of cams and subsidiary contacts, ensures that certain things happen in a certain order. The "timing" of the weld can be adjusted beforehand to suit the particular job.

DOUBLE SEAMING MACHINE.

The Niagara Machine & Tool Works, Buffalo, N.Y., have placed on the market a machine for double-seaming simultaneously both ends of sheet-steel barrels or drums. The machine is handled by only one man. It is capable of seaming barrels from 18 to 36 in. in diameter and from 20 to 45 in. in height and made of No. 12 gauge or lighter steel.

When operating the machine, the barrel, with the heads in place ready for seaming, is rolled in on runways onto the horizontal bars. The barrel is located on the supports by stops, and is raised in line with the chucks by means of a treadle. The column is then moved into position by the hydraulic cylinder, which is operated by means of a hand lever. The pressure thus exerted clamps the barrel between the two chucks, forces the heads into their proper position, and holds the body while the seaming operation is being performed.

The seaming operation is started by means of a hand lever which releases a positive instantaneous clutch and sets two camshafts into motion. The curling rolls are automatically brought down to the work, and curl the seams. These rolls then recede, and the flattening or finishing rolls move into position and finish the seams. The machine makes a predetermined number of revolutions, to allow sufficient time for the proper performance o f the work. Only about forty revolutions of the barrel are required to complete the seams.

WELDING MACHINE

The American Electric Fusion Corporation, Chicago, Ill., have marketed a vertical spot welding machine.This type of welder is built in four sizes, and the nominal throat sizes are 11, 24, 36, and 48 in. In each case however, the actual throat depth exceeds by about 8 in. the size stated. The column is of box-form and incloses all high-voltage parts of the electrical mechanism, including the switches. The lower horn support is a box-form casting that slides on ways bolted to the front of the column. The upper head is so constructed that it may be completely turned around. The welding points are copper die-castings.

SQUARE AND BEVEL GAUGE

A combination die square and bevel gauge for the laying out of tapers and angles on dies and similar work, has been placed on the market by the Scalbom Manufacturing Company of Chicago, Ill. The body of the tool is held against the work while the blade is swiveled to the desired angle. The blade is clamped in position by means of a locknut. All parts are of steel and hardened, the blades being provided in various thicknesses.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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T. H. FENNER, Associate Editor
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A Regrettable Incident

FROM causes yet unknown the British airship R-38, which had been christened ZR-2, before her inclusion in Amer- air fleet, broke in two while flying over Hull, England, ugust 24th. The machine was on a trial flight before be- anded over to the American crew, who were to have nav- ed her across the Atlantic. There is no need to go into letails of the trial trip for all this has been carefully re- d in the various newspapers.

e chief point of interest to aeronautical engineers, is Vat Caused the Disaster?" Some hint at faulty construc- of the steel work; others claim that fire occurred; while again content themselves with commenting upon the handling of the ship, even after the accident occurred. vestigation will no doubt be held, and from the import- of the event, it is likely to be a thorough one. It is to ped that a correct solution of the cause of the disaster will rived at so that another dirigible of like proportions can ilt which will successfully accomplish what the ill-fated ner of the ZR-2 hoped for.

hen we consider the proportions of the dirigible which has been destroyed we cannot but marvel at the rapid strides h have been made in this branch of aeronautics. The th of the ZR-2 was 695 ft. or 50 ft. longer than the R-34. s apacity was 2,700,000 cubic ft., and if altered for com- al purposes it was capable of handling 50 tons. It had a h of 2,100 having six engines of 250 h.p. each. It was le of a cruise of 6,000 miles, and if it had come up to the ner's hopes, it could have carried 40 passengers and two f freight in a non stop flight from England to Egypt in rs. A radio set was installed, having a sending radius 0 miles, also a wireless telephone set. The armament ted of fourteen Lewis guns, one 1-pound automatic gun, 20 pound bombs, and eight 230 pound bombs.

e years ago the airships then in vogue were considered s. but in comparison with a ship such as the ZR-2, they e the small tug boat alongside of the huge liner Levia- An airship in the earlier days was practically at the of every wind, and had no means of knowing when a was approaching. To-day, however, with wireless at h stage of development a ship such as the ZR-2 can hear approaching storm, and in fact this ship did receive of such a storm on her trial trip. The crew can also nicate with those on land, reporting progress, etc., etc. pite of this accident, which will create a stir all over the l the leaders in the movement for larger and safer dirig- ust not falter. The loss of life is much to be regretted, story is merely repeating itself, for science will always d the sacrifice of many lives before an invention of this an be perfected. Those who perished on the ZR-2 will own in the pages of history as heroes and pioneers who rying to accomplish something greater than had been o attempted.

Signs Of A Revival

THE news from the various freight markets of the world show that there is at last some signs of that revival in the shipping trade, that has been earnestly looked for. This follows the resumption of work by the coal miners in Great Britain, and the progress of the price of this fundamental necessity to industry to more reasonable levels. Shipowners are once more enabled to send their vessels on long voyages in ballast, to bring return cargoes home, without the whole revenue of the voyage being eaten up in fuel costs. However, the price of coal has not yet reached the level where it can be exported to any great extent, and the fact that European countries have on hand large stocks of American coal that were shipped during the strike also militates against export of British coal for the time being. This will adjust itself in time, and there is little fear of American competition in this trade once conditions are normal. Another faint hope arises, in contemplating the appalling condition of Russia, that the powers there will be at last convinced that their effort towards a Communistic state has proved abortive, and that agriculture and industry may once more be resumed in that tortured land.



"Hold tight. You'll go up in a short time." Some good advice to the business world from Racey.



MARKET DEVELOPMENTS



The Hopeful Feeling Continues in the Market

Although Business Cannot be Said to be Rushing There is a Decided Spirit of Optomism Existing—Several Reductions in Prices Have Been Made.

THE market situation continues to improve. The movement may be somewhat slow but nevertheless it is there and is getting better as time goes on. Although the past week has shown a slight slackening off in the demand upon the steel mills, there is nothing in general business that would reflect unfavorably in the steel industry. It looks as if the winding up of the regular vacation period is responsible for the change.

The Toronto market shows several reductions this week. Chain blocks are down 12½ per cent; galvanized sheets have been reduced $8 per ton and where a large order is in sight, machine tool manufacturers will shave their schedule prices to the dealer so that he can close the business. One tool manufacturer has announced a further reduction in prices of its machines.

Tubes are moving at nice speed, also metal lath. Re ir work in the former case, and building activities in the la r are said to be responsible for the spurt. Scrap metal rem is at the bottom of the heap. There is nothing being done i the prospect for future business is none too good.

The situation in Montreal is improved over last w k. Activity along the harbor is very marked and railroads re t an increase in the movement of freight. A gradual impr - ment is looked for from now on. Building seems to be pic g up one job costing nearly $500,000. Machine tools are y dull—dealers and manufacturers preferring to quote on l orders, rather than abide by a general price list. The pig n situation in this market also seems to be improving.

SHEETS TAKE A SUDDEN DROP PIG IRON PRICES STILL ADVANCING

PITTSBURGH, Sept. 1.—Demand for steel mill products, on the whole, has decreased in the past week or ten days, after fully a month of continuous though slow improvement. There is no particular reason for the backset, unless it is due merely to the winding up of the regular vacation season. It is a fact that the steel market has usually been particularly dull in the last fortnight of August, the explanation commonly given having been that vacations were running especially strong.

Certainly there is nothing in general business that would reflect unfavorably in the steel industry. General business may not have improved much, but it probably has improved some, and it certainly has not grown worse. Nor can it be thought that steel buyers overbought recently, for all the buying was plainly for the purpose of supplying immediate necessities. Nor, again, can it be said that buyers of steels have lost any "confidence." They never had any confidence. They were buying, not because they had confidence, but because they absolutely required the steel in order to stay in business.

September may be confidently expected to bring an increase in buying, though not a great deal is expected. The present state of general business ought in the long run to give the steel mills an operation of 30 to 40 per cent., this to increase whenever general business improves, when the railroads get in position to buy and when there is freer inception of investment projects involving construction. The last named things are not expected this year, February or March being the expected time for such additional improvement.

The steel mills have been operating at about 25 per cent. of capacity in the past couple of weeks, this comparing with a rate just under 20 per cent. at the middle of July. While buying has been a trifle slacker in the past ten days mill operations are not likely to decrease, at least by a noticeable amount.

Steel Prices.

In the matter of prices of finished steel products, sheets took the centre of the stage in the past week, owing to there being a clear cut decline. Steel prices in general have been showing no more than a slight downward trend in the past few weeks, and the definite decline in sheets was due to two things, that there was a demand sufficient to cause sharp price competition, and that sheets have always been a particularly competitive commodity, due partly to there being so many sellers, and partly to the peculiar personality of some of these sellers. The history of the sheet decline is somewhat interesting. By A ust 1 the regular market had go n down to 3.00c for black and 4.00c galvanized. In the early part of Aug t these prices were being shaded by a few mills in the case of especially sirable orders, but the general ma held at 3.00c and 4.00c. Just after middle of August a Wheeling dist producer began openly quoting 2.75c 3.75c, equal to a cut of $5 a ton. F other independents promptly follo suit, and then the Steel Corporation duced its prices. Judge Gary mad public statement on the subject, rei ating that when important indep ents cut prices the Steel Corpora follows, but that the corporation n takes the lead or originates redu prices. The new prices for sheets probably below the cost of produc to the average mill even if the mill w given a moderately full operation. the other hand, bars at 1.75c and sha and plates at 1.80c, which are g prices now, would give a mill a li profit, perhaps a fair profit, if it full operation. With operations of to 30 per cent. all steel prices t days are below cost.

It is plain that there is still m liquidation to be effected among ma facturing consumers of steel. Th are still stocks of manufactured go to be distributed, but the stocks of s are in most cases down to a low po The agricultural implement industry

particular has large stocks of finished goods, but these are expected to move now, as farmers are realizing on crops and the crops were raised at a very low cost. The implement trade furnishes a particularly strong illustration of the reason for demand on the steel mills being so light at this time, for in normal years the new manufacturing season with the implement trade begins about August 1, whereas this year the implement factories have not even bought steel to any extent.

The advance in pig iron prices is really beginning to amount to something. The Chicago district sellers are up to $20, furnace, having made their lowest sales at $18, some two or three weeks ago. Buffalo is up $1 a ton. Eastern Pennsylvania shows no improvement in prices thus far. In the Pittsburgh valley market there is an advance in basic and a slight advance in foundry iron. Basic had gotten down to $18, valley, equal at $19.96, Pittsburgh. Then all, or nearly all, the sellers concluded that they would ask $20 furnace on the next inquiries. This did not work out altogether, but a 2,000 ton transaction has just gone through in which the buyer, a steel interest in the immediate Pittsburgh district, paid $20.96, delivered, equal to $19 f.o.b. valley furnace. The seller had less than the valley freight to make the delivery, and thus realized more than $19 at furnace. Foundry iron is quotable at $20, valley, or a 50-cent advance. Bessemer remains at $20, valley, and a 300-ton sale was made in the last few days at this figure.

Demand for coke has been looking up in the past two or three weeks, as here and there a furnace has occasion to resume operations, chiefly on account of depletion of stocks, rather than on account of increased demand. The Connellsville coke industry is not getting much out of the improved demand, however, the reason being that by-product coke stands in the way. On account of the value of the gas and other by-products, a by-product plant can pay for coal a better price than the Connellsville operator realizes for the coal when sold in the form of coke, and still undersell Connellsville on the coke. Connellsville furnace coke is not over $3.00 per net ton at ovens, and 1½ tons of coal are required for a ton of coke. At $2 cents to cover the actual cost of coking, the operator would be getting $1.50 a ton for the coal, yet by-product plants pay $1.80 and even higher for Connellsville coal.

Apart from this, there are some piles of by-product coke that have to be liquidated, the coke being accumulated partly because it was considered injurious to let the retorts grow cold and partly because coke manufacture had to be continued to supply gas, either to municipalities or to attached steel works. The Connellsville market for spot or prompt shipment is quotable at $2.90 to $3.00 for furnace and at $4.00 to $4.50 for foundry, as for several weeks past.

POINTS IN WEEK'S MARKETING NOTES

The Exhibition seems to be responsible for an increase in business in some directions, particularly in the outfitting of exhibiting booths.

Some of the larger machine tool manufacturers have announced new prices during the last few weeks, some varying from 10 to 15 per cent.. Chain blocks are down 12½ per cent.

On a large order for machine tools there is a tendency to get away from a fixed schedule. Business is what is wanted and makers of machines are only too anxious to close the order. Small tools are still moving slowly.

A reduction in galvanized sheets is announced this week, the amount being about $8 per ton. Tubes are moving very well and metal lath is selling pretty fast.

The scrap situation is still in bad shape. Nobody seems to want to buy, and dealers have no room to put in further stocks. At present there is no sign of any quick recovery.

Pig iron has stiffened somewhat in price, especially in Pittsburgh. The demand for coke is looking up as here and there a new furnace is being blown in.

An increase in buying is looked for next month although the amount of extra business looked for is not sensational.

The tendency of some manufacturers to demand an allowance for their old equipment when buying new machines is causing some concern among dealers. One dealer claims he is handling second-hand tools for the first time in his experience.

P. E. Thring, formerly manager of Canadian Fairbanks Supply Dept., has been appointed sales manager by the Bond Engineering Works, Toronto, who are manufacturers of power transmission specialties.

* * *

Mr. Carter of the Carter Welding Co., Toronto, is in Chicago at present visiting the firm of Bastien & Blessing. The latter concern make the line of "Rigo" torches, etc., which Mr. Carter's Co. handles in Canada.

Extending Machine Shop. — The Springer Lock Co., of Belleville, are making an addition to their premises. The new quarters will be used for a machine shop, the building being 49 x 87 and two storeys high. Just now the firm is completing the installation of a large automatic press. Operations are being carried on at full speed, and so far there has been no lost time at this plant.

BETTER BUSINESS REPORTED IN TORONTO

TORONTO—Although not claiming that they are experiencing anything in the nature of a permanent revival in business, there are firms in the iron, steel and machine tool market that report better business than they have been experiencing for some months past. The coming of the Toronto Exhibition may have something to do with this state of affairs, for some of the firms pick up a lot of business out of that event, particularly in the outfitting of exhibits and putting up temporary alterations and additions.

Machine tool dealers are not getting much business, but a number of them report that their list of prospects is improving, and some of them are moving in the right direction.

There seems to be an increasing tendency on the part of many of the buyers to insist on the dealer taking some old equipment in part payment for new machinery. One dealer speaking of this tendency remarked to this paper: "It is a long time since we have had much experience in this line, and we prefer to do nothing but sell new tools. In a market such as we are going through just now it is almost necessary to depart from hard and fast rules, and do something to get the buyer into the market. It's an easy matter to get your warehouse filled up with old material in this way, and a person has to move carefully." There are some very fair orders in the market for equipment for the new technical school in Toronto.

Some of the larger makers of machine tools have announced new prices in the last few weeks, some of them varying from ten to fifteen per cent. In several cases the second, and sometimes the third reduction has been made from the prices that were prevailing at the close of the war. An estimate would place the reduction at between thirty and forty per cent. from the peak prices.

Schedules Not Adamant

"There is one thing that will tempt most of them just now," remarked one Toronto dealer," and that is a good-sized order. We had an enquiry not very long ago that would have run into a nice battery of machines of a certain type. We put the matter up to the makers, stating that we were particularly anxious to secure this business. The result was that we got a figure that was 25 and 15 off. Buyers should remember that they can buy to pretty fair advantage right now, and get all sorts of service along with their purchase."

A reduction of 12½ per cent. is also announced in chain blocks.

Small tools are moving slowly. Dealers claim that orders are costing them more to handle on account of their smallness. Renewed efforts are being made by makers and dealers alike to "dig up" anything that looks like an order, and a number of new men have been put on the road with this end in view. Prices remain the same, although

some of the larger buyers are getting pretty fair discounts that the average order does not carry with it.

Steel Market Brighter

The steel market has made a good month out of August—in fact it is one of the best months that has been experienced for quite a while. One firm stated that their business for the month would be at least twice that of any other month this year, and that they would have some money to the good out of the trading they had done during August.

A reduction in galvanized sheets is announced this week, amounting to $8 per ton. Sheets of all kinds are moving out very well, most of the activity of the steel market centreing around these and bar mill material. Dealers are still buying very closely, and none of them seem to be ready to put material in for stock yet. They are still able to secure excellent delivery direct from the mills to their customers, and as long as the mills are in shape to do this the dealer is not apt to stock up, and take the added risk of a fluctuating market.

Tubes have been moving more freely during the week, and no doubt some of this movement can be attributed to the lower price schedule which was announced a few days ago. It is expected that tube business will be better this fall than for some time past. Stocks generally are fairly heavy in tubes, and most of the orders are being filled direct from these. There is an anxiety on the part of a good many of the warehouses to get cleared out of tubes before the market gets below the point where they can get their money out. Bars for building purposes and metal lath are reported as being a very fair sale now, indicating that considerable building is under way now.

The Scrap Business.

The scrap metal dealers are neither buying nor selling. There is some little business to be had, but the big accounts that move stuff out in a hurry are not to be had. One of the steel companies opened up a couple more open hearths during the week, but their yard is full hand to last them for a good many of scrap and they have enough on months to come. There are some small accounts that might be secured now, but the average dealer prefers to do business with known firms, especially this season.

A look through one of the largest scrap warehouses in Canada reveals the fact that the place is packed with almost every line of material that with almost every line of material that could well come within the scope of the scrap metal trade. This firm at the beginning of the year wrote off a clean half million depreciation, and they are none too sure that they are out of the bush yet on this point. Every conceivable line is represented in the million of dollars worth of material that is stored under the roof. It would be possible, if the firm wished, to go out and buy more material now at greatly reduced prices, as compared to those paid some time ago, but there is no place left to store the material, and the absence of any market standards makes buyers very careful of any moves they may be considering. Scrap dealers are none too hopeful for the immediate future, claiming that signs are against any quick recovery.

MONTREAL MARKET IS BETTER RAILWAYS HAVE INCREASE IN FREIGHT

MONTREAL, Sept. 1st.—The volume of business moving generally this week is rather small, but at the same time is a distinct improvement over any one week's business for the last few months. Activity along the harbor front is very marked as there is a large amount of outbound freight, principally grain. Railways report an increase in the movement of freight. Many business men feel that this week is only the beginning of a gradual improvement in all lines of business. Conditions generally are however, too unsettled to permit of any but a gradual improvement, if the improvement is to be permanent. No very large purchases are reported but there seems to be a sufficient amount of business in small lots, to enable many plants to keep operating.

The Canadian Car and Foundry Co. are handling a number of small orders which enables them to employ a fair number of men. The Atlas Construction Co. are commencing work immediately on a new low level pumping station and expect to employ local labor as far as possible. The Molson Breweries are erecting a new 200-ft. smokestack and are rearranging steam boilers. There are many such jobs in progress which in the aggregate provide employment for a large number.

Building Improving

Building seems to be reviving a little from its "siesta" of the last few years. Probably the largest jobs in Montreal and vicinity are the new Low Level Pumping Station at Point St. Charles, which is to cost nearly $500,000.00, and the Canada Cement Co. Bldg., the latter requiring over 900 tons of structure steel.

One firm reports orders on the books of 90,000 tons of rails for the National Railways and C.P.R.

Bar stock is moving slowly, very little British steel being imported. Price of steel is hardly stable yet. Most firms prefer to quote on all work. Base price of steel varies from 3c to 3½c. There is very little call for steel sheets. On the whole business is satisfactory. Steel being produced at present yields a \profit at prevailing prices, but old stocks produced before the present levels of labor and material are being disposed of at a loss.

Machine Tools

Generally speaking the trade is very dull. Some small orders from the smaller firms are coming through. Remanufactured and second hand tools are moving slowly. There is a small but steady demand for small tools and supplies. Dealers and manufacturers prefer to quote on all orders rather than give general price lists.

Present prices are in some instances below pre-war prices, yet even this does not stimulate business. Some weeks ago dealers, jobbers and manufacturers thought the bottom price level had been reached and buying improved. However, still further reductions have occurred and many have lost faith in the market. Very little copper is ever consumed. It always seems to reappear as scrap and the result, under present conditions, is that little or no copper is being mined or refined. All business along these lines is being done on the hand to mouth method.

Pig Iron

Foundries seem to be coming into the market again. One firm reports more pig iron sold this week than they have sold for any one month in the last ten. Even this however, does not indicate anything like a really capacity business. Prices have risen slightly, in the last few days. On the whole there is a marked improvement in all lines of business and there is every reason to believe this gradual improvement will continue.

BETTER REPORTS NOW IN WELLAND

Several Industries There Expect to Resume Normal Operations In Very Near Future.

Welland.—Industries are picking up here lately. Next week the Page-Hersey Co., which has been for some months running five days a week, will return to the six-day week. A M. Mosley, general manager, says the appreciable advance in orders has warranted taking this step. He thinks it will not be long till his firm is running a double shift.

Last week the Empire Cotton Mills put on a night staff, mainly owing to the efforts of J. D. Payne, general manager, who has succeeded in securing large orders.

The Standard Steel Construction Co., which has a plant at Port Robinson, has resumed full-time operation, and there is an indication of general revival in business which will exceed that of pre-war times.

According to an Australian dispatch, the states of Victoria and New South Wales, Australia, are each sending a deputation of four railway officials to North America to study railway operation.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Basic, Pittsburgh	21 00
Basic Valley furnace	26 00
Toronto price:—	
Basic, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Merchants, base, Toronto	$ 3 50
Reinforcing bars, base, Toronto	3 50
Merchants, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Sheet steel, No. 10 gauge and 3-16 base	4 00
Chequered floor plate 3-16 and heavier	6 00
Crane rails, heavy, at mill	2 35
Angle bars, Pittsburgh	2 10
Tank plates, Pittsburgh	2 20
Structural shapes, Pittsburgh	2 20
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Angle bars	3 48
Structural shapes	3 58
Plate	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Hamilton	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electrolytic copper	17 00	17 50
Casting copper	16 75	18 00
Spelter	33 00	39 00
Spelter	7 00	7 50
Antimony	6 25	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$5 00	$3 90
Plates, ¼ up	4 50	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 20%.

Standard couplings, 4-in. and under, 20%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 50	$ 9 00
Copper, crucible	11 00	11 00
Copper, heavy	10 50	11 00
Copper wire	11 00	11 00
No. 1 machine composition	9 50	9 75
New brass cuttings	6 00	8 00
Red brass turnings	8 00	8 00
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	45
Can. carbon cutters, plus	10
Standard drills, all sizes	45
3-fluted drills, plus	10
Jobbers' and letter sizes	45
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	10 to 15 off
Can. high speed cutters, net to plus 10	
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$6 75	$5 25
Sheets, blue ann., No. 10	8 25	4 25
Canada plates, dull, 52 sheets	6 25	7 00
Can. plates, all bright	8 25	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B.W.G.	8 25	....
Fleur-de-Lis, 28 B.W.G.	8 00	....
Gorbal's Best, No. 28	....	....
Colborne Crown, No. 28.	....	....
Premier, No. 28, U.S.	8 25	6 75
Premier, 10¾-oz.	8 25	7 15
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	27 00
1¾ in.	29 75	24 00
2 in.	29 25	22 00
2¼ in.	33 00	25 50
2½ in.	44 75	28 00
3 in.	49 25	34 00
3¼ in.	.....	42 50
3½ in.	63 50	37 50
4 in.	85 00	48 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21	Atlas	.9
Peerless	.22	X Empire	.8
Grand	.21½	Ideal	.8
Superior	.21½	X Press	.3½
X L C R	.16½		

Colored

Lion	.13½	Popular	.0
Standard	.12	Keen	.8
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.2
Axle	.28	Anchor	.2

Washed Wipers

Select White	.17	Dark colored	.3
Mixed colored	.14		

This list subject to trade discou for quantity.

RUBBER BELTING

Standard	10%	Best grades	15

ANODES

Nickel	.55 t
Copper	.38 t
Tin	.70 t
Zinc	.16 t

Prices per lb.

COPPER PRODUCTS

	Montreal
Bars, ½ to 2 in.	$31 00
Copper wire, list plus 10	
Plain sheets, 14 oz., 14x60 in.	33 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00
Copper sheet, planished, 16 oz. base	42 00
Braziers', in sheets, 6 x 4 base	35 00

LEAD SHEETS

	Montreal
Sheets, 3 lbs. sq. ft.	$ 9 50
Sheets, 3½ lbs. sq. ft.	9 25
Sheets, 4 to 6 lbs. sq. ft.	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra

PLATING CHEMICALS

Acid, boracic	
Acid, hydrochloric	
Acid, nitric	
Acid, sulphuric	
Ammonia, aqua	
Ammonium, carbonate	
Ammonium, chloride	
Ammonium, hydrosulphuret	
Ammonium sulphate	
Arsenic, white	
Copper, carbonate, annhy.	
Copper, sulphate	
Cobalt, sulphate	
Iron perchloride	
Lead acetate	
Nickel ammonium sulphate	
Nickel carbonate	
Nickel sulphate	
Potassium sulphide (substitute)	
Silver Chloride (per oz.)	
Silver nitrate (per oz.)	
Sodium bisulphate	
Sodium carbonate crystals	
Sodium cyanide, 127-130%	
Sodium hyposulphite per 100 lb.	
Sodium phosphate	
Tin chloride	
Zinc chloride, C.P.	
Zinc sulphate	

Prices per lb. unless otherwise noted



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



THE BELGIAN MACHINE TOOL MARKET
GERMAN COMPETITION IS VERY KEEN

Belgium may be a country with a ghly developed iron and steel industry, ıt according to Samuel H. Cross, who Acting Commercial Attache at Brus- ls, Belgium manufacturers do not pro- ıce a large variety of machinery.

Speaking on the subject of the Bel- an Machine Tool Market in "Commerce eports," Mr. Cross says that the best ıown branch of Belgian Mechanical nstruction is locomotive and engine ıilding, which centers in the Hainaut ction, Ghent and Liege. Beside stan- rd and narrow-gage railway locomo- es, the industry produces steam tur- nes, gas and oil engines for marine l industrial purposes, compound mar- e engines, and horizontal engines for er craft. Gas engines are generally ed in Belgian metallurgical plants and oduce in some cases as high as 8,000 rsepower. Diesel motors are also con- ucted at Ghent, and are admitted to mpare favorably with similar engines German construction. Belgian steam gines and locomotives are well known their relatively low coal consump- n. Since the armistice, however, owing the lessened repair and construction ilities of Belgian locomotive s Belgian State railways ordered lo- motives both in the United States and England. The American locomotives ve now been delivered (150 in num-), and are, according to official state- nts by government engineers, render- superior service.

Electrical construction, though a field more recent development, is repre- ted by large plants at Charleroi, ent, and Antwerp, turning out dyna- s, motors, transformers, storage bat- es, switch-boards, telephone appara- , cables, and a varied line of access- s. American capital is considerably erested in this branch of Belgian in- try, which employs approximately 8,- workmen.

Machine Tool Production

There are only four important Belgian nts manufacturing machine tools, t located in Brussels, and one each at Lge and Bruges, producing a relative- ly imited variety of implements. One of t Brussels plants specializes on lathes o 14 to 40-in. dimensions, while the o er, which is now increasing its instal- ons to a capacity of from 1,000 to 1,- 2 machines a year, builds lathes, shap- e and pneumatic hammers of good quality. The Bruges plant, aside from re- erating machinery, turns out sev- eral models of boring mills which are considered equal to any similar makes produced outside the United States.

The principal exports for Belgian machine tools are France, England and Italy. Belgian toolmakers have frequent- ly imitated American machines, and one case is noted where an imitation of a small American drilling machine sells for 650 francs, in comparison with 1,200 francs asked for the original. The prices for Belgian tools run in general from one-third to one-half of those charged for their American equivalents. For in- stance, a plant at Liege turns out a wheel lathe selling for one-third the price of a well-known American make. On the other hand. its weight is only one-third of that of the American mach- ine, and it may be reasonably supposed that its comparative durability is in pro- portion.

There is also one fairly large Belgian plant producing woodworking machin- ery, mostly of lighter sorts in compar- ison with the products of Swedish manu- facture. This factory which has an an- nual turnover of 15,000,000 francs, re- latively large for a Belgian enterprise of this nature, is reported practically to control the French market for machines of this type.

Competition Exists

Local machine tool dealers state that before the war 70 per cent of all mach- ine tools imported into this country were of German origin. For reconstruction purposes after the armistice, however, American machine tools of all classes from the smallest millers to the heavi- est grinding wheels and boring mills, were sold in Belgium in large numbers. The War Department alone disposed of $3,500,000 worth of tools through the co- operative known as the Construction Métallique, and it is estimated that fully as large a sum was spent on machines purchased privately. Though these lar sales created a temporary advantage, this preferential position was rapidly lost as soon as German machines, at re- latively low prices. re-entered the field. While it is generally recognized by Bel- gian machine tool users that German products are not of the same high qual- ity (lathe beds, in particular, being made of inferior metal), local enterprises are now making stop-gap purchases of Ger- man tools to hold them over until a fall in the dollar makes it possible to acquire American tools at what they consider a more reasonable price.

Several agents for American machine tools who carried large stocks suffered severe losses during the latter part of 1920 owing to the readier sale of German products. One such agent at least has taken an agency for German mach- ines. The sale of American tools must obviously suffer from this practice if it spreads further. The sale of German machine tools, except in this instance, is in the hands of relatively small and unimportant commission business whose sharp methods and price cutting render matters dificult for the more reputable agents. While German manufacturers have been demanding cash with order they rarely insist on this condition when a sale depends on concessions.

The shop and factory supply business, so far as American products are con- cerned, is now more profitable than the machine tool field. American wheels and small tools of most sorts sell with relative ease, but the market is prac- tically closed to American twist drills. Not only do English twist drills offer some active competition, but prohibitive offers from Germans are beginning to appear. While there are in Belgium numerous small shops producing brass valves, the native product is not able to compete with the standardized American article.

German competition is particularly active in measuring tools and on small carbon steel articles. In the latter branch German manufacturers undersell Ameri- can products in the local market by over 80 per cent. A 36-millimeter carbon drill is being offered in Brussels for 6.25 francs in comparison with 35.15 francs asked for a well-known American drill of the same size. It is the local practice to use carbon steel up to one- half inch diameters and above that di- mension to employ high-speed steel. Ger- man price offers on micrometers are almost as exclusive as on drills. A Ger- men product, not of extremely high finish but of entirely accurate construc- tion, is sold in Brussels for 31.20 francs while the price for the corresponding American micrometer is 96 francs.

German tools of this sort placed on the local market bear no device or mark in- dicating their Teutonic origin, and even for an order of one such micrometer, the German manufacturer will stamp on it the name and address of the local pur- chaser free of charge.

QUEBEC MAKES RAPID PROGRESS

Manufacturing Activities Increase Short History of Different Trades Wide Range of Manufacture

The output of Quebec's manufacture in 1919-1920 was $890,420,023 compared with $158,287,994 in 1900. This shows quite a growth in twenty years. Some interesting data regarding Quebec's activities are contained in a recent issue of "Agricultural and Industrial Progress in Canada," and following are a few of the items which will no doubt interest our readers.

The foundation of the textile industry was laid around the seventeenth century, while hat and shoe factories were established in Quebec prior to the year 1668, and the records of 1681 show the existence at that time of four weavers of cloth, one of carpets, one ribbon weaver, four ropemakers, six hatters and one carder. The first timber manufactured in Canada was shipped from Quebec province.

Mining for ore commenced upon the banks of the St. Maurice River in 1733 and by 1737, smelting operations had been entered upon on a large scale. The first sugar refinery was established in Montreal in 1854 and the first flour mill in 1860. In 1851 the province boasted 541 grist mills, 1065 sawmills, 193 carding machines, 18 woollen mills, 13 breweries, 7 distilleries, 12 shipyards, 38 foundries, 204 tanneries, and 123 industrial establishments.

Quebec's forests are responsible for the greatest amount of industrial activity. Pulp and paper is the leading industry which in the past has witnessed a phenomenal development and is still undergoing a steady expansion. Pulp products increased in value from $2,421,068 in 1900 to $33,637,775 in 1920, and paper from $2,021,592 to $41,601,790 in the same period. Forest products employ 20,000 men and have a production value of $40,761,730, having jumped to this figure from $18,609,716 in 1900.

In the value of manufactured cottons, Quebec leads the Dominion with twelve textile plants having a capital of $37,962,311 out of a total for the Dominion invested in this industry of $58,732,941. These plants produced in 1919 goods to the value of $57,530,438 out of a total for Canada of $82,642,949. Quebec operates 83 of the 147 factories in Canada employed in the manufacture of men's clothing and they represent a capital of $14,180989 out of a total investment in the industry of $25,703,795.

Wide Range of Manufacture

Twenty plants for the manufacture of agricultural implements have the sum of $3,892,851 invested in them. Two of the eight sugar refineries in Canada are in Quebec having an investment of $5,869,592. There are 71 hat, cap and fur manufactories with a capital investment of $7,585,382 and twelve woollen textile mills with a capital of $3,126,141. A total of $3,315,328 is invested in 18 glove and mitt factories.

A very prominent Quebec industry is the manufacture of boots and shoes and out of a total production of $69,319,128 in the Dominion, Quebec is responsible for $41,689,124 from 91 establishments capitalized at $24,894,251.

Though there are nearly 500 mills for the manufacture of flour in the province these are mainly of small capacity with about twelve and a half million dollars invested. About ten million dollars is invested in 15 abattoirs and meat packing establishments. Men's furnishings are responsible for 31 factories and shipbuilding for nine yards.

The principal industrial centres of the province are Montreal, Quebec, Sherbrooke, Three Rivers, Hull and Lachine, which have in the main been responsible for the remarkable progress which in the past ten years have elevated production figures from $158,287,994 to $890,420,023. Industry is said to have become a serious rival to agriculture in the province but the two are amicable competit is progressing hand in hand and mutually aiding. Quebec has now attained the position where she can not only provide most home needs but engage extensively in the export of these products.

UPWARD TREND IS IN EVIDENCE

Business in United States Improving According to Various Sources. Further Improvement Looked For

"The changes in wholesale prices or prices of raw materials are no longer marked by sharp fluctations." There is increasing evidence, continues a writer in "New York Commercial," that one after another of the industries are settling down to a definite price basis.

Surplus stocks are moving into consumption, while the most hopeful feature of the situation is that new business is being developed on a sufficient scale in some lines to warrant restoration of capacity production. Frozen loans are being thawed out, and the banking situation is steadily improving. In the Middle West, in particular, unemployment is decreasing and while there has been a momentary let-down with some automobile factories, in general the motor trades have improved, as have textiles, rubber goods, shoes and leather. Car loadings are increasing and there has been a definite improvement in railroad earnings.

The "Annalist" also feels sure that things are on the upward trend for they say that the outlook as to business and banking conditions, both in the United States and elsewhere, present less complexity than for sometime. In their opinion however, the recovery of business is probably not measuring up to the standard which was hoped for and expected by many earlier in the year. ill progress is being made and while it ill undoubtedly be a long time before t re is any degree of prosperity akin to at which prevailed before deflation b an to make itself manifest, it seems n r- theless true that a stabilization ill come and that manufacturing will o- ceed on a larger scale because of ret n- ing confidence on the part of those o not so many weeks ago were a bit u- icky as to the trend of events.

The building revival, according to Guaranty Trust Co., of New Yor the most encouraging factor as reg ds the prospective betterment of the m- ployment situation. The importanc of this revival, in their opinion, lies in he fact that, in addition to affording m- ployment to thousands of men in he building and allied trades, it stimu es many other industries, such as s l, brick, cement, lumber, and score of others, and, consequently, increases he volume of freight for the railroads Al of this will augment the purchasing w er of the country and create a gr er demand for all kinds of commod es Still further readjustment in the p es of materials and cost of labor mus e- cur, however, before there can be a l ge building boom.

NEW SOCIETY FORMED

According to trade commissione T. O. Klath, at Copenhagen, Denmark a association called "The Anglo-D Technical Society," has been form Copenhagen, Denmark with the o of promoting co-operation between mark and Great Britain along indus and commercial lines. Capt. H. E the newly appointed representative Federation of British Industries in mark, and vice-president of the D Cable Manufacturing Co., has bee lected president of the association Sir Martin Abrahamson, a well k engineer and commercial man, has made vice-president. Ewald made following statement to the Copenh press with regard to the plans and pose of the organization:

The society which has just been f ed is to be considered in the natu a technical club. New members wi admitted only if approved by the o al members. We expect to establis timate relations with English indu and other associations, so that the k ledge and experience gained in Britain concerning various comm and technical conditions will be available to our Danish members made use of to their advantage. It i intention of the society to have mo meetings when addresses will be ma technical subjects, and it is also pl to issue and distribute various pu tions.

The recent marking regulation applied to packages and boxes pa through the customs office, will n enforced until Dec. 31 1921. This give manufacturers a chance to pr for the new ruling.

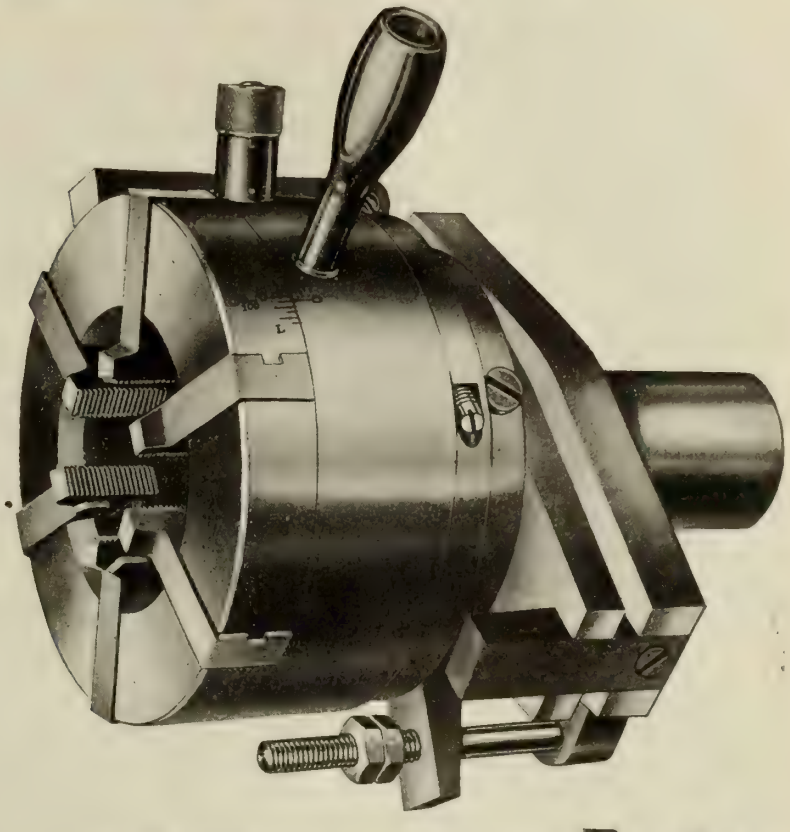
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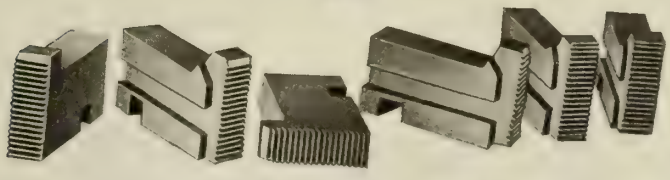
Right on the Lead

E HEADS THAT SHOULDER THE WORK

It is the User who decides the Merits of a Tool

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on
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ic

h ie Best of Results

The Geometric Die Head illustrated is arranged for the Potter & Johnston Automatics. Note the Floating Shank, which makes close camming unnecessary and also prevents inaccuracies caused by either forcing or holding back the turret.

eometric Die Heads can be fitted with chasers for cutting close to a shoulder, when required.

E GEOMETRIC TOOL COMPANY

V. HAVEN CONNECTICUT

Canadian Agents:—

ian & Wilson, Ltd., Montreal. The A.R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S.

Trade Gossip

Various societies are about to hold conventions. The American Society for steel treating are going to meet at Indianapolis, during the week of Sept. 19 to 24 inclusive, while the National Safety Council are holding their annual congress at Boston during the week of Sept. 26.

* * *

The American Society of Mechanical Engineers; the Society of Automotive Engineers, and the Army Ordnance, are going to hold a joint meeting at Aberdeen, Md. on Oct. 7.

* * *

The National Machine Tool Builders Association are going to hold their annual fall meeting at the Hotel Astor, New York, on Oct. 18, 19, and 20.

Improved labor conditions have enabled considerable progress to be made in hydro-electric construction throughout Italy. Should expectations be realised in respect of all projects arranged for, at the end of 1923 there should be a further 1,000,000 horse power available for power and lighting purposes. Not the least remarkable feature of the electric industrial position in Italy is the almost complete elimination of German interests. Before the war, by far the largest amount of electrical goods came from Germany, while the control exercised through the banks was sufficient largely to exclude both French and British participation. It is proposed that hereafter Italy shall produce almost the whole of her own requirements in electrical material, and there is a strong movement towards patronising home only.

* * *

The Brantford Navigation Co., has been in corporporated under the Dominion Companies Act with 500 shares of no nominal or par value, provided it shall carry on business with a capital of $2,500, and have its head office in Montreal. The business of shipbuilder, shipagent, forwarder, carrier by land and water, etc., will be carried on.

* * *

The Belleville Motors, Co., has been incorporated with a capital stock of $40,000. It is the intention of this firm to manufacture and deal in automobiles, etc.

* * *

The International Harvester Co., at Chatham Ont., is said to be considering the making of motor trucks. At present plans are being perfected and a large addition to the plant will perhaps be erected shortly.

* * *

The Bailey Meter Co., Cleveland, Ohio are taking space at the Seventh National Chemical Exposition in New York during the week of September 12th, to be held in the 8th Coast Artillery Armoury, where they will be glad to see their friends who may be in the city that week.

The Smithville Metal Industries has been incorporated to carry on business as iron founders and to manufacture machinery, tools, implements, castings, forgings, etc. The capital stock is placed at $200,000.

The following companies have been incorporated, each with capital stock of $40,000. The Simplex Iron & Tool Co., Toronto; The Steam Valve Co., Toronto, and the Mathewson Brick & Tile Co., amilton.

The Dominion Oxygen Co., Toronto, are erecting a building at Montreal for an oxygen plant. It will be practically a duplicate of the one at Toronto, so that the addition will double the company's present capacity.

* * *

The recently organized firm of Gorman's Ltd., with head offices in Edmonton, Alta., have taken over the old firm of Gorman, Clancey & Grindley, Ltd. The new company will operate in the four western provinces and will require the use of a considerable portion of the authorized capital of $250,000, as considerable improvements to the old organization are being planned.

* * *

Rich coal deposits have been found in the Guadalquivir River Valley, according to the Semana Financiera, and the exploitation of the beds has been begun. It is said that this is likely to prove another valuable coal district to be added to those of the Asturias, Leon and Ciudad Real.

* * *

Steel work for a carbonizing plant at Victoria, B. C., for the Victoria Gas Co., is progressing favorably. The cost when completed will be around $125,000.

* * *

A new association was formed recently in Montreal, this to be known as "The Association of Building Industries for the province of Quebec." According to Mr. Church, president of the Montreal Builders' exchange, the sole object of organizing the new association was that it might serve as an official mouthpiece for the construction interests of the whole province, so that they might be in a position to give the provincial government, and especially the departments of public works and labor, the benefit of their experience.

Following were the officers elected:—K. D. Church, Montreal, president; E. G. Brousseau, Quebec, first vice-president; Alphonse Gratton, Montreal, second vice-president; D. K. Trotter, Montreal, and J. P. Lemieux, Quebec, joint secretaries. It was decided to hold the first annual meeting of the new association in Quebec city, the date to be fixed according to the time of the opening of the Legislature.

* * *

Tenders will be received by A. F. Stewart, chief engineer, Canadian National Railways, Moncton, N. B., up to 12 o'clock noon, September 7 for the construction of the substructure for a single track railway bridg over Coffee River, 41.1 miles fro Do the St. Maurice Division, Que trict. Plans and specificati seen on application to the chief engineer, Canadian Na ways, Toronto; district eng R., Quebec; division enginee tunnel terminals, Montreal.

* * *

Anyone interested in the the Ontario, or Canadian gear box lubricant made i should write us immediat what connection they have buyers etc. Upon receiving ation, further particulars w

* * *

The Society of Chemical Great Britain will visit Aug 26 to Sept. 5. They wl of the Canadian sections o ization, and the party will days in Montreal. Variou plants will be visited; tech will be read, etc., etc. On to the industries of Shaw and Grand 'Mere will be m tawa, Toronto, and Niagar be visited on the remaining Canadian visit. Following t tour, the visitors will cros and inspect some of the pl country.

* * *

An analysis of the fore the United States for th year shows a decrease of $ The balance of trade, hov their favor to the amount o 000 compared with a balan 000,000 in the preceding fis total value of their forei the year ending June 30, 19 171,000,000, compared w 000,000 in 1920. The falli 23.8%. Imports dropped f 000,000 in 1920 to $3,654,00 a loss of $1,584,000,000 or ports were $8,109,000,000 in $6,516,000,000 in 1921,a dec 593,000,000.

Various papers of impor presented before the conv American Socey for Stee be held in Indianapolis for 24 inclusive. Canadian M present some of the mos from time to time.

* * *

The Conveyors Corporat ica, Chicago and New Yor a little pamphlet entitled " the Pudding," which is a letters received by them in letter sent out to a large n customers. This letter recipient to advise the Co oration of any difficulty t have encountered in the op ash conveyor supplied by tion. The letters will be anyone contemplating the ash handling machinery

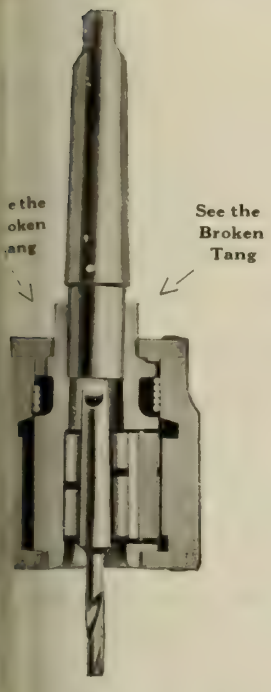
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Aikenhead's

Show Room 17 Temperance Street

Should be your first point of call!



With the exception of our **Ideal Power Lawn Mowers** we are not exhibiting at the Exhibition this year. But the convenient location of our Show Rooms at 17 Temperance Street makes it easy for each user of up-to-date tools to see the newest advances in this line without going out of his way or without losing any time. In addition to Portable Grinders, Vises, Pipe Threading Tools, Drills, Johansson Gauges, Glue Heaters and scores of others, we will be pleased to demonstrate superior features of the.

WAHLSTROM CHUCK

This Automatic Drill Chuck is a remarkable economizer of time. It is automatic and instantaneous in operation and enables the operator to make tool changes in just two seconds without stopping the spindle of the machine.

One of the many good things about this chuck is the fact that it will hold tools whether they have tangs or not. The jaw grips on the side of shank. Made in two different styles. One style holds No. 1, 2 or 3 Morse Taper Shank Drills—with or without a tang. The other style is made in three sizes, which hold all sizes of straight shank tools from ¼ to 1 inch.

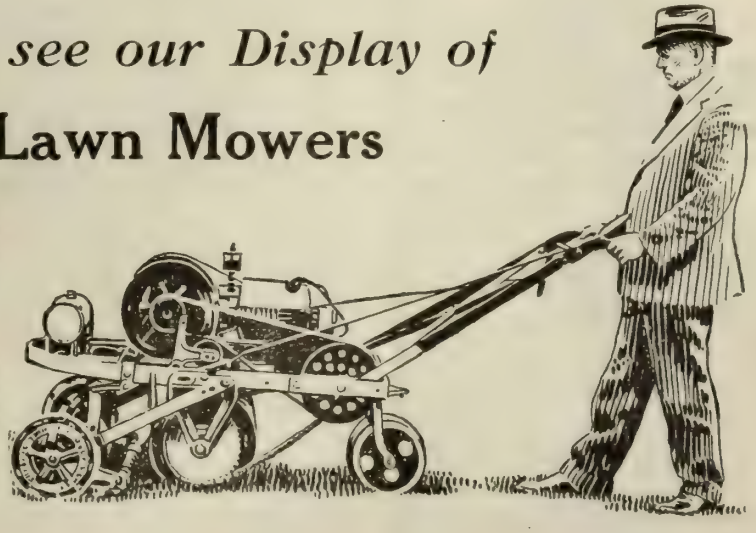
At the Exhibition see our Display of

Ideal Power Lawn Mowers

are demonstrating the 22" Ideal Junior, the 30" al Tractor, and the 84" I. Tractor Triplex on the n between the Dominion Government Building the Horticultural Building, also have a display inside the west door of the Horticultural Build-

Ideal Power Lawn Mower has proved itself to the simplest and most efficient Power Mower on market. Over 100 of these machines are in use Ontario, and each and every machine has given ct satisfaction. The Ideal Power Lawn Mower, kept working, will pay for itself in six weeks pared with cutting with a hand mower.

May we not have your inquiry and quote you on ame? If unable to visit us at the Exhibition, rite for catalogue and information.



Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

CONNECTING RODS

Continued from page 42

in a manner similar to that previously described and the holes drilled at the opposite end. The rod is now ready for fitting the boxes after which they are finish reamed for the bored holes to the proper sizes.

Machining Wrist-pin and Crank-pin Holes.

An interesting jig is used when machining the wrist-pin and crank-pin holes and is shown in Fig. 5. The rod is placed on the pads A which are made of the correct height to enable it to set parallel, as the bosses at each end have been previously machined as noted. The large screw bushing B is then tightened and as the lower end of this medium is made with a bevel or what is known as a cup bushing this coming in contact with the surface machined in Fig. 3 centers it correctly in the jig.

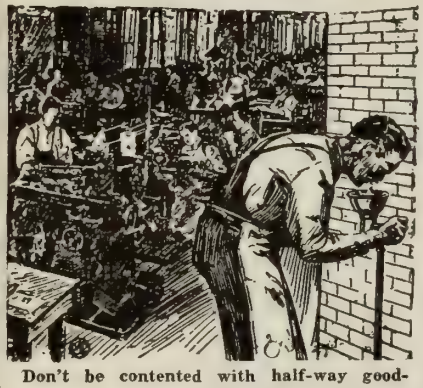
The small end of the element is located by means of the spring actuated by sliding vee block C, the knurled head set screw D holding it against the machining stresses. Long bushings are provided for each hole which is drilled and afterwards reamed in order to obtain both accurate and smooth surfaces. It will be observed that the jig is provided with a shelf design at the places where the rod rests, and as the drill or reamer passes through the lower bushings at A the chips drop away from the locating surfaces thus preventing clogging and insuring a clean tool as the material can be easily removed by the operator even when the rod is being worked upon.

The profile on the outside of the large end of the rod is next machined and the fixture used to hold it in place is illustrated in Fig. 6. The element is located by a large stud that fits into the wrist hole machined in the previous tool shown. The open washer shown is then slid under the threaded portion of the stud, the nut A holding it in position. The set screw B is also adjusted to force the rod back against the locating stop at the rear. The nut A is then fastened and holds the element securely in its correct location. The gang of form cutters C are used for the operation of milling the surface D, and the fixture is employed in conjunction with the circular milling attachment of the machinery.

The illustration, Fig. 7, shows the fixture used when milling the contour of the bolt bosses. The forging is located by means of two pins that fit the machined holes and after the open washers have been slid over the outer surface of the rod the two studs A are tightened to hold the element securely in position. The form cutter B is fed across the bolt bosses, machining them to the desired contour. The fixture is located by means of tongues and is fastened to the machine table to obtain the correct alignment.

A new tool, a tolerance plug gauge with replaceable ends, has been added to the lines of C. E. Johansson, Inc. These tolerance plug gauges of the smaller sizes, were formerly made solid, but the new type provides for the preservation of the unworn (No-Go) end, and refitting the tool with a new Go member. A locking device is used to keep the ends from turning when gauge is in use. This type of gauge is made in sizes from ⅛ to 47-64 inch.

Upon the Health of your employees depend your profit and production



Don't be contented with half-way goodness or makeshift drinking arrangements.

Throw out the germ-laden Drinking Cup!

Give your men a clean drink

PURO SANITARY DRINKING FOUNTAIN

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Allows just the proper amount of cool, clean fresh water to come through the bubbler. No spurting, overflowing, no loss. "Puro" regulates itself. "Puro" saves 35% on water bills, too. You can attach it in a few minutes. Tell us how many men, how many departments, and we'll tell you how much the cost will be.

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Hook Tooth

SOME HAVE wondered
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WHAT THE hook in
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HACK MEANS, but
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MECHANICS KNOW a
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ONCE THAT it is
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THE SCIENTIFIC princ
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OF SIMONDS hack
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SAWS ARE made, they
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BLADES DO not
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WEAR OUT, but last
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LONGER, HOLD their
* * *
CUTTING EDGE and
* * *
NOT SHELL teeth.

When you need hack get the best—Simonds.

Simonds Canada Saw Co. Limited

"The Saw Maker."

Montreal, Que. - St. John, N.B. Vancouver, B. C.

CUTTING TOOLS

ontinued from page 40

purpose, namely, feeding straight in- the work to cut a recess. Such a tool iten sed in narrow form for cutting recs between different diameters a tu ed shaft; and in broader form the irst operation in planing tee fra the solid. As this tool cuts ress deeply into the work, both of he tool are given a side angle degres, in order to clear the work. c sition of steel used will depend a the width of cutting edge de-

ndi instructions are practically as those given for tools Nos. d C.

To Be Continued

IKNOWN ENGINEER DIES

s inclair, who was well known iv engineer and railway con- d a few days ago in Toronto. built many of the railway Canadian Pacific and Cana- ern systems, and was well n hatham, N. B., where he was 19. Since that time he passed ny experiences. In 1869 he staff of the Intercolonial d remained until 1875, when d the completion of the road Mamedia to Bathurst. He came to n1875, joined the staff of the Port Arthur under the late Helwood in 1875 and remained rict until 1878, when he engineering for contracting, d on the C. P. R. as a con- ul the road was completed. section of the C. P. R. east and in partnership with Eneny constructed the road hamsville to Windsor for the C. in partnership with the late McDonnell, he constructed C. P. R. short line through a portion of Walkerville section of the Maine Cen- from north Stratford to on in Vermont. He was employed on the C. N. R. 1898, during which time rom Point Tupper to Broad C from Halifax to Mahone Middleton to Victoria Beach, rurned to Ontario in 1903, built or completed from el and from Capreol Junc- boke, 240 miles. He was also in pleting the excavation of of Mount Royal Tunnel ity of Montreal.

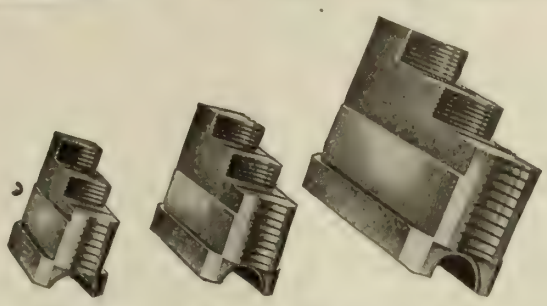
WATS EQUIPMENT

f Canadian Machinery rchase a two-ton chain d a on and a half block. He econd hand, and in good rmation can be secured W. Hill, Box 164 Preston,



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

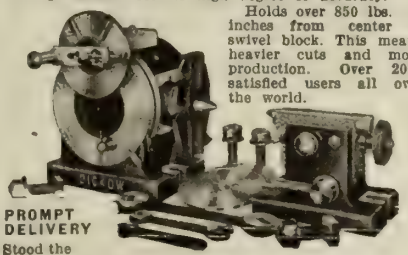
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3

Why Reduce Your Production

and waste money by using cheap, inaccurate Index Centers, when a few dollars more will buy a DICKOW INDEX CENTER, which is absolutely dependable, and guaranteed for its high degree of accuracy.

Holds over 850 lbs. 22 inches from center of swivel block. This means heavier cuts and more production. Over 2000 satisfied users all over the world.



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Stood the test for 14 years.

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Write us to-day for complete description.

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No. 4 Press
10 to 12 tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger Co., Windsor, Ont.

CLOSING TIME

Condensed advertisements for this section must be in our composing room Tuesday morning prior to day of issue. Display advertisements for this section must be in Monday afternoon.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Classified Opportunities

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

THIS COMPANY IS DESIROUS OF EXTENDing its business by acquiring additional capital. It is prepared to dispose of a part interest or the whole property. The plant is well situated on the main line of the C. P. Railway a few miles from Saint John, N.B., and includes Lands. Buildings and Factory, all in good condition, with ample room for expansion. It affords a good opportunity for building up a large industry.

Apply to
THE THOMPSON MACHINERY CO., LIMITED,
P.O. Box 76, Saint John, N.B. (c9m).

SALESMAN WANTE

J. RHODES & SONS, LTD., Ironworks, Wakefield, Eng., the manufacturers of Power Presses in are open to appoint a commission Canada for the sale of their Powe A real live Agent who thoroughl stands the selling points of Power required, and one having a show-ro be an advantage.

FOR SALE

ELECTRIC STORAGE BATTERY tives for sale. Two. 36-inch ga plete and in good condition. R. T. Company, Dept. "E," 211 McGill Stree

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT
Builders of Reliable Machinery.

REGO WELDING and CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

SUNCLO BRAND
WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

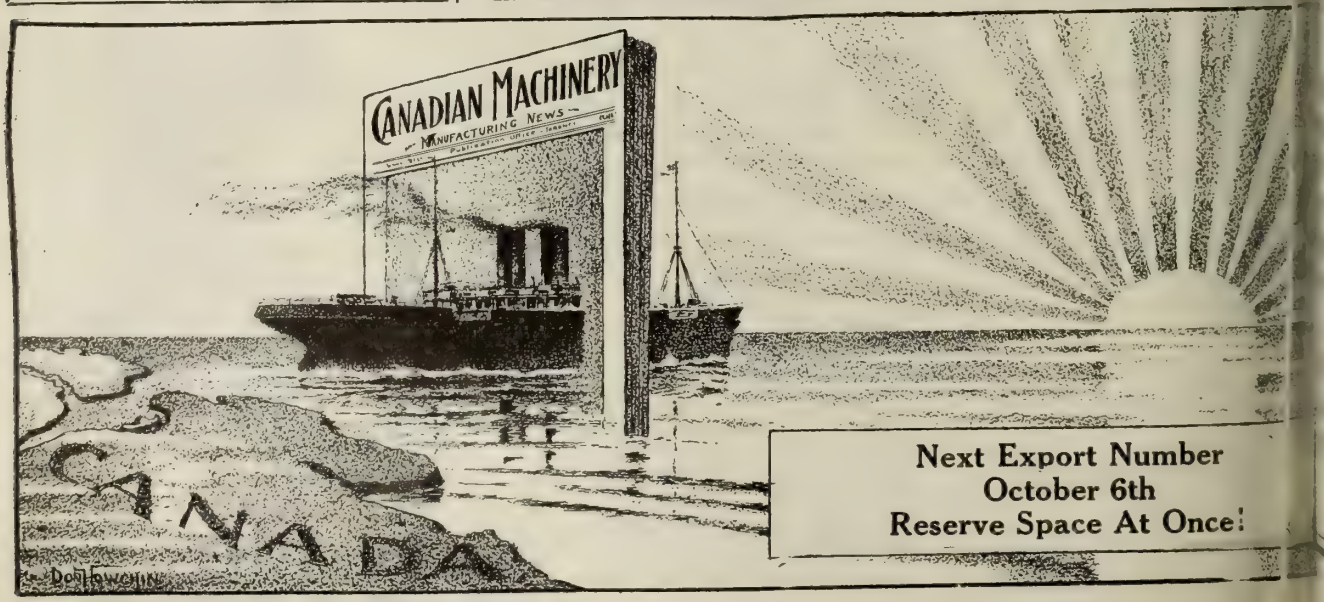
THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

USED MACHINERY FOR
1—13" x 5' South Bend Engine
1—18" x 8' Mueller Engine Lathe
1—20" x 10' Whitcomb Blaisdell Lathe.
1—24" x 10' Bertram Engine
1—Power Hack Saw.
1—No. 3 Greenard Arbor Press.
1—Air Hammer.
CHAS. P. ARCHIBALD &
285 Beaver Hall Hill

Grey Iron Casti
Light and Medium-Bench and Floor Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern advice and estimates will save you mo Semi-finishing operations on Lathe o Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT

Modern Marine Mach
Automatic Steam Towing Mach Windlasses, Cargo and Deck Steam Capstans, Dock Gypsies, Engines, Hydraulic Freight H Grey Iron and Brass Castings machinery built to order. The Co dry & Machine Co., Limited, Ow Ont.



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...—24 ...ockford Shapes, back-geared
...—26 ...ack-geared Drill, lever feed only.
...—No ...4 Perkins Sprue Cutter.
...—No ...20 Brown-Boggs Press.
...—10 ...4" Plain Landis Grinder, self-contained.
...—1 ... Triplex Hydraulic Pump, 1¼"x 4"
...—26 12' Pond Lathe, S.B.G., C.R., P.C.F.
...—24 12' New Haven Lathe, D.B.G., S-Q.C.G., C.R.
...—24 12' Can. Mach. Lathe, S.B.G., C.R., P.C.F.
...—22 10' Davis Lathes, D.B.G., Q.C.G., C.R.
...—21 10' London Lathe, S.B.G., C.R., P.C.F.
...—20 8' C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
...—19 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.
...—29 10' Butler Lathe, D.B.G., Q.C.G., C.R
...—16 6' McDougall Lathe, S.B.G., S-Q.C.G., C.R.
...—19 8' Mueller Lathe, D.B.G., Q.C.G. Turret on cross ...id

Shapers

...6" ...ockford Shaper.
...2" ...ort Hope Shaper.

Drills

...o. ...1 H.D. Colburn Drill.
...o H.D. Foote Burt Drills.
...." ...arnes Drill, B.G., P.F.
...." ...arnes Drill, B.G., P.F.
...Dougall Drills, W. & L.F.

Miscellaneous

...6" Pratt & Whitney Turrets.
...o. Gardner Disc Grinder.
...ne Bolt Cutter.

...EATES MACHINERY
HALE STREET
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REAL FIRE BRICK SERVICE

When you buy Elk Fire Brick we sell you a brand with the qualifications equal to the duty for which it is intended. We do not recommend the best quality brick for a certain job if a lower-priced brand will stand up just as well. Each brand of

ELK
FIRE BRICK

has some particular qualification which fits it to give better results in certain places than other brands we produce.

OUR BRAND

"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
"Keystone"
"M.D. Elk"
"Rotex"
"Elk Ladle"
"Keystone Dust"
"Elk Dust"
"Rotex Dust"

Try us on your next fire brick needs. You'll find both our quality and service right.
Large stocks of various shapes carried in warehouse in Hamilton.

ELK FIRE BRICK CO, OF CANADA
LIMITED
Sun Life Building, HAMILTON, ONTARIO

...o You Read These Advertisements?

...very advertisement in this magazine is worth reading. It is the product of ...ur concern that is using a modern method of making sales, viz., technical ...apr advertising, in order to present most effectively to you the leading fea...re of its line.

...hese advertisers are making it easier for you to buy intelligently with the ...aswaste of your time and theirs. They realize that a sales force cannot ...eplce this service at equal cost. They know that advertising is good busi...ess for the manufacturer who does not advertise cannot save the cost of ...dvetising. Consistent advertisers are progressive merchandisers. They ...re ...aving your money and their own; and it pays to do business with them.

...Don't miss your opportunities. These advertisements are interesting. Many ...re ...istinctly instructive, and a glance through them every month will keep ...you ...posted on the latest developments for machinery equipment.

THE

TRADE K–T MARK

FOUNDRY
GALT, ONT.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25 per cent.; a diff method of molding them might double your production at no increase in mo cost. We can advise you and we have expert metal and wood patternmakers are able to make any changes that may commend themselves to you.

If you need some new Patter

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you any If our advice is good and commends itself to you, it is only fair to assume that our will be equally satisfactory, and we need the work as badly as you need the patterns

We are in a position to do turning, boring, drilling or other semi-finishing operatic castings supplied by us. Ask us.

We have for our and your requirements, a large stock of assorted Iron Stars, suitable for light agricultural to medium weight mach castings, while they last, at 8 cents per lb. F. O. B. Galt.

PATENTS

Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. **Booklet Free.**

WIRE SPRINGS
OF ALL KINDS

Machine Springs, Valve Springs, Automobile Cushion Springs, etc., of a quality that defies competition. Tell us your requirements. Send sample or specification for price.

JAMES STEELE, LIMITED
GUELPH, ONTARIO

SMITH BELTING
138 YORK ST. TORONTO

"Maple Leaf"
BRAND
Stitched Cotton Duck Belting

"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.



Have us send you samples and see just why "Maple Leaf" sets the standard in economy, strength and durability.

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LIMITED

Consulting and Designing

Tools, Jigs, Special Machi us shoulder blems.

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PAPER MILL MACH
BERTRAMS LI
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BLACK DIAMOND OVENS

"OVENS
Japanning and Varnishing Ovens Gas, Electricity, Steam or Coal. Siphonage Ventilators, Bakers' Oven casters, etc. Write for Book

Brantford Oven & Rack Co.
Brantford, Canada

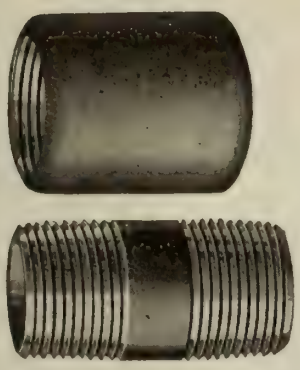
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CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all other manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.

STANDARD TUBE COMPANY, LIMITED
WOODSTOCK, ONT.

WROUGHT PIPE
COUPLINGS and NIPPLES





Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black, or galvanized.

THE STEEL COMPANY OF CANADA LIMITED

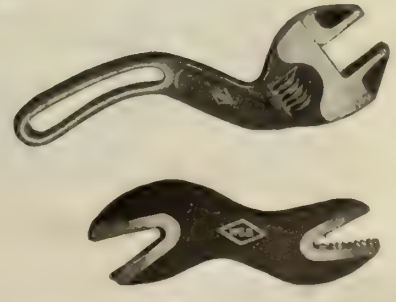
HAMILTON MONTREAL

Made in Canada

Made in Canada







WILLIAMS'
SUPERIOR
DROP-FORGED WRENCHES

40 Standard Patterns, 1000 Sizes

J. H. WILLIAMS & CO. LIMITED

"The Wrench People"

Formerly Canadian Division of
The Whitman & Barnes Mfg. Co.

41 Thorold Road, St. Catharines, Ont.

? Who was the Third Man?

WHEN the retirement of Sir Robert Borden as Premier of Canada was first announced, three outstanding men were considered as his possible successors. Their names were displayed prominently in every Canadian newspaper. The present Premier was of course one of the men mentioned. Sir Geo. Foster another. Who was the third man? You would remember him no doubt if his name were displayed prominently in the daily press to-day—but he has retired from the political arena, and his name is seldom mentioned.

How easily names slip from the memory when they cease to be given publicity.

There is a lesson here. If you wish your name and the name of your products to be remembered, you must give them constant publicity.

The prudent manufacturer of machine tools, power plant equipment, or industrial supplies of any kind places his name and the name of his products where they will be seen and remembered to best advantage: **in reliable technical newspapers.**

Reliable technical newspapers in Canada are those included as members of Canadian National Newspapers and Periodicals Association. Their circulation is bona-fide and their editorial practice is carefully guarded, in fact their whole policy must conform to the highest standards else they would not be eligible to membership in the association.

Canadian Machinery

Power House

Canadian Foundryman

Marine Engineering

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The MacLean Publishing Company, Limited

153 University Ave., Toronto

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CUT GEARS

Theoretically Correct

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LIMITED

52 NAZARETH ST., MONTREAL, P. Q.

RAWHIDE OR METAL

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up on

The U.S. MILLER

The Miller for Small Work



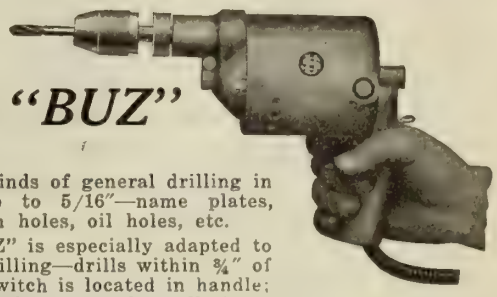
A small machine that sets up less floor space, requires less power, is easier to operate and is more accurate.

The Paramount Miller of its size. Write us a line for all details.

United States Machine Tool Company

Cincinnati, Ohio, U.S.A.

United States Electric Drills and Grinders



The "BUZ"

For all kinds of general drilling in metal up to 5/16"—name plates, cotter pin holes, oil holes, etc.

The "BUZ" is especially adapted to corner drilling—drills within ¾" of corner. Switch is located in handle; under absolute control at all times. Attaches to any lamp socket, alternating or direct current, 110 or 220 volts. Guaranteed the most powerful electric drill of its weight on the market.

Order a few to-day for trial. Their time and labor saving ability will convince you you need more!

For Sale By

The Canadian Fairbanks-Morse Co., Limited

Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.

CINCINNATI, OHIO

HANNA

IRON ORE - PIG IRON

Sales Agents:

Cleveland Cincinnati Pittsburgh Toronto Buffalo Detroit

One Man at the Air Drill

IN the boiler shop of the Canadian plant of a great American industry the men said no staybolt tap made could be driven easily enough to require but one man at the air drill —said they'd strike before they'd obey the order to use only one man on each staybolt tap.

But the answer came back from headquarters in "The States" that the *"Maxi"* Staybolt Tap made by the GTD Corporation was different; that only one man was needed and that only one man must be used in Canada.

Headquarters even sent photographs to prove their statement but they thought the photos must be fakes, and so the Railroad Union sent a committee to see it done—and they saw and were convinced.



This is one of the best arguments we can give you on the *"Maxi"* Staybolt Tap. The saving in labor is not the only argument that there is, however.

The *"Maxi"* Staybolt Tap has the *exclusive* features of a *pilot point*, which finds the hole in the inner plate immediately, and guides the tap into it—a *chip breaker*, which prevents accumulation and wedging of chips —an extra long taper threaded section—specially designed flutes.

Consequently the *"Maxi"* cuts many more threads than any other staybolt tap on the market.

Let us tell you more about this remarkable tool. Clip the coupon and send it in. No obligation, of course.

GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO

Successors to

Wells Bros. Co. Of Canada, Limited

London Office; 139 Queen Victoria Street, E.C.4

GTD Screw Plates, Taps, Dies, Reamers, Gages, Pipe Wrenches.



GTD Corporation of Canada, Limited, Galt, Ontario

I am interested in cutting threading costs on boiler work. Please send me your circular the *"Maxi"*-Tap and put my name on your mailing list to receive additional screw-threading information as issued.

Name

Position

Firm

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C.M. 209

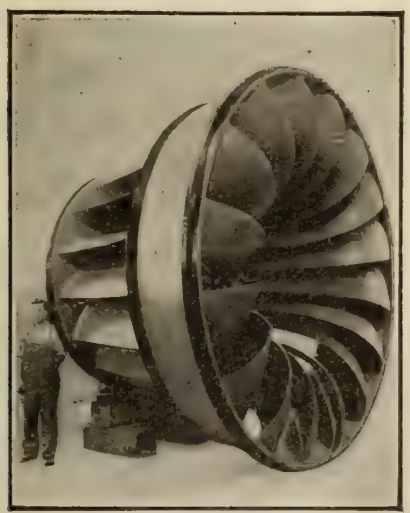
HIGH-GRADE CASTINGS

OF

SEMI-STEEL OR GREY IRON

WE SPECIALIZE IN HEAVY AND COMPLICATED CASTINGS OF EITHER MIXTURE IN

DRY SAND, GREEN SAND OR LOAM



Semi-steel castings, carrying as high as 40 per cent steel, are unexcelled where a tough, clean, close-grained and durable material is required. They will take a high polish, and for many purposes are superseding the more expensive steel castings.

A corps of skilled workmen under efficient supervision and having unexcelled facilities and equipment ensure prompt and careful attention and are a guarantee of quality.

The services of our engineering staff are at the disposal of our customers, and we will gladly submit prices upon receipt of particulars.

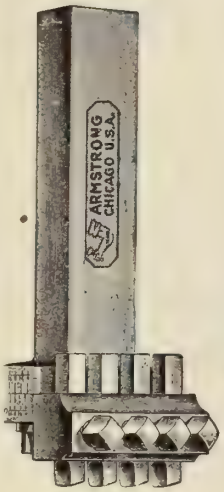
THE DOMINION ENGINEERING WORKS LIMITED

MONTREAL - - CANADA



THIS Armstrong Gang Planer Tool is making tremendous reductions in cutting time and costs on many large surface planing jobs.

Each tool consists of a holder, four cutters, a wrench and grinding gauge.



IT is built for heavy duty and has become very popular with shop mechanics on account of its rigidity and the ease with which the tools are set for any desired feed or depth of cut.

We Also Make Ratchet Drills, Dogs and Clamps. Have You Our Catalog B-20

ARMSTRONG BROS. TOOL CO.

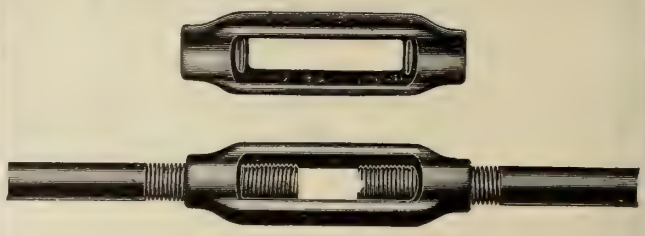
"The Tool Holder People"

306 N. Francisco Ave - - Chicago, U.S.A.



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FOUNDRIES & FORGINGS
LIMITED

Drop Forged Steel

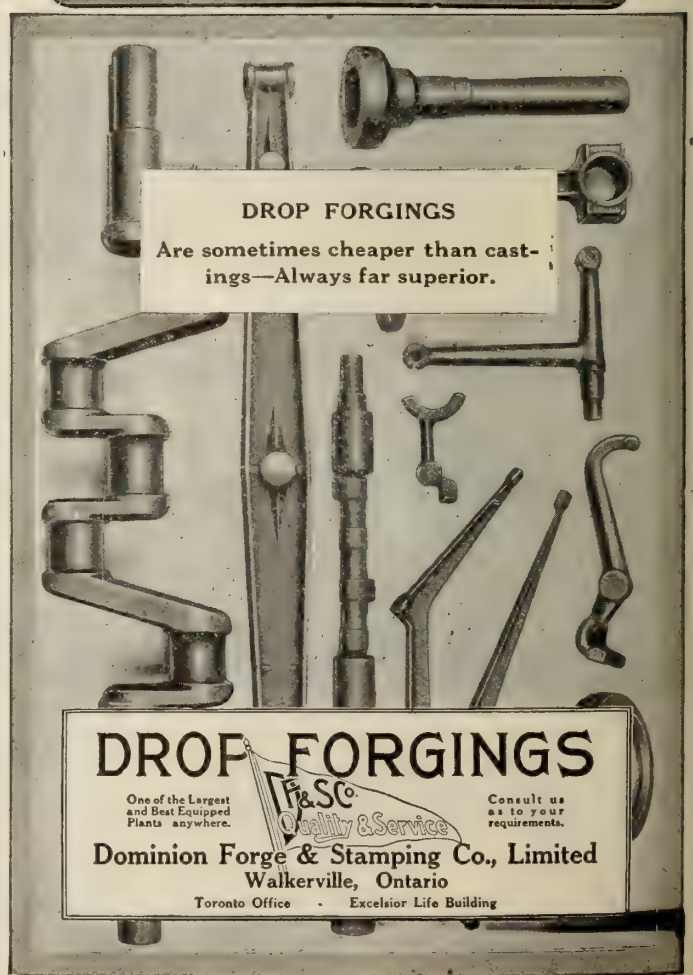


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16 Sizes with / without Stubs

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Are sometimes cheaper than castings—Always far superior.

DROP FORGINGS

One of the Largest and Best Equipped Plants anywhere.

F & S Co. Quality & Service

Consult us as to your requirements.

Dominion Forge & Stamping Co., Limited

Walkerville, Ontario

Toronto Office - Excelsior Life Building

Increased Output
and
Lower Operating Costs

follow the use of

P.H. and IMPERIAL FILES.

P H

IMPERIAL

"They Cut Faster and Wear Longer."

Be File-Wise.

INGERSOLL FILE COMPANY, LIMITED.

John Morrow Screw and Nut Company Limited,
Sole Distributors,
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INGERSOLL

ALLIGATOR

TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING



Push Your ALLIGATOR Sales

Quick application, belt saving features, economy and general satisfaction make ALLIGATOR Steel Belt Lacing the logical belt lacing to sell your trade.

ALLIGATOR Steel Belt Lacing works equally well on any kind or thickness of power or conveyor belting. Anyone can put it on. Requires no tool but a hammer. Three minutes' average time makes a permanent, flexible joint, with two working surfaces, that is stronger than any other known.

ALLIGATOR Steel Belt Lacing is being advertised nationally to master mechanics, shop superintendents, purchasing agents, executives, etc., in all classes of publications. Demand is growing stronger. A size and type for every need. Write on letterhead for samples and trade prices.

FLEXIBLE STEEL LACING CO.
4610 Lexington Street, Chicago, Ill., U.S.A.
135 Finsbury Pavement London, E.C., England
Stocked by the Best Supply Houses Throughout Canada



Be Sure Your Files Cut Clean

As soon as a file ceases to cut keenly at every stroke it has outlived its usefulness.

You will actually save money by throwing it away and buying a new file, because files cost less than workmen's time.

Long, efficient service is ensured by specifying one of these brands when ordering.

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GREAT WESTERN
AMERICAN
ARCADE
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Files and Rasps

Made in Canada by

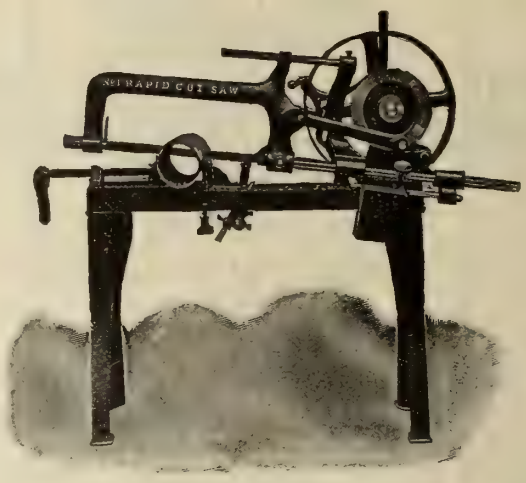
Nicholson File Company

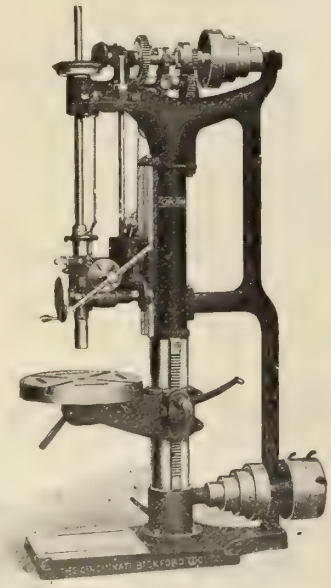
PORT HOPE, ONTARIO

MACHINERY AND SUPPLIES

Are You Taking Advantage of our "Exhibition" Invitation?

Many Toronto Exhibition Visitors will be taking advantage of the convenient location of our warehouses to "drop in" for a visit of inspection. We hope that you intend doing so also. Either at 131 Front St., W.—practically next door to the Union Station or at 27 Bathurst St. —on the way to the eastern Exhibition entrance —a cordial reception awaits you.







Canada's Dependable Machinery and Supply House

See Petrie before you place your orders for new equipment. Our fifty years of experience and square dealing will mean a lot to you.

If you can't call at our office or warehouse write us for particulars of any machine you need.

These and Scores of other Machines Displayed--

at our Bathurst St. warehouse. This huge structure covers

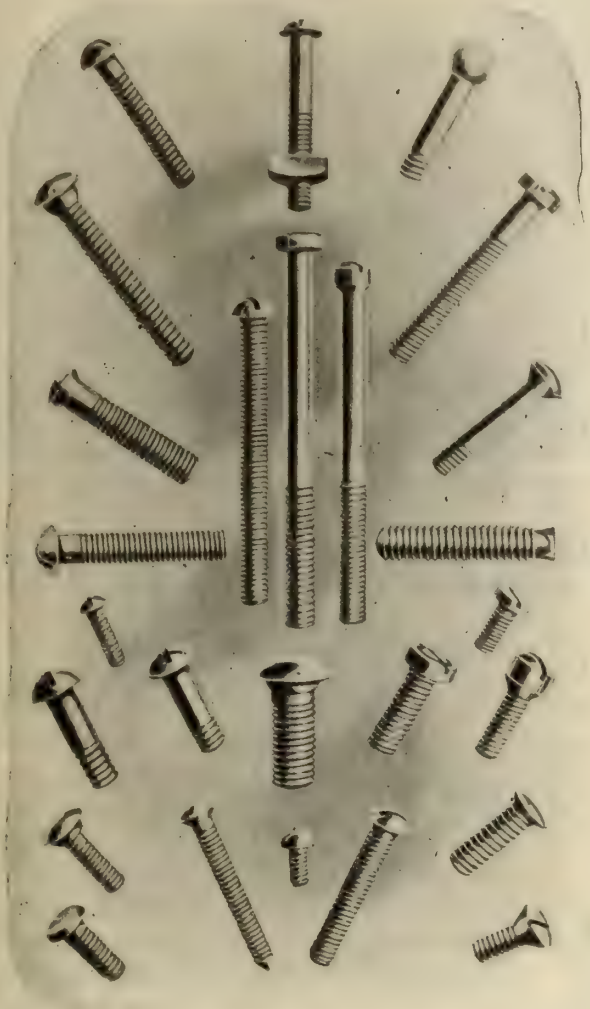
3½ Acres of Floor Space

and will contain a varied assortment of lathes, planers, millers, grinders, shapers, drills, boring mills, punches, shears, boilers, etc. No matter what you need you'll find it there.

H. W. PETRIE Limited

TORONTO and HAMILTON

"Repeat Orders" Built Our Business





Quality Products At a Modest Price

You can "sting" a man once but he doesn't generally "bite" the second time. If our policy was one of exorbitant initial prices we would have been out of business long ago.

But this is not our method. While we produce the highest quality Machine Screw Products possible we ask only a moderate profit. But we make our money through "repeat orders."

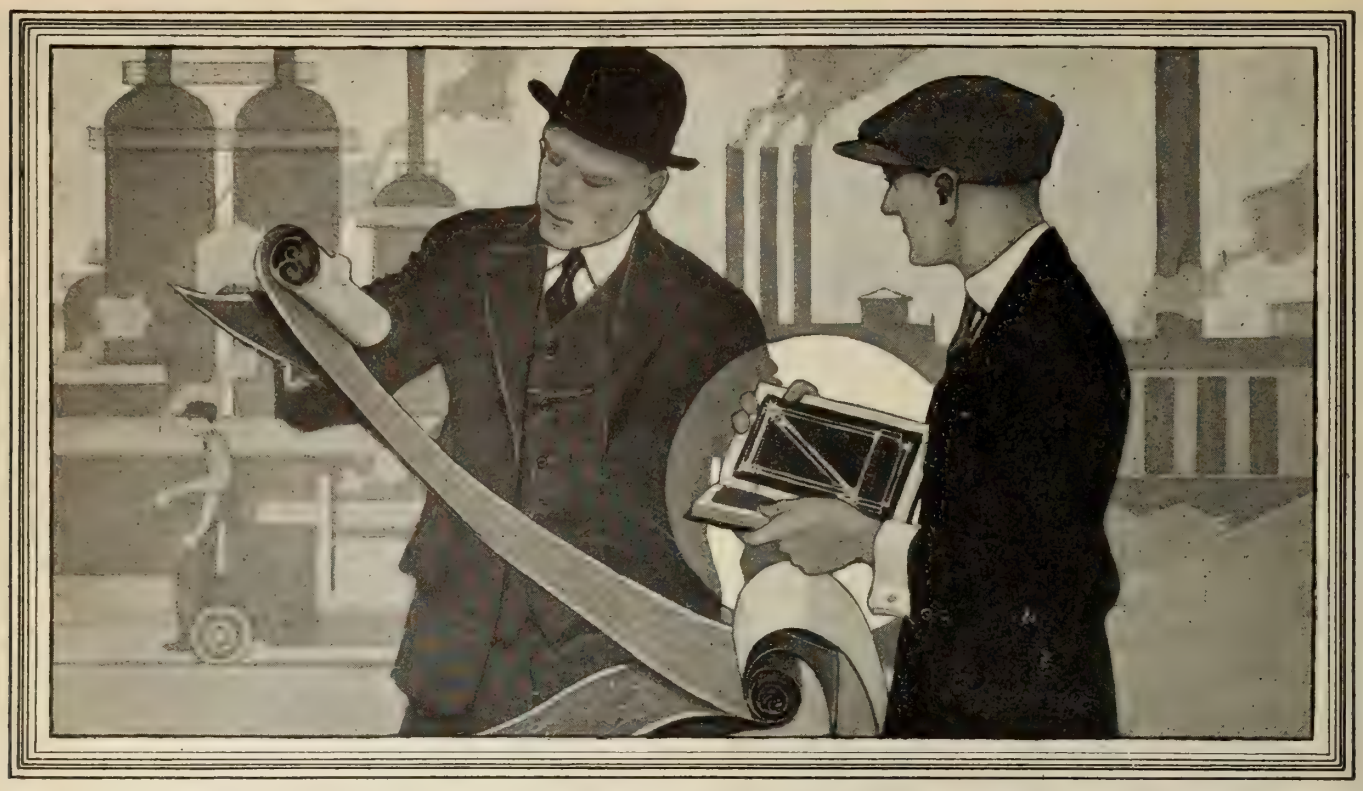
Canadian manufacturers recognize this. They know they get true economy by using Torrington Standard and Special Machine Screws, Rivets, Threaded Wires and Specialties.

MADE IN CANADA

Torrington

MACHINE SCREWS

The Torrington Co., Limited
Upper Bedford, Quebec



"Why Don't You Use PHOTOSTAT Prints"

And the PHOTOSTAT makes no mistakes.

It makes photographic facsimiles.

Let us send you a booklet containing letters from many firms telling of large savings through the use of the PHOTOSTAT.

IT is not necessary to carry around large, awkward blue prints for field and shop work. PHOTOSTAT copies can be made either of the blue print or of the original drawing, in a few minutes' time, and at a convenient size so that they will fit into a loose leaf book which is easily handled. Furthermore these copies will not fade or smut and being of uniform size can be conveniently filed for future reference after the job is completed.

The installation of a PHOTOSTAT in an industrial plant means the elimination to a large extent of tracing work, because pencil sketches are copied direct in photographic facsimile; or, if the original sketch is not available the blueprint can be copied equally well. Catalog pages, advertising layouts, maps, production charts, test reports, and documents of all kinds are also copied in photographic facsimile by the PHOTOSTAT with a great saving in time and money.

The PHOTOSTAT is made by the Eastman Kodak Co., exclusively for the

PHOTOSTAT CORPORATION

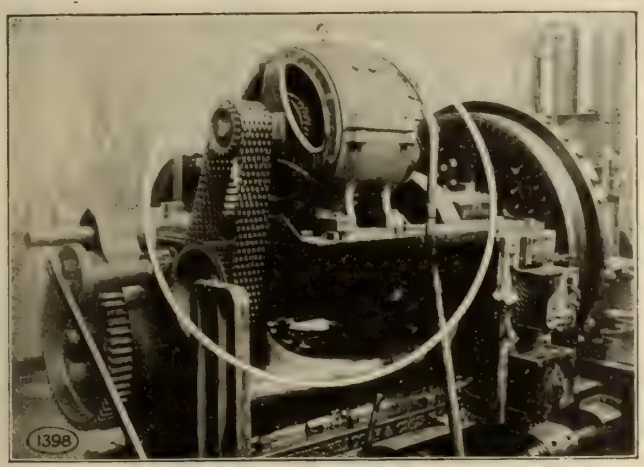
299 STATE STREET, - ROCHESTER, N.Y.

88 Broad Street, Boston. 19 South LaSalle Street, Chicago. 7 Dey Street, New York City. 1102 North American Building, Philadelphia. 429 Monadnock Bldg., San Francisco, 700 Tenth Street, N.W., Washington. Executive Office: Providence, R.I.

AGENCIES: Alfred Herbert, Ltd., Coventry, England; Paris; Milan; Brussels; Amsterdam; Calcutta; Yokohoma; Sydney. Graham Brothers, Stockholm.

PHOTOSTAT

RENOLD DRIVING CHAINS



Renold Inverted Tooth (Silent) Chain, 1.25-in. pitch, 6-in. wide, transmitting 20-H.P. from Motor to 36-in. Lathe.

When studying the transmission of power from Electric Motors to Machines, do not overlook

CHAIN DRIVING

as a means of obtaining constant

Maximum Efficiency

with a minimum of friction, noise and wear.

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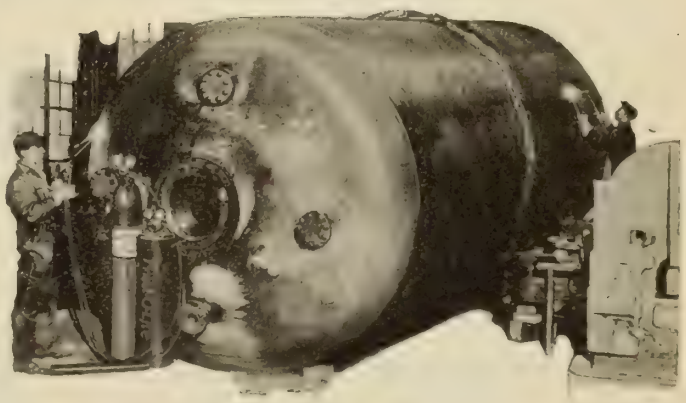
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of Tapping Square or Hexagon Nuts

MODERN manufacture and industrial readjustments demand a machine tool, which, besides being a high-speed producer, is capable of precision work under the most severe service.

Of such nature are Acme Nut-Tapping Machines. These easily-operated tools are limited to speed only by the endurance of the taps. For this reason Acme Machines most profitably meet to-day's demands.

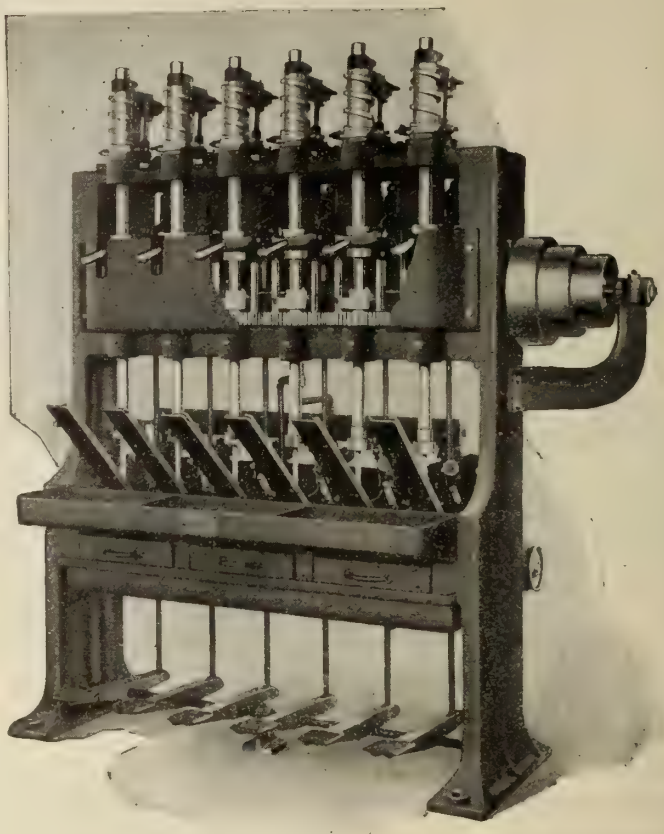
One plant has been using two Acme Tappers for eight years. They have subjected them to the most strenuous service, yet to-day each averages 10,000 threaded nuts per nine hour day with a spindle speed of 100 r.p.m., the limit of tap endurance on the tough material used.

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In every respect Acme ability clearly reflects the years of building experience.

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Nut Tapping Machines

Acme Six-Spindle, Semi-Automatic Nut Tappers have many important features which facilitate operation and increase speed. Each spindle is equipped with automatic lifting device which permits automatic feed to place nut under tap. Every action has been carefully developed and proved correct in practice. Write for further details.

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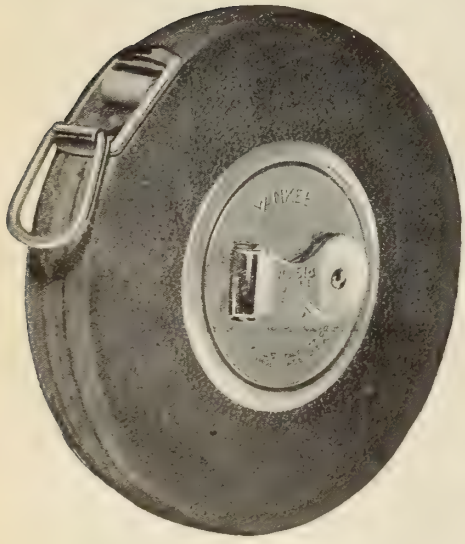
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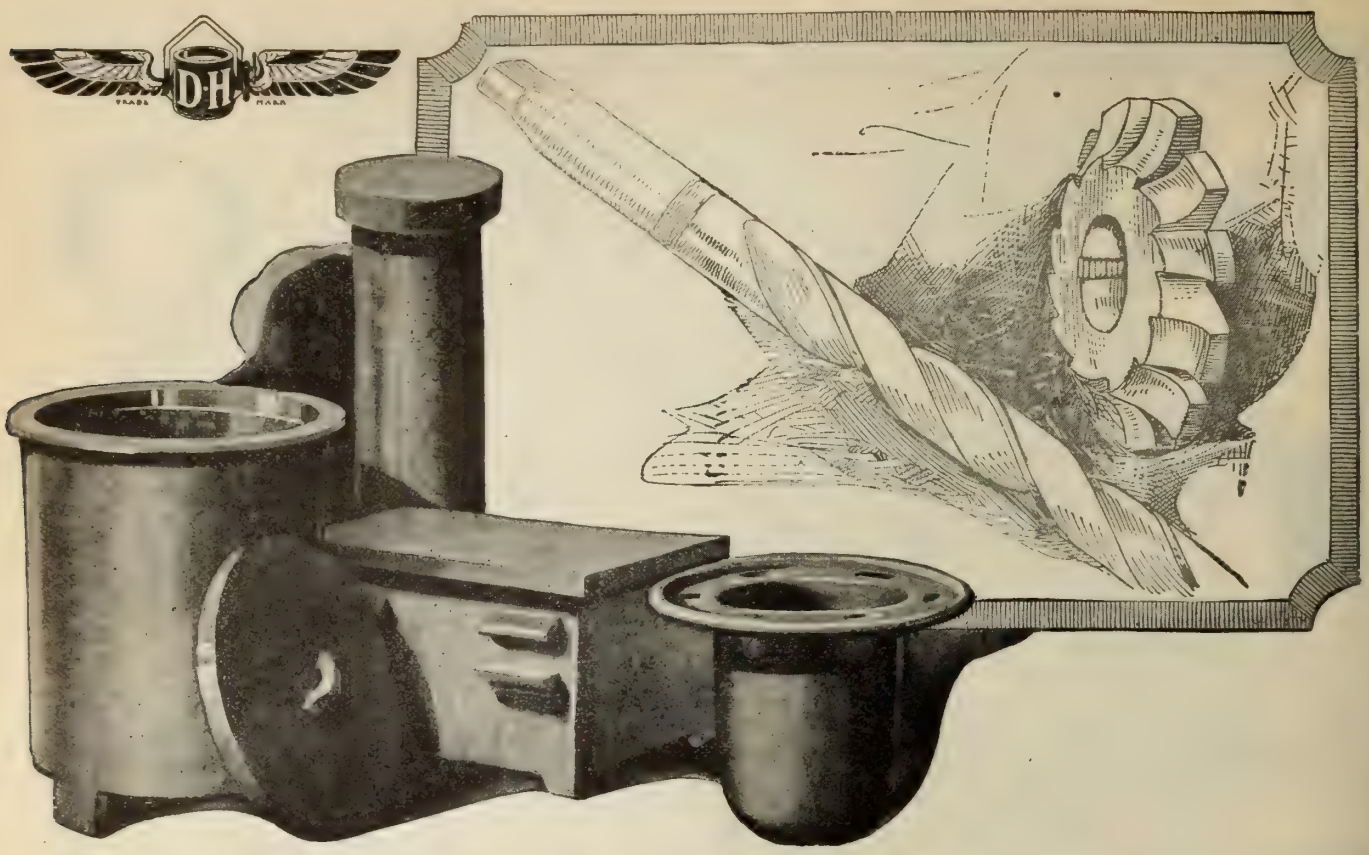
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The Mettle of the Cutting Tool

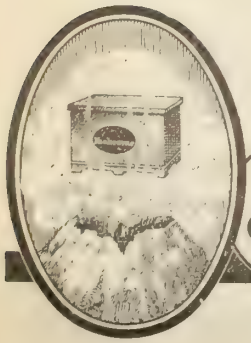
BASIC steel of proper quality may be the beginning of a good tool but it is far from the finished tool that meets the demand of present day practice.

And so it is with heat-treating equipment. The most highly perfected furnace equipment and other materials are handicapped if containers, muffles, racks, etc., crack, warp, scale and change in other ways that interfere with the process.

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Nichrome

CAST **Heat Treating Containers**

Endure in High Temperatures

WIRE ROPES

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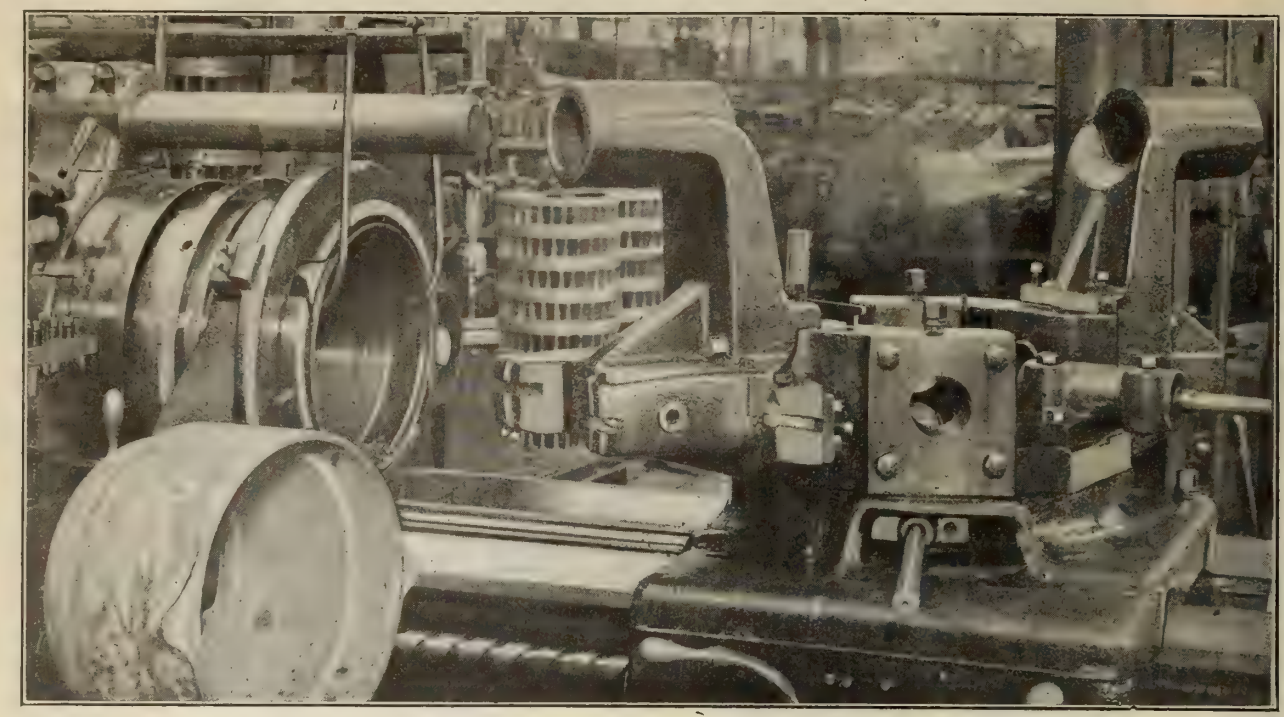
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Machining Delco Generator Frames

The photograph above shows a tool set-up on a Steinle 24-in. Turret Lathe for turning out Delco Generator Frames at the plant of the Delco Light Company of Dayton, Ohio.

The chucking fixture revolves in a steady rest and is equipped with centering and stop pins for centering and locating rear end of frame by pulling sleeve collar forward. Set screws hold the front end in place. The turret fixture is reinforced in the machining operation by the overhead bar support; thus preventing undue chatter or jar under the heavy cuts taken.

This is only one of a number of installations in plants manufacturing electrical equipment where the Steinle is called upon to produce various parts from castings, forgings or bar stock.

In view of present manufacturing conditions it is invariably performance that counts and the Steinle qualities of accuracy, speed, ease of operation, power, reliability, and economy of upkeep are guarantees of satisfactory performance on your own work.

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Finish—Bore, Counterbore, Face Bottom, Face Lugs
Time—25 Minutes Each

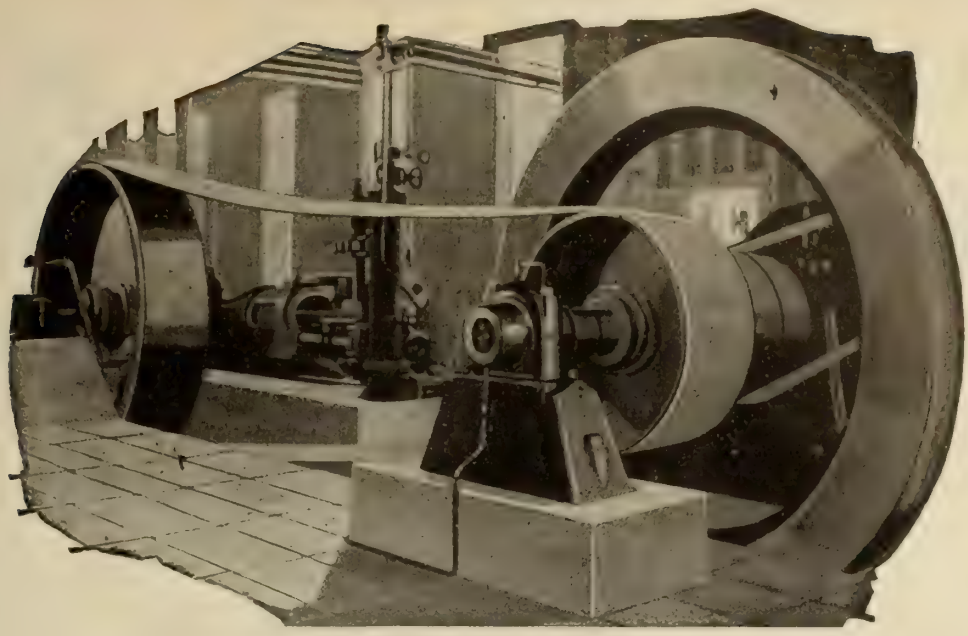
Why not send us your blueprints if your requirements call for the installation of equipment of this character? We shall be glad to furnish you with production and tooling estimates, or to have a qualified representative call and take up the question of Steinle methods as applied to your production problems.

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Originators of the full swing side carriage turret lathe

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Miscellaneous

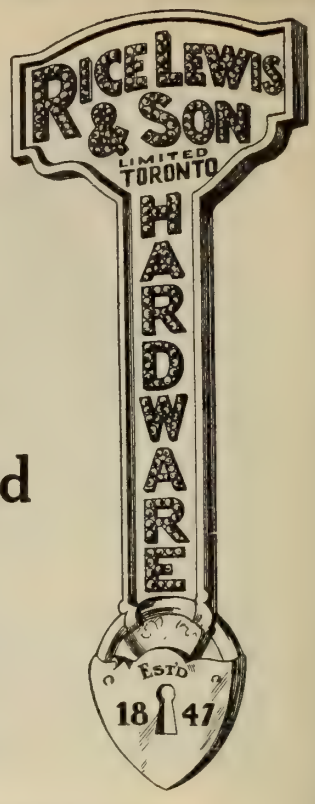
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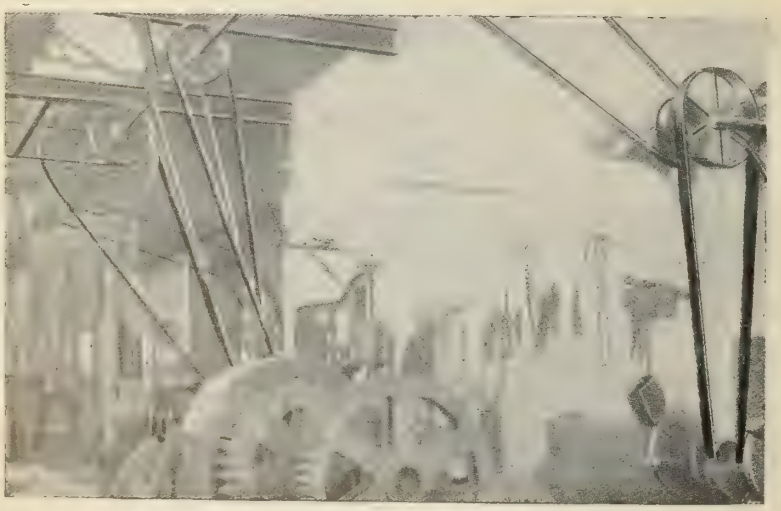
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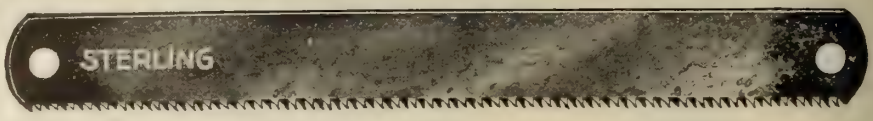
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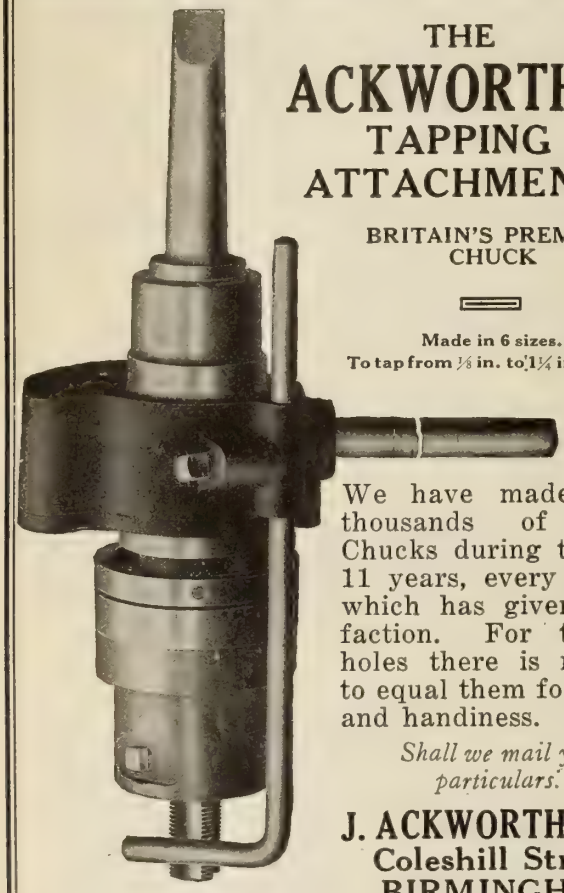
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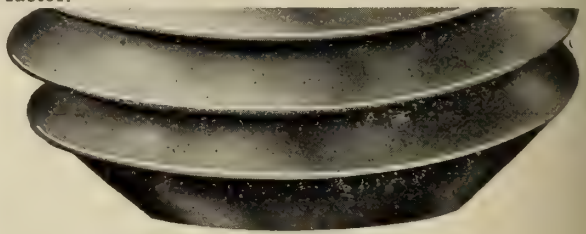
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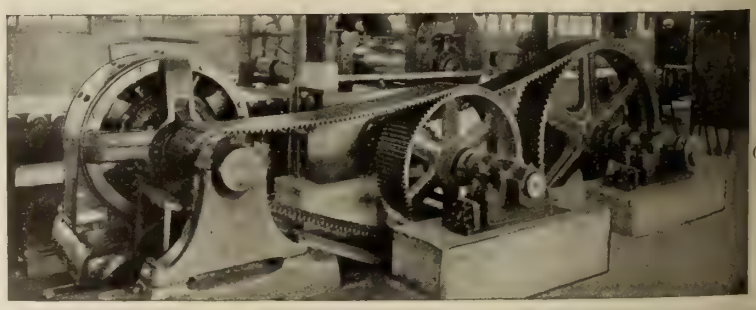
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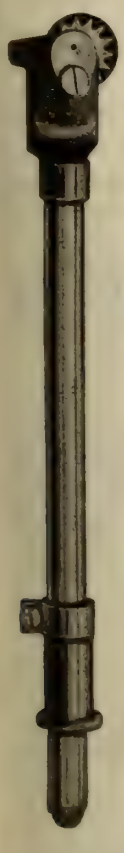
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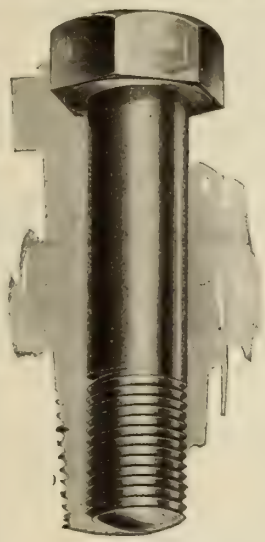
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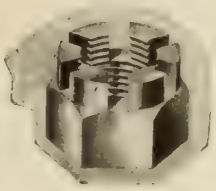
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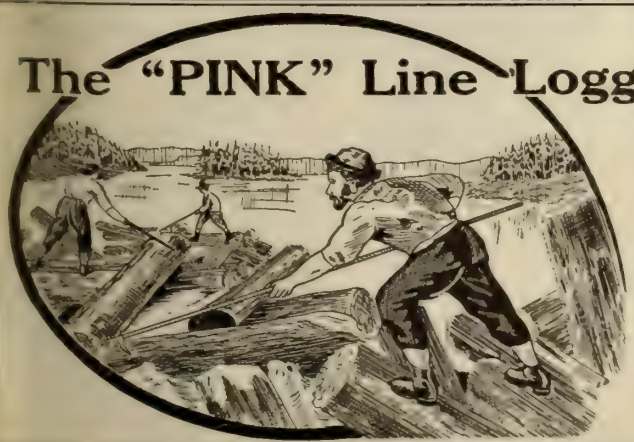
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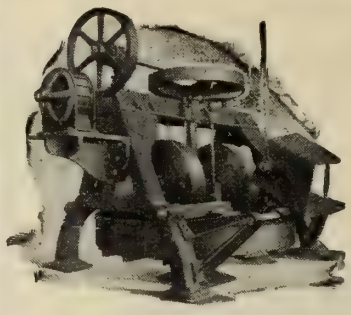
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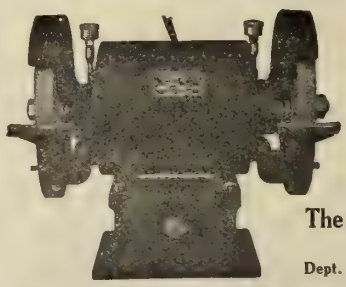
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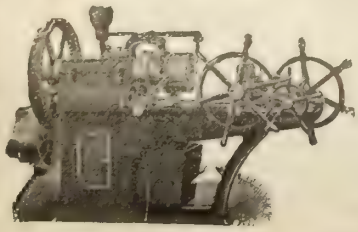
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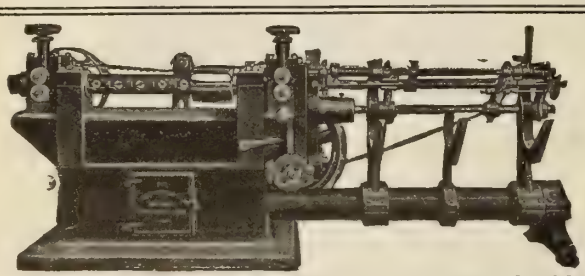
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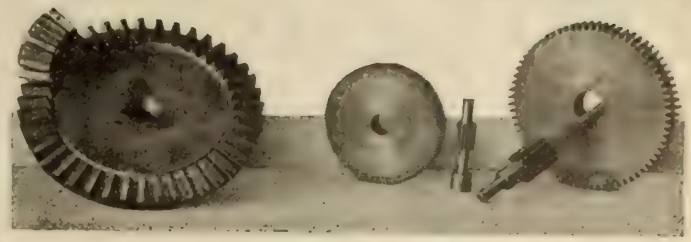
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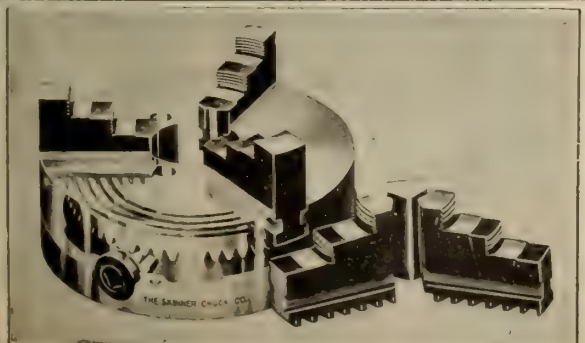
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Dom. Foundries & Steel, Hamilton, Ont.
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Blocks, Pillow
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Acme Machinery Co., Cleveland, Ohio
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Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.
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Garlock-Walker Mchy. Co., Toronto, On
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Garlock-Walker Mchy. Co., Toronto, O
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mi
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
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Boring Tools
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Armstrong Bros. Tool Co., Chicago.
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Ontario Metal Products Co., Ltd., T onto, Ont.

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Puro Sanitary Drinking Fountain Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Haydenville, Mass.

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MacKinnon Steel Co., Sherbrooke,

Broaching Machines
Bilton Machine Co., Bridgeport, Conn
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Ontario Metal Products Co., Ltd., onto, Ont.

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British Smelting & Refining Co., Montreal, Que.
Canada Metal Co., Ltd., Toronto, On
Ontario Metal Products Co., Ltd., onto, Ont.

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Can. Link-Belt Co., Toronto, Ont.

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Blount Co., J. G., Everett, Mass.
Can Hanson & Van Winkle Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
U S. Electrical Tool Co., Cincinnat

Bulldozers
Bertram & Son Co., Ltd., The Dundas, Ont.
Canada Machinery Corp., Galt, On
Garlock-Walker Mchy. Co., Toronto

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General Combustion Co. of Can., Montreal, Que.
Rockwell Co., W. S., New York Ci

Burrs
Steel Co. of Canada, Ltd., Hamilton

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Fisher Motor Co., Ltd., Orillia, O
Morrow Screw & Nut Co., Ltd., Ingersoll, Ont.

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S. F. Bowser & Co., Ltd., Toronto

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Brown & Sharpe Mfg. Co., Providen
Starrett Co., L. S., Athol, Mass.

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Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.

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Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.
Can. Hansen & Van Winkle Co., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Bassfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton,

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont
Canada Electric Castings Co., Ltd., Orillia.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

astings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

[illegible]s, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

astings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

astings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

astings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

astings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont.

astings, Semi-Steel
Dartmouth Mfg. Co., Thos., Montreal, Que.
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

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Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Wheeler Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smooth-On Mfg. Co., Jersey City, N.J.

Centering Machines
Hanson & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Page Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Weight Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Glassco, Montreal, Que.
Page Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Weight Mfg. Co., Lisbon, Ohio.

Chains
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Toronto Testing Laboratory, Toronto, Ont.

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Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O.
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Banfield & Sons, Ltd., W. H., Toronto.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Ford-Smith Machine Co., Hamilton, Ont
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd. Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd. Montreal, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd Montreal, Que.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Oil and Ga
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrook Que.
Can. Fairbanks-Morse Co., Ltd., Montrea
General Combustion Co. of Can., Ltd Montreal, Que.
Mechanical Engineering Co., Three River Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealin
Brown & Sharpe Mfg. Co., Providence, R.
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Three River Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, On

Gages, Comparator
Jones & Lamson Machine Co., Spring

BUYERS' DIRECTORY

field, Vt.
Herbert Ltd., Alfred, Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Chesterman & Co., Ltd., J., Sheffield, Eng.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthle, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis
Johansson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthle, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glasco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia.
Renold (Hans) of Canada, Ltd., Montreal, Que
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Can. Steel Foundries, Montreal, Que.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can Wire & Iron Goods Co., Hamilton, Ont

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Can. Link-Belt Co., Toronto, Ont.
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Terry & Co., John C., Birmingham, Eng
Williams Machinery & Supply Co., A. R., Montreal Que.

Hardening, Case-Hardening and Tempering
Hamilton Gear & Machine Co., Toronto, Ont.

Hardness Testing Apparatus
Shore Instrument Co., Jamaica, N.Y

Heating
Skinner Bros. Mfg. Co., Inc., St. Louis Mo.

Hobbing Machines
Herbert Ltd., Alfred, Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can. Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton.

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Stewart & Co., Duncan Glasgow Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation

BUYERS' DIRECTORY

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co. Ltd., Montreal, Que.

Japanning and Varnishing Ovens
[illegible], Ont.

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Sidney Machine Tool Co., Sidney, Ohio
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton,
Dennis Wire & Iron Works, London, Ont.

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy Co., Toronto, Ont
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mil Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, On

Nitrogen
L'Air Liquide Society, Toronto, Ont

Nut Tappers (See Bolt and Nut M chinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The Joh Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montre
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper B ford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, O

Nuts, S.A.E., Plain and Castellate
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, C

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, C

Oils
Canadian Oil Companies, Ltd., Toro Ont.
Cateract Refining Co., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, O

Oils, Soluble
Cateract Refining Co., Toronto, Ont
Imperial Oil Ltd., Toronto, Ont
Brantford Oven & Rack Co., Brantford,

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worce Mass.
Guildford & Sons, L..., Halifax, N.S

Packing, Steam
Can. Consolidated Rubber Co., Ltd Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Mont
Graton & Knight Mfg. Co., Worce Mass.

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Alkenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven Mich

Polishing and Buffing Machines
Armstrong, Whitworth, John, Birmingham, Eng.
Armstrong & Co., Chas. P., Montreal, Q.
Bissett Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto Ont
Clarke Smith Machine Co., Hamilton, Ont.
Garlock Walker Mchy. Co., Toronto, Ont.
Perm & Co., John C., Birmingham, Eng.

Pen Steel
Scottish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Armstrong, Whitworth Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Chas. P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pollinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Alkenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Alkenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Alkenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal. Q

Screens
Can. Wire & Iron Goods Co., Hamilton,

BUYERS' DIRECTORY

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrew Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, On

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, On

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Qu
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfiel Vermont.
Murchey Machine & Tool Co., Detro Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Lt Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfie Vermont.
Landis Machine Co., Inc., Waynesboro, P

Threaded Wires
Torrington Company, Ltd., Upper Be ford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont
Jones & Lamson Machine Co., Spri field, Vt.
Murchey Machine & Tool Co., Detr Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Bra ford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Spri field, Vt.
Pratt & Whitney Co., of Canada, L Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, O

Tongs
Hepburn Ltd., John T., Toronto, Ont

Tool Cases
Rice Lewis & Son, Ltd., Toronto, On

Tool Holders
Armstrong Bros. Tool Co., Chicago,
Bilton Machine Co., Bridgeport, Conn
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbr Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The Dundas, Ont.
Canada Machinery Corp., Galt, Ont
Williams & Co., J. H., Brooklyn, N

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Burgess & Marchand, Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Chesterman & Co., Ltd., J., Sheffield, Eng.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ...eering Service, Ltd., Hamilton, ...t
Herbert Ltd., Alfred, Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.
National Machine Tool Co., Racine, Wis.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
...n. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Maple Leaf Mfg. Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

Trucks, Industrial Motor
Maple Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

...ubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
...rris Metal Products Co., Ltd., Tor... Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Dominion Engineering Works, Limited, Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.

Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co. Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

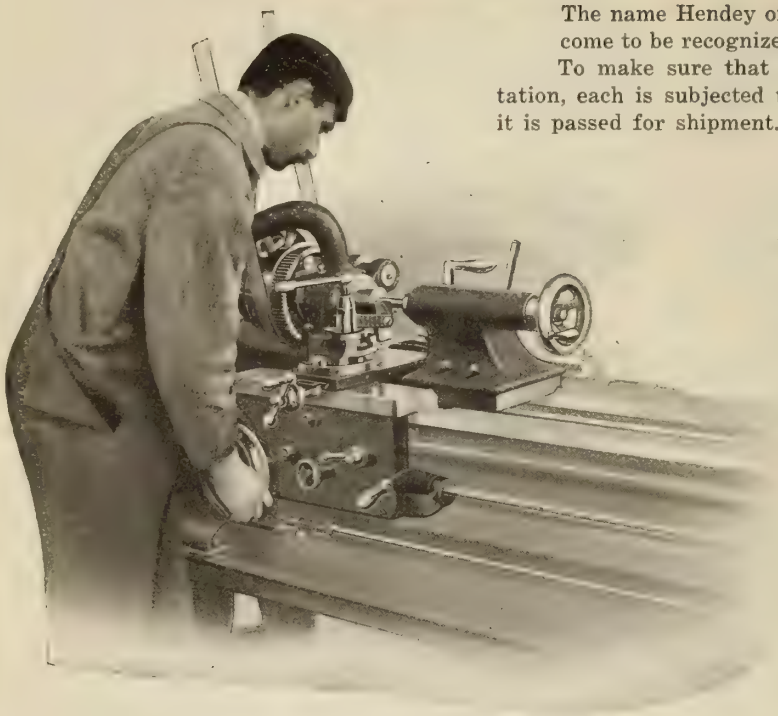
WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

SHEFFIELD ENGINEERING SUPPLIES LIMITED
"DORMER" BRAND
H. S. DRILLS REAMERS STEEL
MILLING-CUTTERS FILES HACK-SAW BLADES
"Safety" Plastic Metallic Packing
230 CRAIG ST. W. MONTREAL, CANADA

MILWAUKEE MILLING MACHINES
ACCURATE RIGID DEPENDABLE
Manufactured in various types and sizes
for all classes of milling.
KEARNEY & TRECKER
CORPORATION
MILWAUKEE WIS., U. S. A.

HENDEY



The name Hendey on a lathe, shaper, miller or centering machine has come to be recognized as a mark indicative of exceptional performance. To make sure that every machine will live up to the Hendey reputation, each is subjected to a careful, well-rounded system of tests before it is passed for shipment.

The test here shown is for the alignment of the tai. spindle with head spindle of a Hendey Lathe. The requirements allow the axis of the tail spindle to be either exact with that of the head spindle or else run not to exceed .001" high. The latter is not objectionable as in cases where tailstock is frequently moved along bed, the first wear will tend to bring the tail centre in closer alignment with the head centre. A record showing results of each test on machine is furnished the purchaser.

The Hendey Machine Co.
Torrington, Conn., U.S.A.

CANADIAN AGENTS:

A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Winnipeg, Man.
A. R Williams Machinery Co., Vancouver, B.C.
A. R. Williams Machinery Co., St. John, N.B.
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Jacobs Super Chuck

Patented 1909-1915. Other patents pending



A Look Inside

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FIRST THE BODY—scientifically casehardened; size limits within .0005″, arbor hole ground on a special fixture with six gages to position it accurately in relation to the hole for the jaw.

THE SLOT FOR THE NUT, correctly located in relation to the jaw holes by means of micrometer gages, insures a properly fitting thread on the nut and jaws.

NO WEAR ON KEY HOLES because of the deeply casehardened body, result—a well fitting Gear on Sleeve and Key.

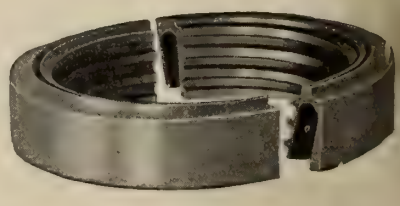


THE JAW, OF TOOL STEEL, has glass hard gripping surface; threads are tough, and all surfaces are ground on centers to within **a quarter of a thousandth** of an inch.
THE NUT, of special analysis steel, is ground after heat-treatment, in correct alignment with thread; tolerance .0005″.

THE BALL RACE comes within limits of .0001″; finest grade balls are used. An important point is the pitch of thread on nut—angle is 90 degrees to center line of jaw, so part cannot run over thread of latter.



The Jacobs Super Chuck centers a drill, **accurately,** and will continue to do so after years of use. It saves its cost time and again by preventing drill breakage. Its correct balance preserves bearings of your drilling machine—order a Super Chuck from your dealer.



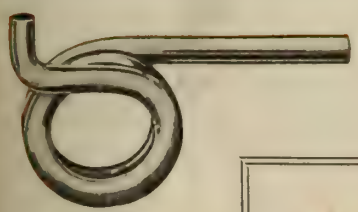
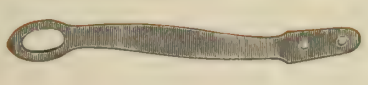
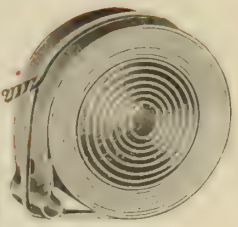
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Hartford, Connecticut, U.S.A.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVI., No. 10 Published by the MacLean Publishing Company, Limited, Toronto, Ont. Sept. 8, 1921 $4.00 a Year Subscription Price

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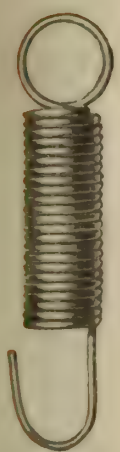
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To Our Many Customers—

and friends in Canada, we take pleasure in announcing the incorporation of the Wallace Barnes Co., Ltd., in Hamilton, Ontario. This corporation, with a completely equipped factory and under the management of men of long experience, is now ready to enter into the manufacture of springs for the Canadian trade.

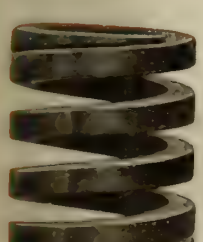
The quality of output and the financial integrity that has characterized the parent plant in Bristol, Conn., for over half a century will characterize the Canadian plant.

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The BERTRAM Page

MACHINE TOOLS

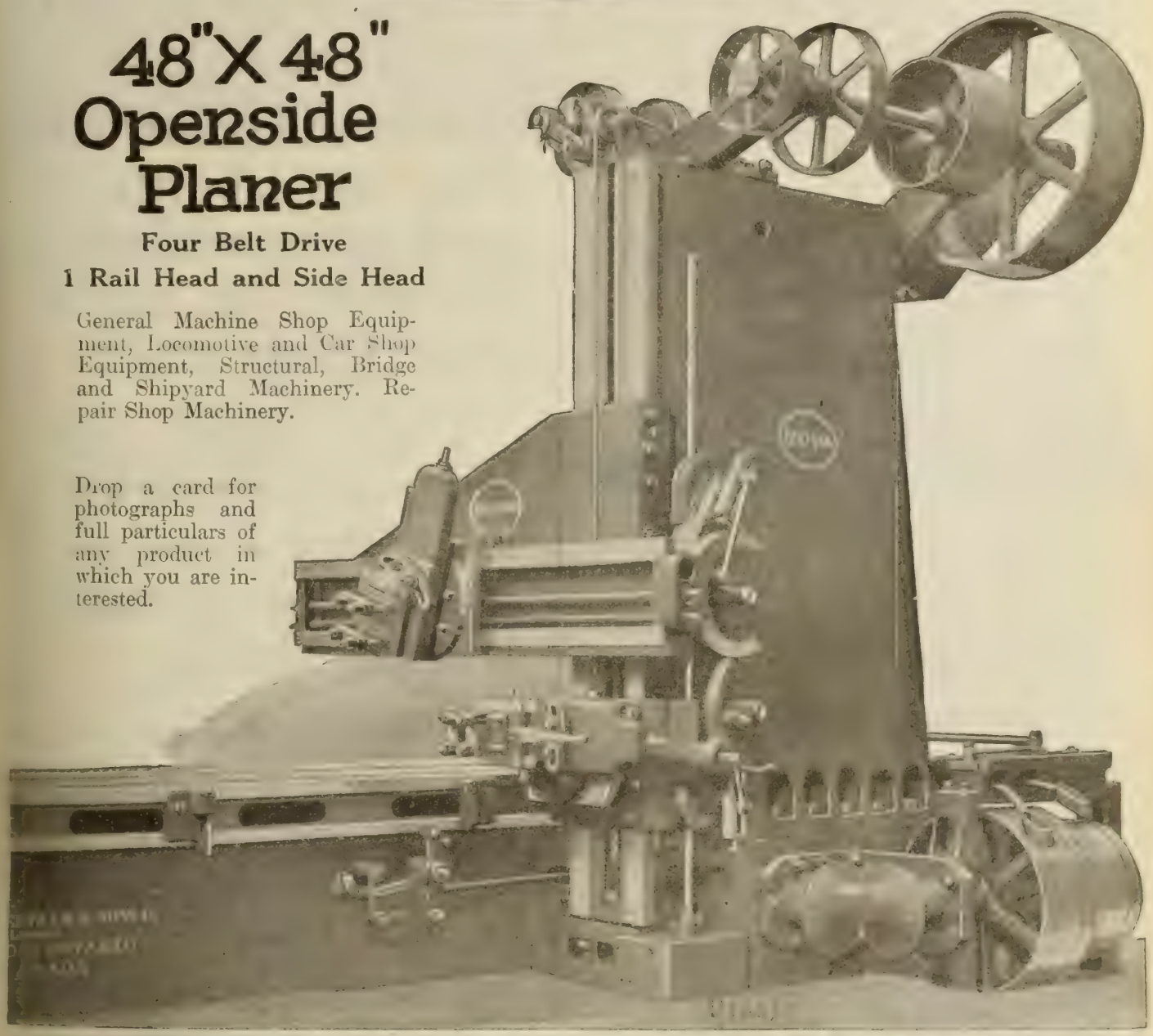
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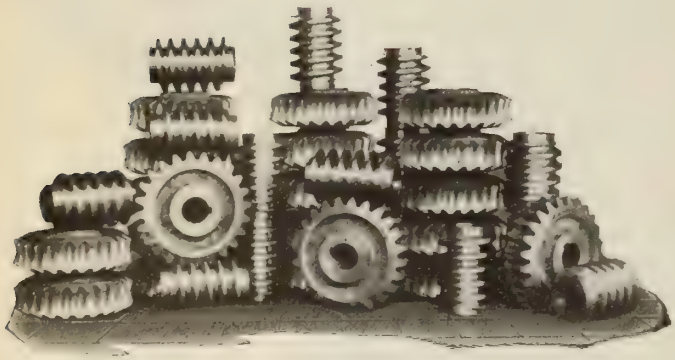
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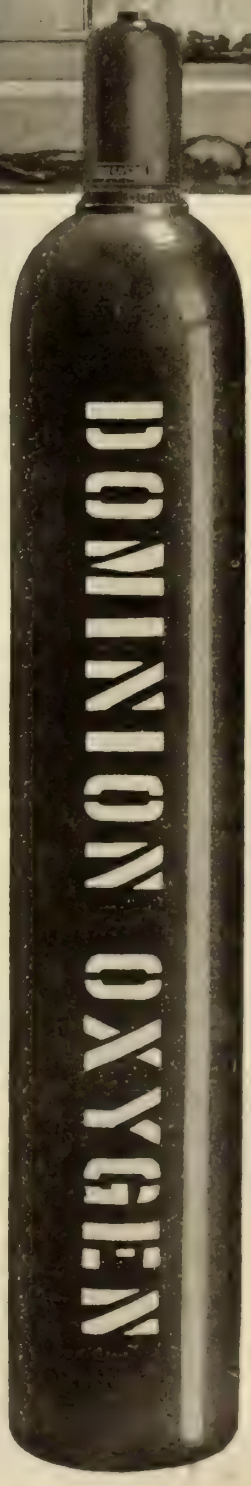
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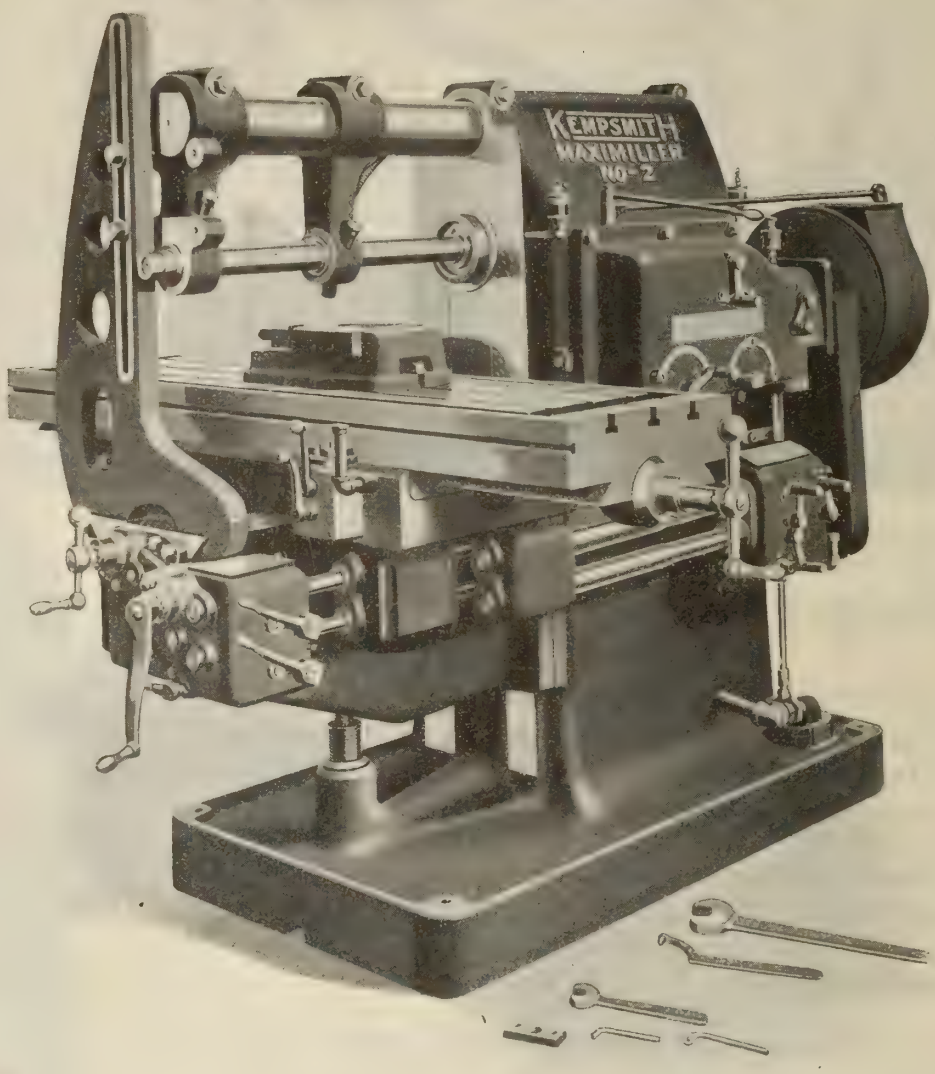


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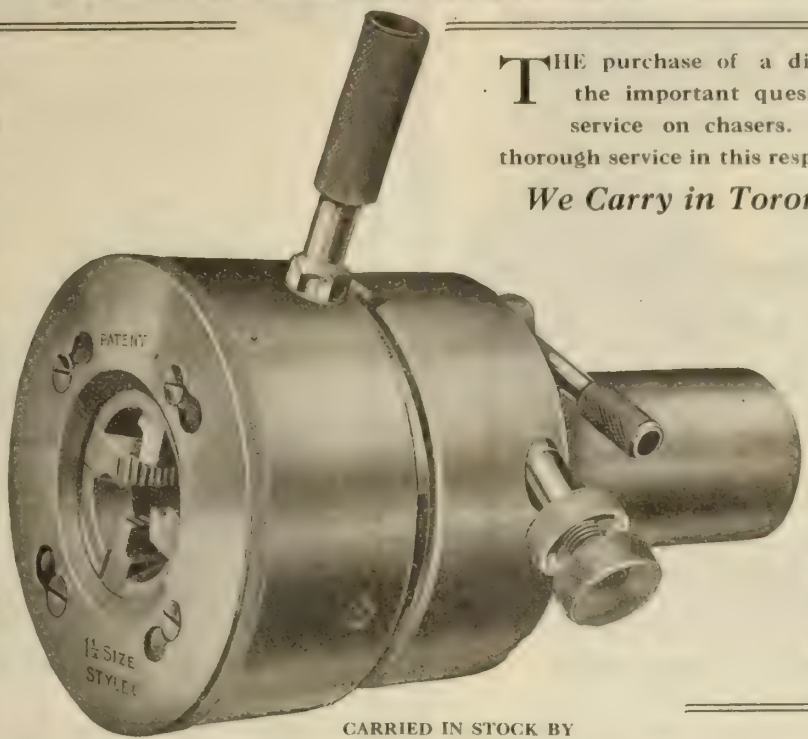
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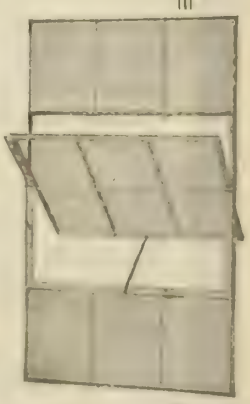
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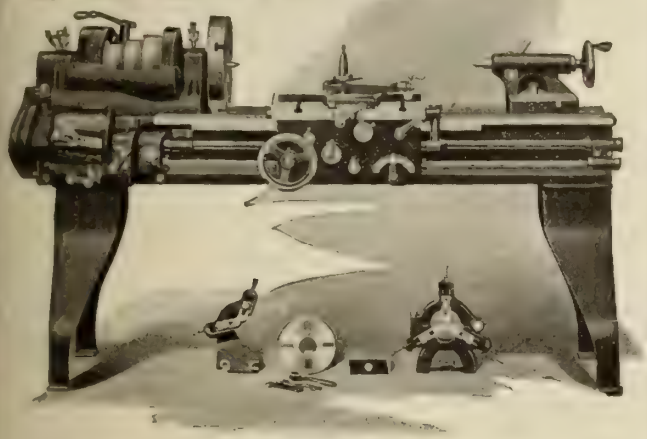
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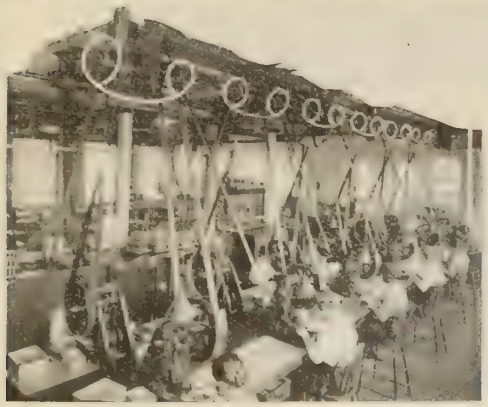
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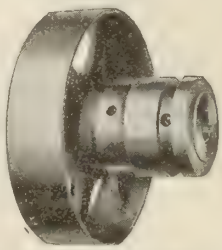
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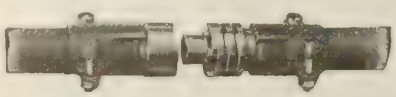


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For this service we have developed a hot rolled process drill known as the Canadian-Detroit Double-D (DD) Rolled Drill. It combines the strength of the forged type drill with the accuracy and uniformity of the milled type.

The flute of the DD is formed straight from the bar stock by successive passes through specially built and patented rolls at a temperature of 1850° F. This mechanical rolling of the flutes produces a refinement and uniformity in the grain of the steel and gives additional density at the centre and at the outer edge. Each drill is rolled separately, and the rolls are so designed and operated as to produce the same uniform increase in web thickness as is obtained in high-grade drill of the milled type.

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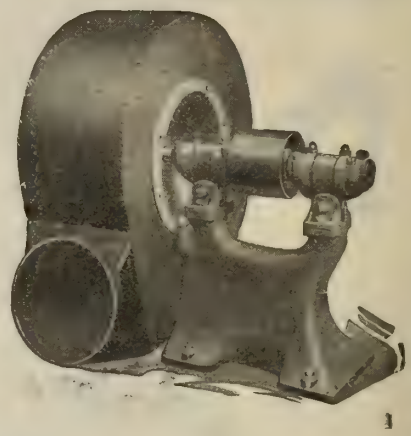
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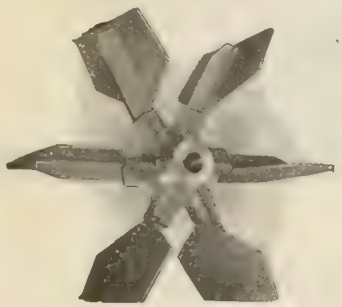
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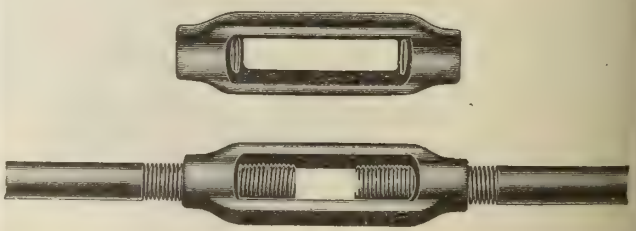
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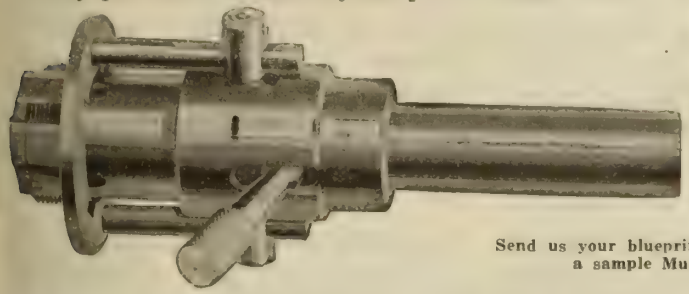
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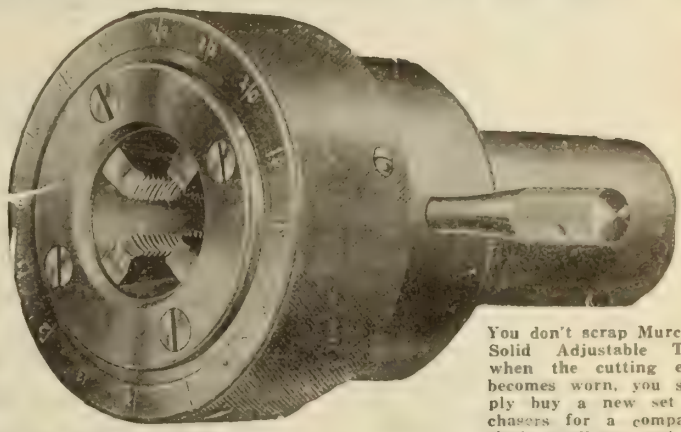
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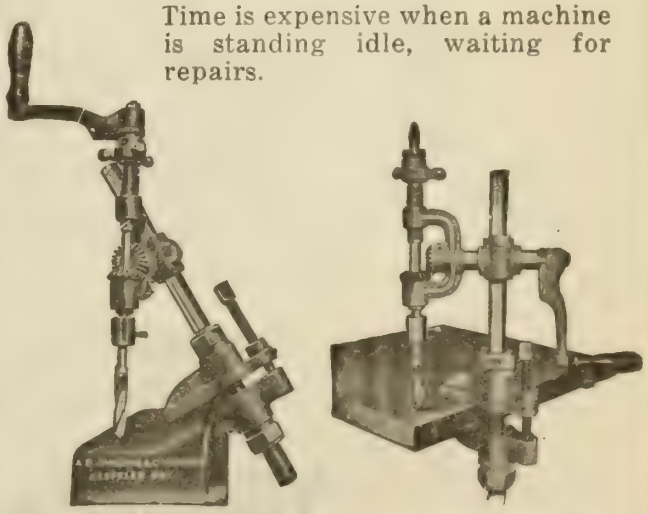
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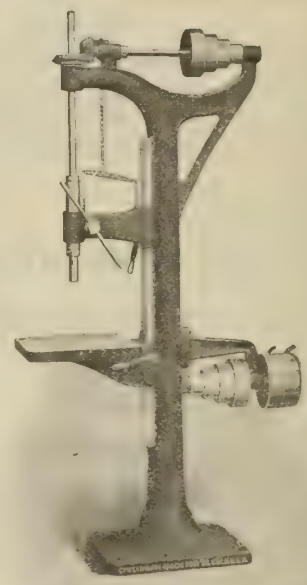
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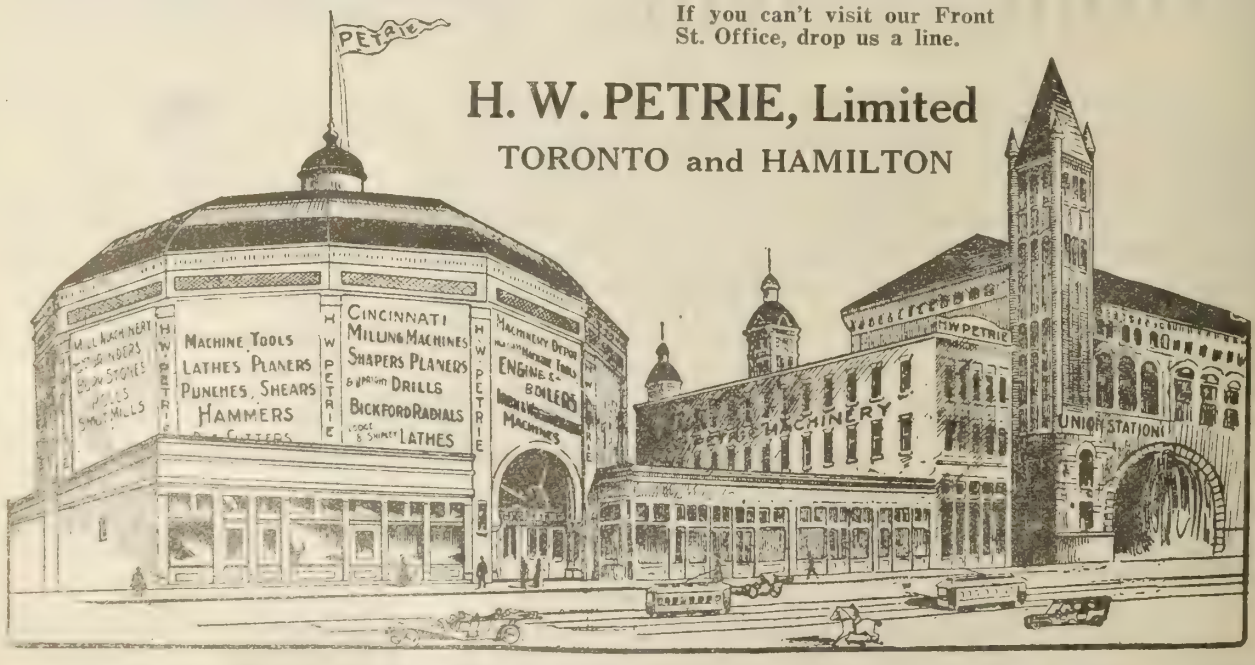
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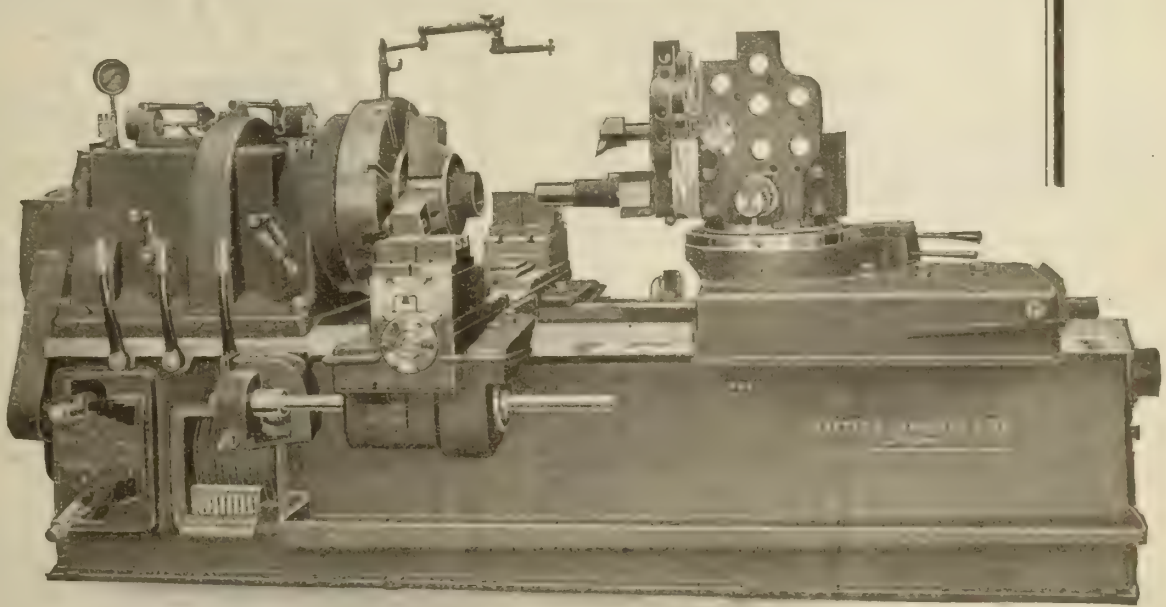
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Diameter of Holes in Turret	3"
Depth of Holes in Turret	4½"
Distances from Centre of Turret Hole to Top of Turret Slide	5"
Maximum Turret Slide Travel	28"
Turret Feed	28"
Length of Turret Slide Travel which permits of Supporting or Piloting Turret Boring Tools	15½"
Turret Slide Adjustment	13"
Front Spindle Bearing	7¾" dia. by 7" long
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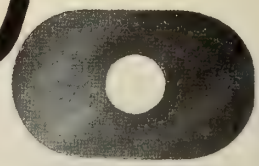
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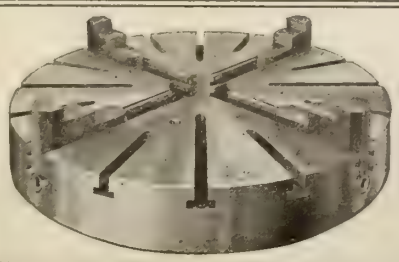
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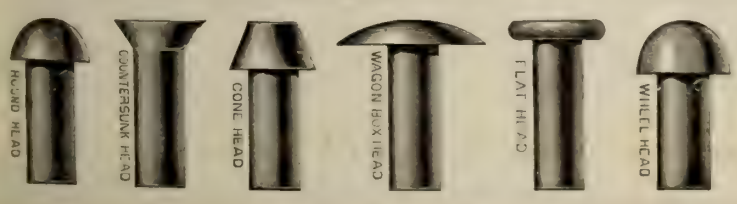
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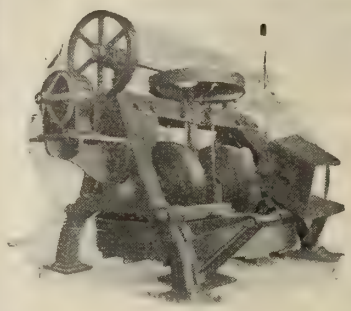
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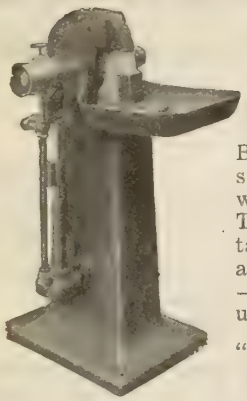
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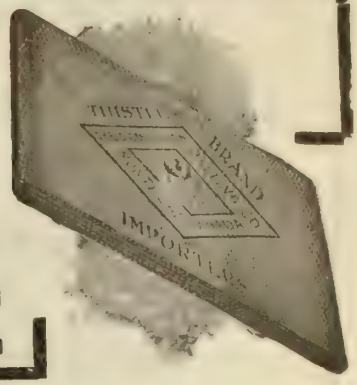
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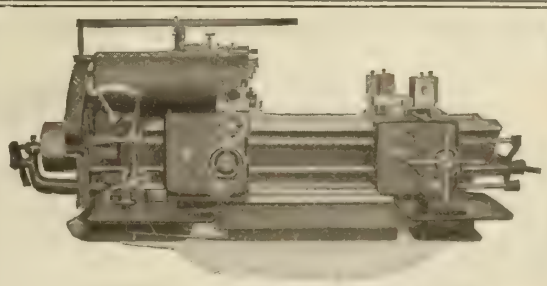
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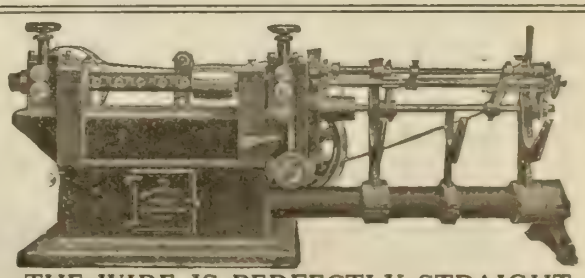
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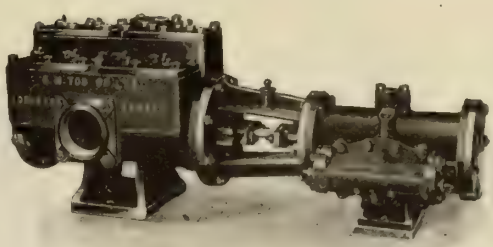
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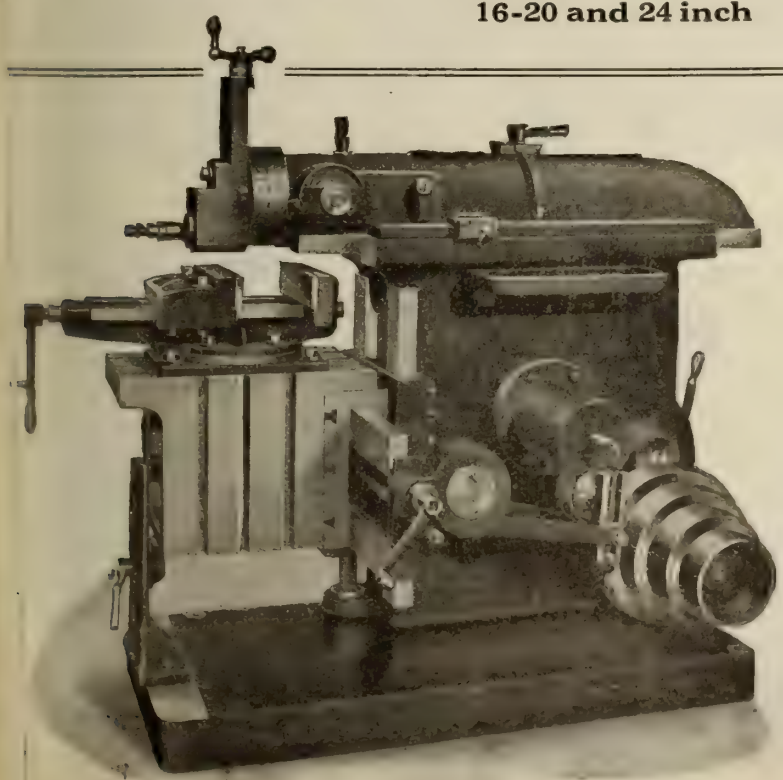
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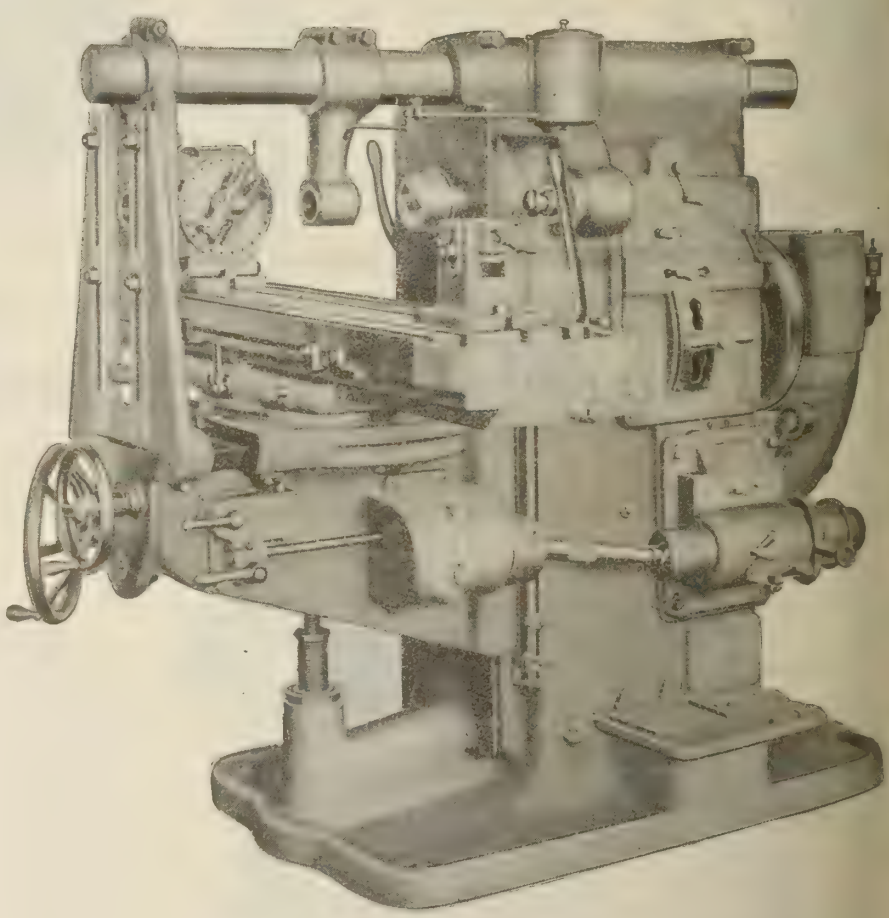
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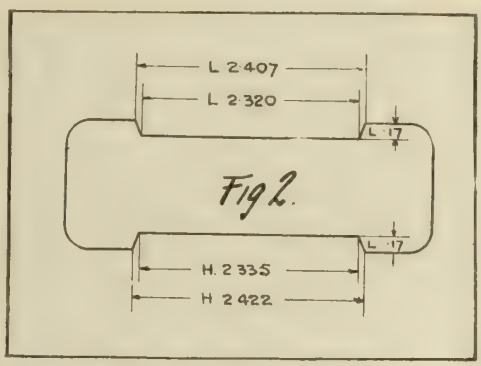
VOL. XXVI, No. 10. September 8, 1921.

Some Precision Measuring Methods Adopted

Microscopic Measuring Machine for Testing Screw Thread Tools, Form Tools, Gauges, Etc.—How Machine is Usd—Measuring Pitch and Angle of Threads—Diameter Measuring Machines

THERE was a period when a thirty-second looked to a mechanic like a thousandth part of an inch, but these days of precision and interangeability, the craftsman actually eats a mere thousandth as an every day currence. Since the light wave method measurement came into being a millth of an inch is a commercial possibty. We will not attempt however, in present material to describe the light ve system, but shall confine our attion to two machines that are found common use through industrial nts.

ake for example Fig. 1. shows a roscopic measuring machine that is d as a convenient and accurate methof taking the measurement of screw ad tools, form tools, gauges, threaded k, and similar articles with a conThis type of machine is well a- for measuring lengths, angles pitches. It does not depend on s for its accuracy, but upon end suring rods and large-dial micros graduated to .0001-in. It can, therefore, be relied upon to give accurate results throughout its life, as the measuring rods which are used in making all length measurements can be readily checked by well-known means.



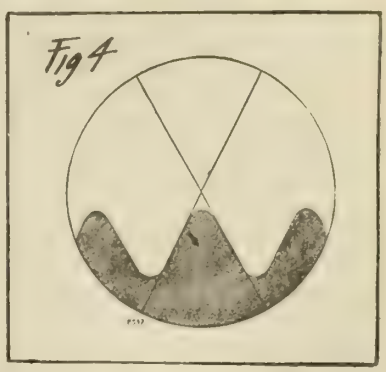


Fig. 2 — A Limit Gauge.
Fig. 4 — The two hairlines set to the profile of the thread for angular measurement.

The machine consists of two main parts viz., A. a rigid box bed, and B. a microscope. The rigid box bed carries a table capable of 12-in. movement by accurate amounts through the insertion and removal of standard hardened steel measuring rods of known length between flat pieces which are hardened; these contact pieces are mounted one on the end of the bed and one on the end of the table. This table is fitted with a pair of centres, one of which is adjustable in a crosswise direction to enable work to be lined up accurately.

The Microscope

The microscope has a vertical movement by means of rack and pinion for focussing, and is mounted on a compound slide rest, with screw movements parallel with the slides and at right angles to the table slide. It is fitted with two hair lines across its diameter, one rotating with the outside tube and the other rotating with the eyepiece.

The outer tube carries a large dial carefully graduated in half degrees. The eyepiece carries a vernier, which enables readings accurate to one minute to be made. Thus the angle between the two hair lines is indicated to the finest commercial accuracy.

A Light Projector, clearly seen in photograph, is fitted to the machine to project parallel rays of light through a lens on to a mirror placed at an angle, and so past the work. When measuring threads this attachment eliminates all shadows and light projected from the flanks of the thread which tend to make the object indistinct. The mirror is adjustable to suit the lead of the thread, and enables the object to be defined clearly through the microscope.

This type of machine is exceptionally

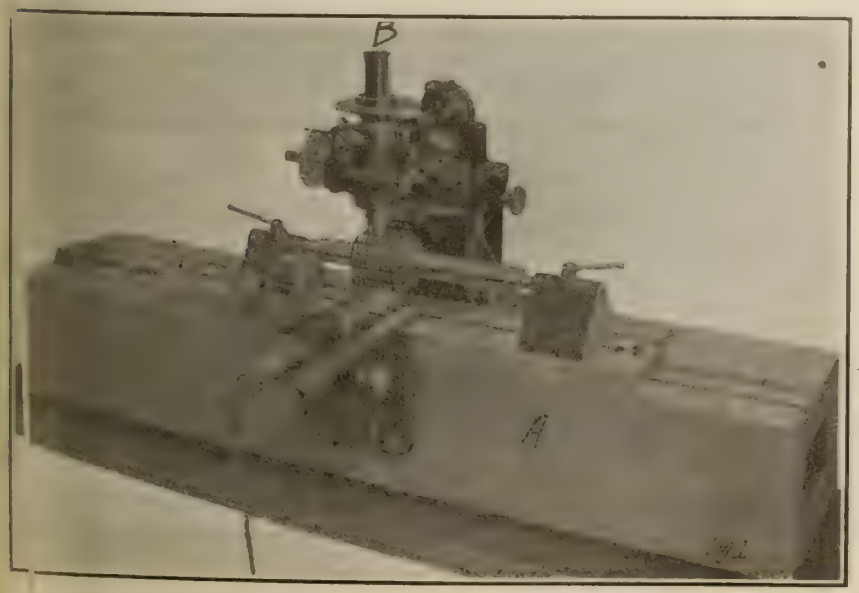


Fig. 1 — General view of Measuring Machine.

...ines of Alfred Herbert Ltd., Coventry, ... and Toronto, Canada.

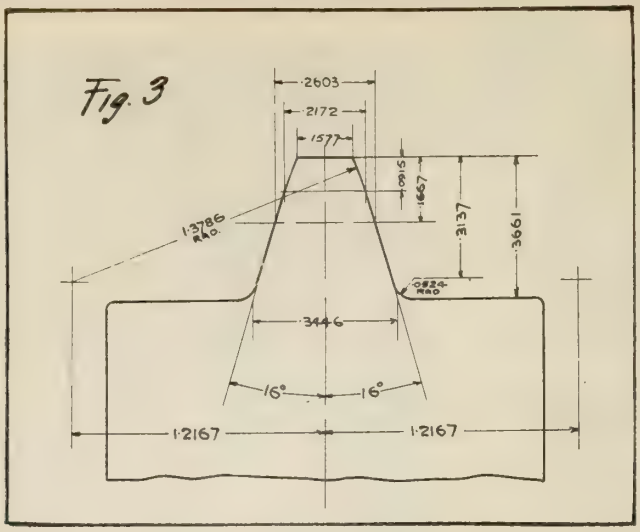


Fig. 3 — A Master Template for a Gear Hob Form Tool.

universal many classes of work being checked by its use. The following two examples of work with some observations on the modus operandi employed, will no doubt suffice to convey to the reader the principle of operation.

How Machine Is Used

In making a plain length measurement, the work is clamped on the table-it must be clamped in order to avoid any movement of the work—and the table is clamped to the bed, a measuring rod being held firmly between the two contact pieces. The microscope is then focussed on one end of the piece or part to be measured, with the hairlines covering a defined point from which the measurement will be made.

The measuring rod is next substituted by another or different length and the table is adjusted and re-clamped, with the new measuring rod firmly held. Then, by looking through the microscope, it is quickly seen whether the part to be measured corresponds with the difference between the lengths of the two measuring rods. If it varies, the compound slide can be adjusted till the hairlines cover the second point that should have come immediately under them if the part had been correct. The micrometer on the compound slide registers the error. The hairlines are very useful in making such measurements, as they can both be rotated; they can thus be set to coincide with any part or profile to be measured.

The first example to be considered will be the measurement of a simple gauge or templet, as illustrated in Fig. 2. In measuring a piece of this description, it is first necessary to select two meauring rods with a difference in length of something within 0.5-in. of the lengths to be measured; in this case the two rods should have a difference in length of 2.5-in.

Fix the longer rod between the contact, and clamp the table. Carefully set the templet with its long side parallel to the edges of the table and with the left hand end of one recess under the microscope. Set one hairline to cover the long side and the other at right angles to it, with the intersection coinciding with the outer corner of the recess. (Note.—In setting the templet with its long sides parallel to the travel of the table, advantage can be taken of the hairlines. One of these should be set parallel with the templet; then slowly move the table endwise. By adjusting the hairline and the templet with the table movement, exact parrallelism can be obtained. Carefully clamp the templet to the table and re-examine to see that parallelism has not been disturbed.)

Change the measuring rods and move and re-clamp the table; then adjust the compound slide till the hairlines cover the outer corner at the other end of the recess. In the case of the high limit side, if the templet is correct the compound slide will have to be adjusted 2.5--in. minus 2.422-in. that is, .078-in., which measurement will be registered on the micrometer.

Repeat this for the bottom of the recess, then measure the depth, setting one hairline to cover the outer edge. The compound slide can then be adjusted till the hairline covers the inner edge of the recess. It is important that one does not first forget to set the microscope to the required dimension an then try to persuade himself that the hairlines coincide correctly with the work.—First set the hairlines to the work, then take the reading.

Another Example

Fig. 3 represents a master templet, for checking form tools used in cutting gear hubs. In making such a templet it would be advisable to check the marking out on the microscopic measuring machine, as the dimensions for the radii can then be checked. After the templet is cut out, the angle of the flanks and the dimensions of the tooth thickness on the pitch line (.2603-in.), on the width (.2172-in.), and on the face (.1577-in.) can easily be measured. The depth measurements can also be made.

Threads finer than 6 per inch can have the pitch and angle measured in one operation. For coarser threads it must be done in two operations, using only one side of the thread for measuring the pitch and using the adjustments of the compound slide for measuring the angle. Focus the microscope on a thread profile near one end of the work. Rotate one hairline till it exactly coincides with one side of the thread. Repeat with the other hairline for the other side of the thread. It may be necessary to adjust the compound slide while doing this.

Note the readings on the dial of the microscope—this gives the exact angle of the thread in degrees and minutes. Next, move the table endwise a definite number of inches—any amount up to 12-in. is possible on the machine—and look through the microscope. If the hair lines exactly correspond with another thread it may generally be taken that the number of threads per inch is correct, though it may be as well to mark and count them as a precaution. If the hairlines do not correspond, adjust the microscope sideways until they do, and note the error on the micrometer.

Depth of Thread

Superimpose one hairline over the other, and adjust the work and the microscope until the hairlines just touch the crests of the threads. Next adjust the compound slide until the hairlines just touch the roots of the threads—the micrometer then registers the depth of the threads, see Figs. 4 and 5.

An intelligent operator quickly

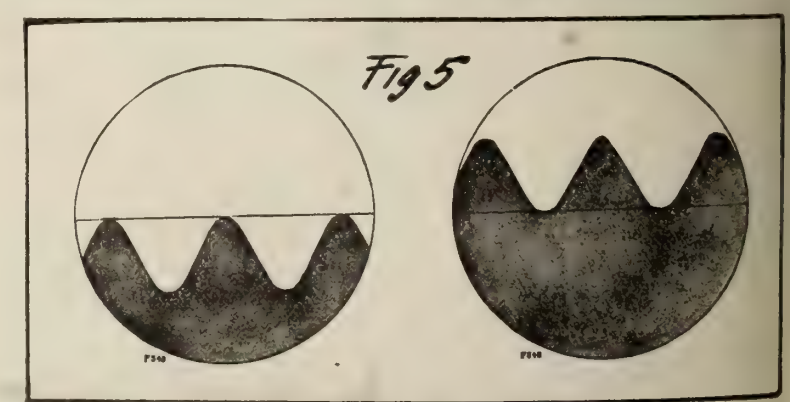


Fig. 5 — The two hairlines superimposed and set to the crests of the thread, then adjusted by the compound slide to the roots. The depth of thread is then given by the micrometer.

omes adept at rapid measuring and hecking of contours, etc., and a little ractice enables the user to undertake ork of a varied and comprehensive nge.

Diameter Measuring Machines

The production of accurate screw reads, such as are required in present y practice, has been occupying the inds of engineers for a considerable ne. The importance of obtaining satisctory results and the universal desire reach a higher standard is evidenced the repeated references on e subject appearing continually in most every technical publication. the circumstances of the case are instigated in detail it will at once beone apparent why the task of making screw, the threads of which will fit eir counterparts exactly, is by no ans an easy undertaking. The outside, ective and root diameters must be ht, likewise the radius at crest and t, and particularly the form and pitch the thread must be accurate. Whilst s impossible to produce perfectly acate threads, we can approach accuracy y closely by means of up-to-date chines and systematic inspection.

he inspection of threads when the and high limits are very close ether is a much more delicate operan than the inspection of cylindrical k. It requires a great deal of skill, sted by some of the finest measuring paratus built. Among the thread eleents above-mentioned the effective or ch diameter is one of the most imtant, it is at the same time one of most difficult to control, it can only measured by indirect methods.

cylinder of known diameter will alys lie a certain definite depth inside h thread groove of any screw of the same diameter, and the same thread form, consequently if the angle formed by the sides of two adjacent threads is smaller or larger than the standard the cylinder will not go so deep or will go deeper, as the case may be, into the thread groove. On this fact the measurements of threads by the three wire system is based.

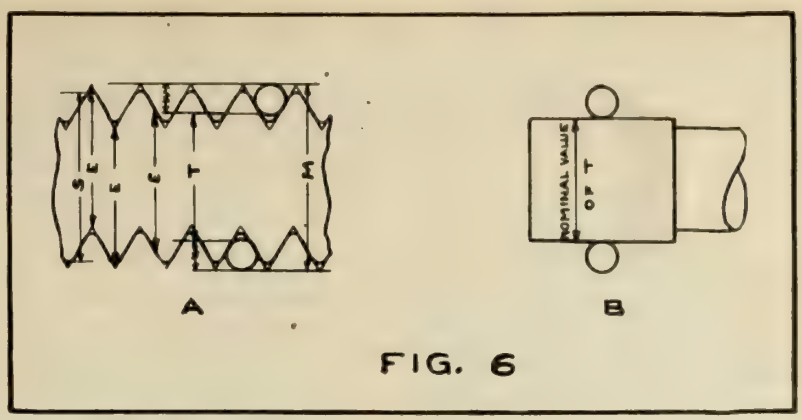


FIG. 6

Fig. 6 — Showing the wire method of measurement.

If we place three wires of the same diameter, as shown in Fig. 6. at A, the measurement over the wires consists of:—The diameter "T" of cylinder touched by the apexes of thread angles below the root diameter, plus twice the distance "S" from that point to the centre of one of the wires, plus the diameter "W" of one of the wires.

The first quantity being always a fixed amount for each particular size of screw and the size of the wire being known, any departures from the overall reading must necessarily indicate a corresponding departure in the other dimension, i, e., the distance "S" which can only happen if the form of the thread and consequently the effective diameter is incorrect. The machine shown at Fig. 7 has been designed to measure accurately and with convenience the outside, effective and root diameter of screws. Being particularly sensitive it is also invaluable for measuring cylindrical gauges, mounted between centres on the machine. Flat parts or portions out of round on such gauges can be detected quite easily. The bed of the machine consists of a heavy box form casting, machined all over to relieve any internal stress. The top face is provided with a Vee groove and a Tee slot. The groove serves as a guide for the adjustable tailstock and the saddle upon which the micrometer frame slides.

The headstock carrying a fixed centre, shown to the left of the machine, is permanently fastened down, while the tailstock is free to slide along the bed and can be clamped wherever required. The centre in the tailstock can be pushed in or out and clamped securely in position without upsetting the alignment.

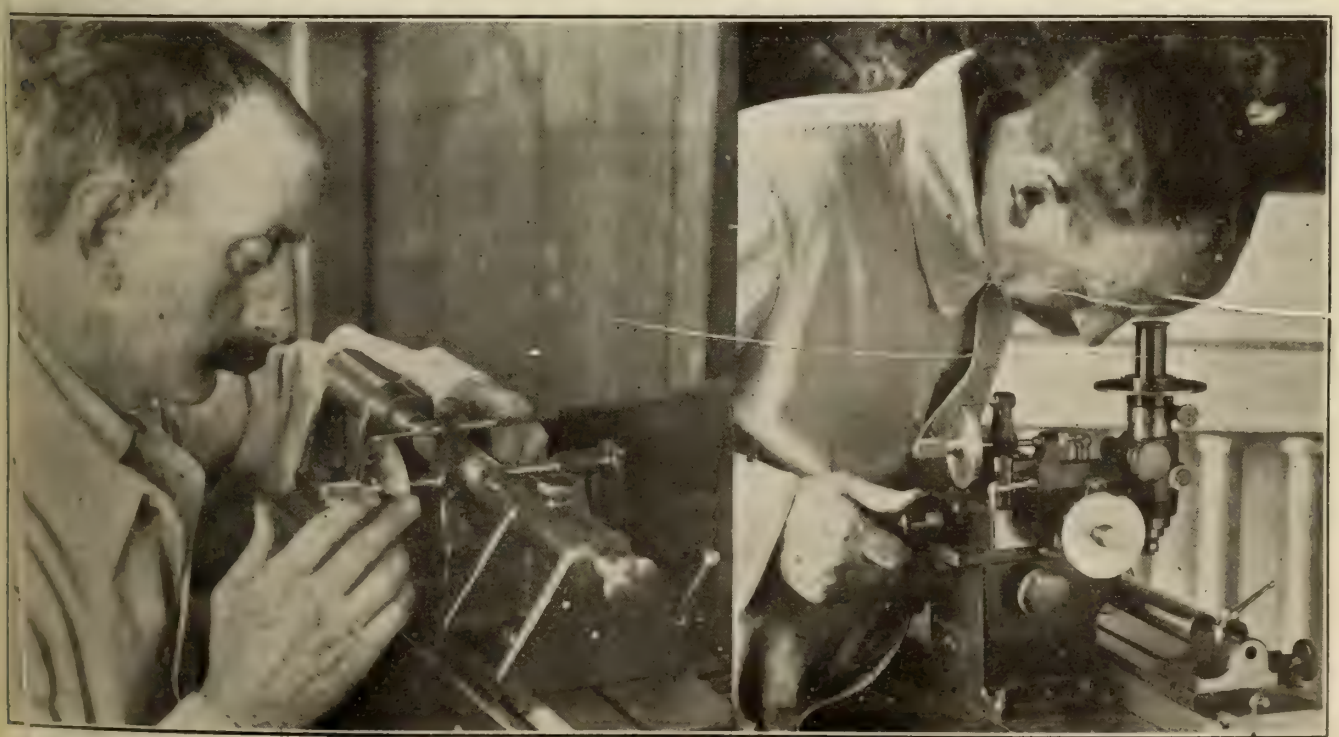


Fig. 7 — Showing type of measuring machines used.

Automobile Repair Work Can Be Made Profitable

Experiences of a Concern That Tackled This Branch of The Business—The Limits of Welding—A Fire Department Repair—Work on Aluminum—Saving Broken Drills

By DONALD A. HAMPSON

A MACHINIST should be the most competent man to do repair work, and the machine shop is better equipped than a garage back room, so why should not the smaller shops solicit automobile repair work, charging enough to make it profitable?

The city of Chicago, running true to form, has put out a number of "makes" of mail order cars. Those that had appeared were nice looking machines, though what was inside was largely a matter of conjecture, for the mail order buyer steers clear of garages. The owner of one of these cars came in our shop one morning carrying his flywheel which he had taken out himself. The wheel was of cast iron and had the starter teeth milled in from edge. About a dozen consecutive teeth were broken off and the owner wanted us to weld up the spot and cut new teeth.

We advised against this. Advised him to get a new wheel altogether or to get a steel ring to set in against a turned shoulder to be made on the old wheel. The cost of all three ways totalled about the same, and we advised against the welded repair because of the possible hard spots to be encountered in milling, the possible porous spots in the new teeth, and the fact that he would still have his cast iron teeth for clash gears. He went away.

The next day he was back with his flywheel welded, said he had found a welder who recommended such a repair but who had no way of putting in the teeth. The drawing shows the wheel in section. We didn't object to doing the work as long as the customer accepted the responsibility and paid all our charges, so we made a cast iron arbor. This had a shoulder or flange, against which a cast iron nut held the web of the wheel, which was centred by its fit on the cylindrical part of the arbor. The teeth were cut on a No. 2 plain miller. Our index centre had to be blocked up to swing a piece of this diameter. This, and the general shape of the piece, made the arrangement rather springy, a condition that was greatly relieved by clamping two angle plates to the miller table in such a position that they rested against the flywheel rim near the top, and on the side opposite from the cut. A preliminary file test showed a couple of hard spots; these were chipped out before the cuts were made.

Another Story

One of our men solicited a job from the city fire department that added considerably to our reputation. It seems that the Excelsiors had a motor apparatus that had proven itself a "lemon" and the city treasurer was getting used to paying twenty and thirty-dollar checks every time the machine left the house. It was always engine, or clutch, or transmission trouble, or sometimes a cracked case, at others a stuck bearing, and again just a clutch bushing or a universal pin. They had tried all sorts of lubricating schemes, bought a dozen advertised improvements, and realigned the parts several times; the general verdict was that the assembly was out of line and couldn't be kept in line. Engine and transmission were mounted on a sub-frame of heavy channels that extended back to the jack shaft—6-inch channels inside the frame of 8-inch channels.

A driver's chance remark gave our machinist the clew that ultimately saved the city all those repair bills. "If one of those front wheels is up four inches, I can't push the clutch out." The machinist pondered on this, and the next time he was in the fire house he took occasion to look over the mechanism. He noted that there were two universal joints in the line, each of which was fixed longitudinally. He reasoned that the frame, though seemingly heavy, must weave to some extent when the car was on an uneven surface and that this must put severe stresses in the line of action between the engine in front and the transmission, back with the jack shaft. Here was an unbroken line of steel between two fixed points. If these two points remained fixed with only an imaginary line between them, the length of the latter must necessarily change with a weave in the frame. Explaining this reasoning to the fire chief, permission was obtained to change one of the universals to a sliding type which would allow the imaginary centre line to change as per conditions. All the troubles in the major units concerned automatically ceased with the change.

* * *

A certain shop had long used a well-known brand of packing for general engine and boiler work. When they began to take in auto work, it was but natural that they make use of the stock on hand, and in the case of circulating pump packings, which autoists find very troublesome, they used the same brand to great success.

* * *

One thing peculiar to automobile repairs is the work on aluminum cases. The machinist is frequently called upon to retap holes in these cases, either for screws or studs — holes in which the threads have become badly worn. In every case, these retapped holes should be made U.S. standard threads and not S.A.E. threads. Aluminum and its compositions are so soft and granular that it is difficult to tap holes and get even as good threads as in cast iron; so when the thread in aluminum is made it is usualy somewhat ragged—now, if a roughly threaded bolt is run in this hole, the strength is lessened again and by the time a full load is applied to the part a few times the thread in the case strips entirely. To get more wearing surface in the soft metal, coarser threads are used and these hold very well if properly fitted.

The automobile, like other pieces of machinery, runs longer without repairs when certain parts are made a tight initial fit. A loose flywheel can never be kept tight by a key or keys. Nothing will ever remedy recurring trouble except a tight fit of the bore on the shaft. Universal joints and separate pinion gears and wheel hubs may seem to be tight when put together, because the bore fits at one or two points, or because a key holds, but unless both the bore and the key fit, and fit tightly the parts will loosen up on the first five hundred miles of running.

Leaving sliding gears and bearing fits out of the question, it may be said that the automobile is defective mechanically in that a considerable number of parts that should be press fits are made running fits in order to assemble them easily and in some cases so that the parts may be disassembled more readily

POINTS BROUGHT OUT

Machinists should be the most competent men to do repair work as their experience is valuable.

The machine shop is better equipped than a garage back room, so that it would pay the small machine shop to solicit automobile repair work, charging enough to make it profitable.

The question of proper fitting is most important. Both the bore and key should fit, and too much should not be left to the key alone.

The shop that goes after automobile work is sure to encounter the rush-work fraud. Learn to distinguish between a bona fide hurry job and one that is not—then let the man who is fooling you wait his turn and do not depart from this rule.

for inspection or repairs. Take universals, for instance; these should be the tightest kind of a fit on the shaft with their keys made so tight that it would take a two-pound hammer to drive them home—but in practice the universal is frequently split through the hub and a binder screw used, while the key is a piece of ⅜-inch C.D.S. slipped in a ⅜-inch keyway.

Woodruff keys are dropped in seats milled by cutters of the same nominal size, leaving a fit that is a plain botch job, no matter what the name of the car. Wheels that have taper bored hubs and a square key to drive are another example of poor practice. In any other line of machinery, that wheel would be pressed home so tightly that it would drive the car without the aid of a key but we ordinarily find the automobile hub just slipped on with a nut loosely tightened behind it and a key inserted that may be pushed in with the fingers. Little wonder that five thousand miles shows the hub worn, its keyseat "chawed" beyond repair, the key worn down a thirty-second, and the axle keyseat so bad that it has to be recut a sixteenth larger. So, if you would do lasting work, make an original drive or press fit on every part that is to transmit power, be that part wheel, gear, bolt, nut, key or shaft.

* * *

The twist drill stands up under more abuse than any other small tool in the shop. And when used in electric or hand breast drills, they are most severely tried, due to the carelessness of the workman in holding and forcing the drill. When in a drilling machine, the drill is maintained in a fixed centre line of action but the ordinary workman's centre line may swing fifteen degrees to the east and the west, all in making the same hole. That the number of drills broken on such work is not doubled speaks more for the quality of those tools than for the skill of the workmen. One shop follows the practice of saving broken drills; these are sorted and reground, then made up into complete sets just as new drills are cut. These short drills are issued for portable electric drill work and no others are allowed in these electrics. They work fully as well, and the saving effected has been remarkable.

Some Further Hints

Sometimes the slots in a castellated nut do not line up with the hole in the bolt—the slot ahead makes the fit too tight, the slot behind makes it too loose. If the nut is removed and its face treated to a few passes with a good file, it will be thinned enough to allow the cotter to enter the slot ahead. The satisfaction from well doing is sufficient reward for the effort involved, even if a person was not interested in doing a first-class job.

* * *

A great many cars and trucks are built with the "Hotchkiss drive," a construction in which the impulse of the axle is transmitted to the body or frame through the springs alone. All other cars have two members attached to the rear axle housing and extending forward, one to each side of the frame or else coming together V-shaped and fastened to a cross member in the centre. These "radius rods" relieve the springs of the drive; they are pivoted at each end so that the axle is free to move up and down, and it always remains at the same distance from the forward joint.

This type of drive is simpler, cheaper and lighter, but it has an objection, in that as the body load increases the axle moves backwards (the spring is fixed at the front eye which forces the centre bolt back as the weight straightens out the camber of the spring). As the axle moves back, the brake rods necessarily change also, this change bringing the bands closer to the drums—as a result, with a heavy load the brakes take hold much quicker and there isn't the movement of the foot pedal. This change in axle position makes it impossible to adjust brakes so they grip the same with full load as with no load and so they grip as well backing up as in forward motion. On some cars, this latter is so marked that they have no brake at all when backing—very dangerous in a hilly country.

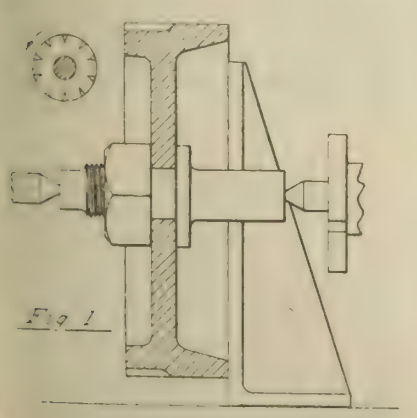
We changed a three-ton truck over from such a drive. The owner said the difference was as the difference between black and white. He never felt safe when one of his men had to go outside of the level centre part of town—now they can go anywhere, carry anything and always have brakes. Our bill for the job was $62. A drawing and description of the work follow and they may serve to guide others who would like to do the same thing, but hesitate.

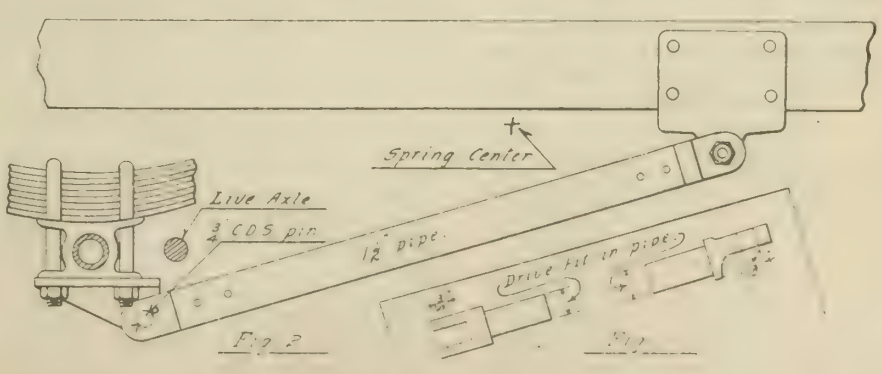
Our rods were made out of 1½-inch pipe. This is about 2 inches outside diameter. Pieces of steel were turned to drive in these pipes at each end and were secured further by cross rivets. These steel pieces had projections that were shaped up into rod and eye ends which were in turn joined to the fixed chassis members by means of pins. On this particular truck, the best way to fasten at the axle was to make longer spring clips and bolt steel angles to the under side of the axle housing. Cast iron saddles were used at the forward end and these were riveted to the frame channels in the customary manner. Plain pin joints were employed; a better job would have been ball-and-socket joints, but the extra expense was not warranted.

As the truck was of the shaft drive type, no adjustment for length was needed, as it would have been if the drive had been by chain. In doing such a job, it is best to have the rods short—the longer they are, the less do they follow the movement of the spring up and down and slightly backwards as the load settles the spring.

* * *

The shop that goes after automobile work is sure to encounter the rush-job fiend. It is a very strange thing that a man will arrange for a sitting with his dentist weeks ahead, he will cheerfully bargain with the plumber or the carpenter to do some repairs to his house "next week," and he willingly agrees to have that ton of coal he needs so badly brought around as soon as the roads are broken—but when it comes to a repair job on his automobile, he has got to have it started inside of ten minutes. If he can't get that, he hollers as though he were being robbed and he regales his friends with the news that "there ought to be at least one shop in this town where you could get a job done promptly and not get soaked for it." This rush-job man is an unprofitable customer for any shop. Learn to distinguish between a bona fide hurry





The three sketches are fully explained in text.

job and one that is not—then, let the man who is fooling you wait his turn and do not depart from this rule.

* * *

Workmen, and others, are apt to judge a car's braking power by the size of the drums. As a matter of fact, size has nothing to do with it—pressure perpendicular to the surface of the drum is what counts. This pressure remaining the same, an increase in drum size means longer life for the drum and the linings.

* * *

A fellow came in the shop one day for a little work on his car which involved our going out and looking under the hood for a measurement. In so doing, we noticed an unfamiliar wire running from the radiator and another from the crank case; both led up to the dash. Asked what these were, the owner replied, "You see, the car is an old one and has no dash oil indicator and no motometer. I have to get out and look to be sure my oil and water are high enough. Well, I borrowed the idea from our farm lighting system which has a cut out switch that stops the ignition when either the oil or the water gets low. It works all right and I like to fuss with those things even though I don't expect to depend on them to tell me when my engine is in danger." There are a good many people driving cars who know little else than how to press the starter button and fill the gas tank and who would profit immensely if such a device were made part of the car in the beginning.

* * *

The motoring public looks for more careful workmanship in the machine shop than in the garage and expects greater attention to details. Machinists should play up to this good opinion of them. One way is by being careful of the finish of any car they are working on. If working on the engine, for instance, a cloth should be spread over the fender and adjacent section of the running board—then when greasy tools or bolts are laid down on these parts, scratches and grease spots are avoided; a wrench that slips is guarded from the customary result of scraping off a generous portion of paint. Another paint protector is the leather topped jack; half an hour spent in riveting a piece of old belt leather to the top will prevent scraping the paint off axles and rods and the nickel from hub caps.

* * *

Bronze bushings for automobile work usually have a relatively thin wall. This fact, plus a little trick, will often help out when there is no supply of bronze to draw from and a bushing is needed in a hurry. Suppose a bushing is wanted for a shaft that has been worn and ground true again, making it a few thousandths under size and the only bushing or blank available is one piece that already has been reamed to the nearest sixteenth above—how can that blank be reclaimed?

Turn the outside diameter to, say, ten thousandths over some standard size—then drill and ream a hole in a piece of cast iron to that standard size. Scrape or countersink one end of the hole bell-mouthed and file one end of the bronze a little tapered so it will enter the hole. Put oil on the outside and force the bushing through in an arbor press or a vise. It will be found that the interior of the bushing is smaller by about two-thirds the amount that was left on the outside of it. There is a limit to this process but if there is material enough on the outside, the bushing may be further compressed by successive forcing through smaller holes. And a bushing that has been spoiled by boring it too large may be salvaged in a similar manner.

* * *

One of the most useful tools for automobile work, and in fact for general repairs, is the gooseneck style of screw straightening press. The conventional arbor press and the heavier two-post style of press are found in all shops but for straightening shafts both of these are outclassed by the third type referred to. This tool, which does not seem to be very well known, has an open side facing the workman with a rather long flat bed extending from right to left. On this bed are placed the fulcrum blocks, adjusted to suit the bend under repairs, and directly above the bend is the screw for forcing the piece back to straightness. Centres, adjustable along a convenient rod, are provided for testing the piece without the workman leaving his position. The screw is fitted with a hand wheel for quick movement and a bar for powerful impression while graduations on the wheel enable one to gauge the amount of pressure applied for successive trials on a stubborn piece. Every shop that does auto work should make or buy a press of this type.

MEASURING METHODS

Continued from page 27

ment. The tailstock is clamped by means of a lever which tightens a bolt inside the tenon groove. The saddle is provided with two Vee grooves to accommodate two rows of steel balls, upon which the micrometer frame rests. The micrometer frame has a groove of the same shape as that on the saddle and a flat which rests on the other row of balls. The transverse motion of the micrometer is perfectly smooth and free. The Vee grooves for all the balls are cut on steel strips, hardened and ground.

The micrometer is furnished with three anvils. One of the anvils measures from zero to 1-in., another measures from 1-in. to 2-in., and the third allows measurements from 1¼-in. to 2¼-in. to be taken. In order to set the two last anvils correctly suitable gauges are used.

The micrometer head is adjustable to enable the operator to set the micrometer to zero. The thimble carries a large graduated disc reading to .0001-in. Above the micrometer there is a fixed index pointer to read the graduations on the disc and a rod from which the wires are suspended. The measurement of outside diameters is naturally a comparatively simple matter as the position of the micrometer in relation to the work ensures correct readings even with a two point contact.

For measuring the root diameter two special adapters as shown at B, Fig. 6, are used. They are hung from the rod on the micrometer frame. The adapters are made of steel, hardened and ground, the threads being relieved so as to ensure the points coming in contact with the thread root without touching the flanks of the threads.

For measuring the pitch diameter the following formulae can be used:—

$$M = T + 2S + W.$$

in which M is the reading of micrometer when measuring over the wires, T is the diameter of cylinder touched by the apexes of thread angles below the root diameter. S is the distance from that cylinder to the centre of the wires, and W is the diameter of any of the three wires.

For Whitworth threads $S = \frac{W}{.9235}$

From the formula given above another formula can be derived which is more convenient in working:—

M=D—1.6008P+3.1657W For Whitworth threads

M=D—1.5155P+3W For U. S. or metric if pitch "P" is given in inches.

M=D—1.732P+3W For the sharp V threads.

The wires used must not be smaller than .506P or larger than .840P.

$$P = \frac{1}{\text{number of threads}}$$

If the measurement over the wires differs from the results obtained according to the formula, the effective diameter is incorrect by the amount of the difference between the reading and the standard.

These two methods will suffice for the present, and in a later article we shall discuss "Modern Types of Gauges And Their uses."

The first part of the programme drawn up for the electrification of the Japanese Government railways, which is to be begun during this fiscal year, is said to embrace 203 miles of railway and to cover the various routes in the neighborhood of Tokyo and Osaka. The work is to be completed by 1926 or 1927, and the amount of power required will be 70,000 kilowatts, all of which will be obtained from power stations erected by the Government. A station of 15,000 kilowatts capacity is now being built in the suburbs of Tokyo.

Another Demonstration of Canada's Progress

New Extension to Meet Increased Demands—Large Foundry—Description of Different Castings Completed—Paper Machinery is Made—Photographs Showing Specimen Castings, Molds And Equipment

OF RECENT years Canada has been developing along lines hitherto considered beyond her reach ut each stride convinces not only the anadians but those of all nations that anada is becoming a nation to be reckned with.

From the standpoint of natural reources it has always been known that e possessed an enviable share, but our xtreme modesty and lack of self esteem as prevented us from making much use f them, or would it not be more fitting o say that the lack of gumption on the art of our immediate forefathers stood n the way of our natural resources eing developed to the advantage of our eople.

It has always been a strange trait of he Canadians to want outside capital nd outside brains to do all our develping. The recent print paper fracas owed us that our pulp wood forests ere the reserves on which outside pubishing houses depended for their supply of paper, but it also showed us that hile these reserves are within our borer and under our flag they do not beong to us. This, of course, is only true f certain sections.

We still have lots of pulp wood which as not been thrown away, and we have he natural water power and electric ossibilities to develop it and work it p, not only into pulp, but into paper is ell. Different concerns in Canada have or some time back been making pulp achinery, but the machinery for makg the paper has been for the most art, imported. The same might be said f the water wheels. Canadian institutons have been making turbines for ears back, but not going extensively in the larger sizes such as are now called r, but this also has been changed and me large contracts have been taken by anadian establishments and delivered a most satisfactory manner.

To meet the increasing demands for ese large engineering contracts the ominion Engineering Works, Limited, Rockfield, Que., have recently exended their grey iron foundry, which the present time is capable of taking re of work of every character from he smallest to the largest castings. any one-piece castings weighing close fifty tons have been successfully oduced, and orders now in hand call r pieces that will approximate 60 tons weight for one casting. The original undry, whch was about one-half the ze of the present building, was opened out sixteen months ago, the first heat eing run off on the 10th. of January 920. At that time the castings produced were intended for paper making machinery and small turbines, but the activities of the company during the past year have expanded so that greater facilities were essential to meet the prowing demands for larger and heavier castings.

Different Castings

Most of the castings required for water turbine work are of a most difficult character, and it is for this work that the foundry has been particularly organized. Such intricate castings as turbine runners, head covers and speed rings require equipment and expert moulders not found in most foundries. The Dominion Engineering Works is now building turbines of the largest sizes yet built, as well as smaller wheels.

The foundry building, which is located at the eastern end of the general machine shop, and at right angles to it, has a total length of 346 feet, 6inches, and a width of 145 feet 6 inches the width being divided into three sections, two side portions of 30 feet width, and the center section, where the heavier work is prepared, having a width of 85 feet 6 inches throughout the entire length. The height from the floor to the central roof truss is 41 feet, while each side section has 24 feet 6 inches clear below the roof supports. The side farthest removed from the main shop for a length of 180 feet is reserved for the blower room, cupolas, core drying ovens, sand mixer, etc., while the charging floor extends above. The total foundry floor space is approximately 29,400 square feet, and that available for moulding purposes is close to 28,000 square feet, divided into a number of sections of different size, each division intended for different classes of work. The main floor is served by three cranes of 70 tons, 35 tons, and 15 tons capacity, travelling throughout the entire length.

For the production of the large paper making machines pits were necessary for the making of the large drying rolls on each. Two of these pits have been provided, one having a diameter of 12 feet 9 inches and 16 feet deep while the other has a diameter of 9 feet 4 inches by 12 feet deep, both being lined with steel plate, and located at the north end of the foundry. In addition to these pits being used for the moulding of long drums they were also utilized for the making of the built-up cores. Adjoining these pits are special core ovens in which the prepared cores for the dryer rolls are placed on end. This section of the shop is also provided with two wall jib cranes of 3 and 5 ton capacity. Directly opposite the cupolas and about the center of the main floor is a 72 inch by 72 inch pneumatic jolt ramming machine. This is conveniently located for serving both the main floor and the side section.

At the west end of the main floor are located the concrete pits for casting the large water wheel and generator sections. Five of these pits are of uniform size, 30 feet by 16 feet, while one on the end for very large work is 34 feet by 30 feet, the depth of 12 feet being common to all. The reinforced walls are 18 inches thick. For mould preparation and the setting of cores, a five-ton Dominion Bridge gantry crane straddles the pits and travels over the entire six. For the removal of the finished castings the large travelling crane is used. Some of the work is shown in the accompanying views.

The cupolas, three in number, are located about midway of the length and directly opposite the entrance to the machine shop. The cupolas are 37 inches, 54 inches, and 84 inches in diameter respectively, with capacities of 7½ tons, 15 tons, and 25 tons of iron per hour, and were built by the Dominion Bridge Co. Three blower units, with capacities of 13 cubic feet, 24 cubic feet, and 81 cubic feet of free air per minute are provided, and they are so arranged that any one of the three may be used for any cupola. This is one of the best features in the entire plant, and one which is too frequently overlooked.

Directly above and adjoining the cupola section is the charging floor which has storage facilities for 100 tons of material. On the same level as the charging floor and extending out over the material stores section are two loading platforms, each 16 feet 6 inches in width, and with a length of 21 feet, half of which protrudes outside the building. The material storage space occupies about 35,000 square feet. The coke, scrap and pig iron, from the yard are loaded into skips handled by a 15 ton bridge crane operating over the entire yard. When the skips are brought to the loading platform the material is loaded into buggies with the proper proportion of each material, and weighed before going to the cupolas. Foundry sand is also delivered in this way and dumped into the mixer located below the charging platform.

At the south end of the foundry is the flask storage yard, where heavy flasks and moulding plates are kept. An interesting feature in regard to wall construction is shown at this end, where the brickwork is only built part way up to facilitate the handling of the large

flasks to and from the foundry. The crane runways extend out over the storage yard so that the crane can run past the wall without trouble, the hanging material entering through the large central swinging doors. Overhead doors are provided for closing the space above the partial wall, but during the summe

Continued on page 34



Specimen Castings, Molds and Equipment Dominion Engineering Works, Ltd., Rockfield, ue.

E-46—Half of head cover for twenty thousand horse power turbine water wheel. E-70—Half of speed ring....E-50—Core work for spee ring. E-112—Cupolas such as are required for pouring this size of casting. E-9—Equipment for making large paper machine roll E-16—Jolt machine and other foundry appliances. E-42—Loam molding floor. E-118—Casting pits and molds for heavy work.

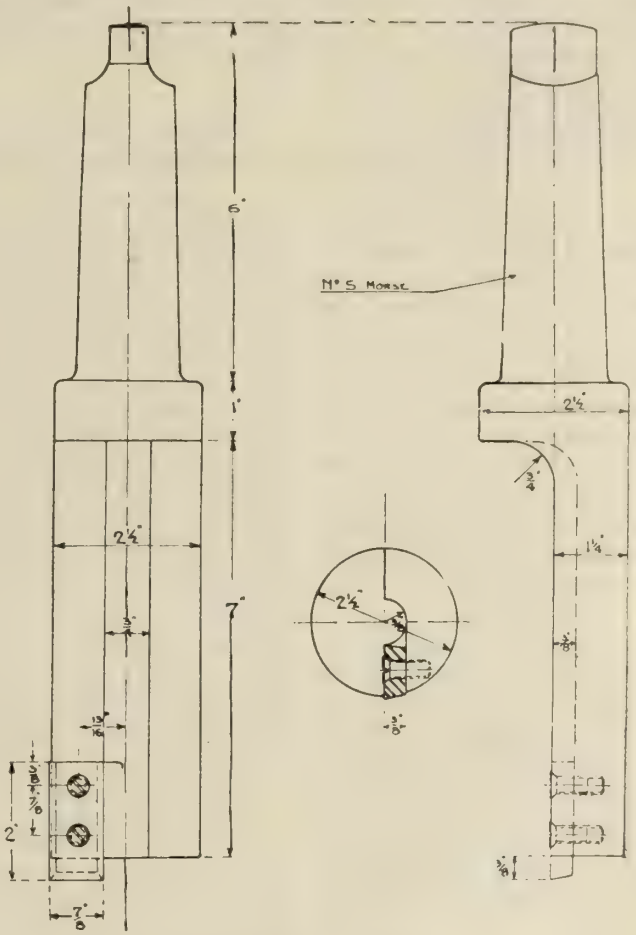
What Is A Drilling Job?—An English Opinion

THE DRILLING machine has remained a surprisingly simple tool when compared with some other machines, according to R. S. Mallison, and yet, as he says, its range and capabilities are almost unlimited. Speaking on the subject of "What is a Drilling Job" he states in British Machine Tool Engineering, that amongst many unusual operations he has seen executed on the radial drill, the ones shown in the present article are particularly worthy of mention. He states that in the one case the work was mounted in a special jig or bridge, in the top of which was a pilot hole with a standard thread. When drilling and opening out the hole by bar and cutter, a bush was screwed into the pilot hole, being taken out for threading operations.

A bar with a master thread was used, fitted with a single cutter, the threaded portion of the bar engaging with the pilot hole threads just before the cutter enters the work. When the spindle is started the tool, of course, automatically feeds down to cut the corresponding thread in the work. I saw a 5 in. diameter hole bored and threaded by this method, with accuracy and in about one third the time occupied for the same operations on a lathe.

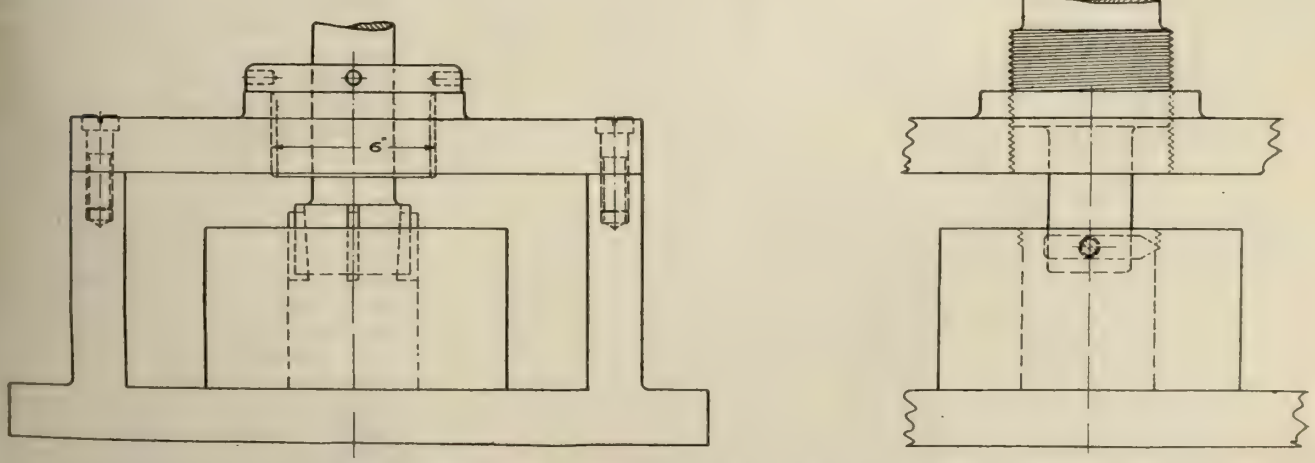
On the other occasion the setting lugs of aluminum gear cases for motor waggons were being sawn off. A horizontal circular saw was fastened to a morse taper shank, which latter was cottered into the drill spindle. The spindle was then adjusted to the correct height, the friction applied to hold it from slipping, and the lugs sawn off by moving the radial arm. This method gives quite good results besides eliminating the necessity for moving to another machine.

Particularly interesting is the machining of connecting rods in locomotive shops. A special tool usually known as a "D" cutter is employed to cut out of the solid, a lubricating well about 2½ in. diameter, leaving a solid piece of metal in the center. The latter is then drilled for the syphon, and the outer face of the well is threaded for the purpose of screwing in a cap. All these operations are executed on the one drilling machine.



What is known as a "D" cutter.

By the use of a simple form of tie-rod the heavier radial drilling machines can be immediately converted into a rigid form of vertical boring machines. Cylinder boring is executed to advantage by this method, various forms of cutters being employed. Large holes are bored in steel and wrought iron jobs which could not be accommodated on horizontal borers without some difficulty, and,



Showing the jig used for drilling, opening out and threading.

in many instances, with an appreciable saving both in setting up and machining times.

On one occasion the writer saw a box body vertical drill with a compound work table, on which was fastened a universal chuck, used to distinct advantage for boring blanks and flanges. The users were enthusiastic about the job, for it was saving both power and time on an expensive turret lathe. Trepanning is another operation usually assigned to the radial drill. A pilot hole is first drilled in the center of the job, which acts as a steady hole for the trepanning tool. This latter has two adjustable cutters, carried in a horizontal slide, which are set to the diameter of the hole required. By this method it is possible to cut out a hole up to twenty inches diameter in cast iron on the heavier radials. On one particular occasion the writer noticed trepanning operations being executed on crank webs without the use of a pilot hole, a specially strong tool being employed. The finished hole was 14 in. diameter, and the metal removed was then machined for another job. This procedure must have resulted in a fairly considerable saving each year.

The improved powerful friction on Asquith radials, for instance, makes them suitable for milling and keyseating to a surprising degree. The spindle is securely held by this friction arrangement, thus preventing it from slipping. The milling cutter is horizontal, of course, and the traverse is obtained by the movement of the saddle along the arm. The use of tie-rods gives rigidity for this work. The vertical drilling machine with its compound work table has even greater advantages than the radial for these operations, as the work can be accurately adjusted both longitudinally and transversely. In one particular instance, to my knowledge, an Asquith box body machine is used practically as much for milling and keyseating as for the ordinary run of drilling jobs.

ANOTHER DEMONSTRATION OF CANADA'S PROGRESS

(Continued from page 32.)

months it is left open, thus giving maximum ventilation for gases, etc.

The roof over the casting pit is of concrete, this doing away with the necessity of sprinklers, but the latter are provided in all other sections of the plant. Between the foundry and the machine shop is a space 41 feet wide and 347 feet in length, where the cleaning room is located, together with a general storage bay for finished castings before the same are delivered to the machine shop. This section is served by a 40-ton travelling crane.

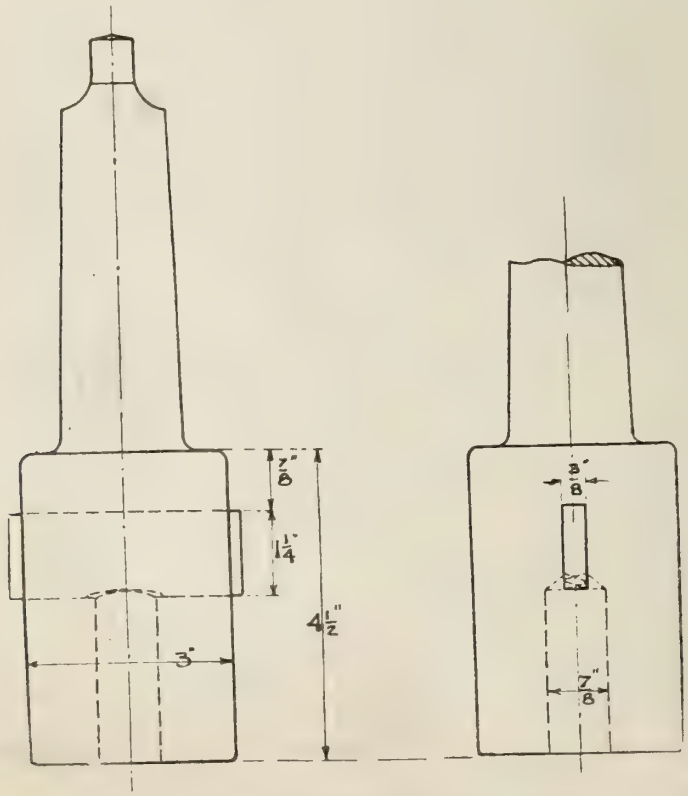
Standard gage railway tracks are laid directly into the shop and this assures economic handling of all material and heavy castings. Convenient track scales are located in different parts of the shop. The smaller castings are cleaned by a Pangborn sand blast, while the larger ones are handled with a wire brush.

Every attention has been given to the welfare of the workmen; a large locker room has been provided with wash basins, where the men may clean up and change their clothes.

On the whole, it must be admitted that this plant compares favorably with those of any country and speaks well for Canadian ambition and confidence in Canada's future.

In the illustrations will be seen some views of the interior of the foundry, showing the style of work being done, the method of doing it, and the facilities at the disposal of the men for accomplishing the same. The one marked E-46 is half of a head cover for a twenty thousand horse power turbine water wheel. Compared with the gentleman who stands beside it, and who by the way is Mr. Cahill, the foundry superintendent, it is a fair sized piece of casting. In the rear of this casting and in line with where Mr. Cahill is standing will be seen a grab bucket which was not mentioned in the list of equipment. This is just an incidental which is expected to be found in a plant of this kind. Pits are not filled nor emptied these days with a hand-operated shovel.

Another good sized casting is shown in E-70. This is half of a speed ring and makes a better showing than the other in comparison with the workman who stands in front of it. E-50 shows a commencement being made on the mould for the speed ring just mentioned. E-42 is a typical loam moulding floor, while E-118 shows the large casting pits, and the moulds in various stages of completion for the large turbine castings. E-9 is a view of the north end of the foundry showing pits and the round sectional flasks used for moulding and casting the long paper mill drying rolls which are poured on end in these pits. E-16 is a general view of the foundry interior, showing the jolt ramming machine in the middle of the floor and the drying ovens in the rear. E-117 shows the battery of cupolas with a combined capacity of 47½ tons per hour.



Showing the tool used for ending studs.

KILLING ATMOSPHERICS

One of the most troublesome difficulties in wireless telegraphy is the interference caused by what are known as "atmospherics." The receiving instruments are affected by electric waves which arise no one quite knows how. They are worse during the day than at night and also during certain weather conditions. For many years a British company has been striving to overcome this difficulty and it has at last been rewarded by the discovery and perfection of a device by which the effect of "atmospherics" can be quite eliminated. What this means in practice is that existing wireless stations can carry far more messages than they have yet been use of automatic signalling at high speed had to be given up and oral reception employed, owing to the way in which the atmospherics played havoc with the machine records of the signals. A skilful operator could disentangle the human signals from nature's freaks, but the speed at which an operator can receive is limited.



WHAT OUR READERS THINK AND DO



TREATMENT OF UNDESIRABLE WORKERS

By JOHN HOMEWOOD

I have just had a chat with a man who has been hobbling around for the last few months on a pair of crutches, as he had met with an accident in falling from a scaffold. He had been on the job but a little while when the misfortune happened. But, prior to this job, he had been discharged from a manufacturing plant as an example to others; he had committed an industrial crime known as doing "government work."

The fact that he was going round on crutches does not have any particular bearing on the issue I bring forth, but the case serves as a practical example of the dangers confronting a workman discharged from a plant under the condition mentioned. A man's last employer is of vital importance in assisting to secure another position, and his opinion is looked upon by most people as being the most reliable recommendation. It was unfair to the man not to give him a fair chance to make good. Had his record been spotless prior to this offence, the injustice becomes greater in not giving him another chance to prove up. How much more benefit could have been obtained had the offender been summoned to the office and given a talking to that would have sown a seed of self respect in the man's mind, which would have grown in volume for the benefit of himself and the man who had shown him leniency. It is only necessary to apply a little grease to the track of a worker to see him slip away, unless he is equipped with an emerency brake in the form of "forming his own opinions." Tactless decisions from the mouths of men who cannot see any farther than the length of their nose, are as so much rich fertilizer spread upon barren soil in preparing the worker's mind for the growth of oppression and antagonism. Why should we apply penalties to offenders in industry who have taken their first wrong step, when other means could be applied that would be a benefit to both him and his employer. The policy of "setting an example" creates a spirit of distrust in the employer and one of revenge in the other.

Why should a petty offence justify an effort to tear at the heart of a man's honor? It destroys that which we are trying to gain, namely, confidence and good will between employee and employer. You may fire a man from your plant for being dishonest but it will not correct the malady. The next man that hires him will probably suffer greater than you as the consequence. It is often not the man's fault, but yours, as you haven't given him his chance. Men are born with good qualities in them, and it is up to employers to get them out. The days of the club and coercion are back numbers to modern ways of thinking; we have got to meet our issues in another way; we have to use methods of construction; construction of morale, not destruction of character. An employee whose loyalty is "bought" with deeds of kindness coming from the heart is worth a hundred smiling ones who eagerly hang around waiting for their regular check.

INSERTED BLADE PIPE TAP

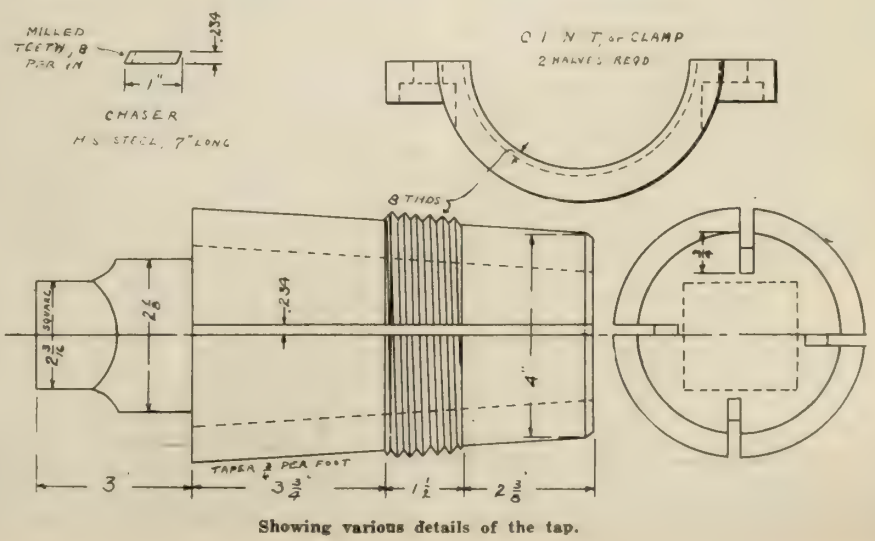
By DONALD HAMPSON

Where pipe fittings are manufactured, and in plants that have to tap many holes for pipe, the outlay for taps is a considerable item. It is doubtful if there is any better way for the smaller sized holes than to buy stock taps and keep sharpening them untill they can be ground no more—then to throw the taps away. Bigger taps handled this way run into quite a bit of money and it is for the purpose of helping others save, that the tap shown herewith is presented.

The tap is of the inserted blade variety and uses three, four, or five blades according to diameter. The blades, or chasers, are made of high speed steel; they are not machined except for cutting of the teeth, which is done by a hob in a milling machine, holding several chaser blanks at one time, on the angle in a special fixture of conventional design. An economical feature is that all the chasers are alike and may be used interchangeably in any of the tap bodies from 2½ inch up. After milling the teeth, the chasers are heat treated and stored in the tool room.

The bodies are turned from machinery steel, slotted for the chasers, and squared on the driving end to suit the driver in the tapping machine, or carried in the spindle of a drill press. The dimensions given show the 4 inch size; other sizes may readily be taken from this as the taper is the same for all, and so is the length. The threaded portion serves the double purpose of positioning the clamp for the chasers thereby aligning the chasers to the correct spiral.

When assembled, the tap shows a little more than two inches of cutting length at the small end of the taper. The teeth nearest the end dull fastest, and these are ground off when they retard production and the blades are all shoved down so many threads. The construction is as near fool proof as can be made; it is simple; the parts are interchangeable; and the design is rugged and free cutting.



Showing various details of the tap.

THE REMEDY FOR CASTING TROUBLES

By JOHN S WATTS

REPLYING to the article entitled "A Recital of Casting Troubles" by Donald Hampson, on page 40 of Canadian Machinery dated July 21, 1921, having been through similar experiences to those given in Mr. Hampson's recital. I can appreciate his feelings in the matter, but in my opinion the remedy is in his own hands, and a fair part of the responsibility for his troubles rests upon his own shoulders.

To start with, no matter how much we may preach about the foolishness of tuning out work of a poor quality, the firm that is working on a small and uncertain margin of profit will never turn out as good work as will one that is assured of a reasonable return. It is common knowledge that iron foundries, whether independent or run as part of a manufacturing plant, are subject to intense competition and do not make the profits that other departments can. Because of the small capital involved in starting up a foundry, there being very little machinery required, the business attracts the mechanic with a small stake, and being able to operate with little or no overhead expense, he can cut the price to the bone. The small operator being usually innocent of any knowledge of costs and book-keeping may run for some time before he finds that the prices he is working for are losing him money instead of being profitable as he thought. By the time sad experience has proved to him his mistake, some other fellow like himself has started in, and this competition in turn prevents his raising his prices to a fair figure. It seems probable that foundries will always be subject to these conditions, and that the only way to get a good grade of castings is to have them thoroughly inspected at the foundry.

There are so many different defects to which castings are subject, and frequently many of these defects are of little or no importance as regards the final utility of the casting, that the majority of foundry men come to look upon all but the most serious defects as mere trifles, which can be overlooked. It is but human for any man to be lenient in the inspection of his own products, and anyway a molder is seldom sufficiently conversant with the ultimate purpose to which the casting is destined to really form a competent opinion as to what defects matter, and what do not, and will naturally give the casting the benefit of any doubts he may have.

Routine at Fault

The regular routine of sending a pattern to the foundry with an order for so many castings off it, gives the foundry no inkling of what will pass or what will be condemned, and with such a number of faults as a casting may have, it is impossible to write out a specification that will give the foundry man an idea of what will be passed unless we demand absolute perfection, and if we do, the price would make us think the castings were to be of solid gold.

Then there are defects such as warping of the casting, which may or may not be fatal, depending upon whether they will clean up or not, and to determine if the defect will machine out may require surface plates, gauges etc., which it would be absurd to expect the foundry to supply out of the price received for the castings. It seems only logical then that the purchaser should do the inspecting of the castings, and that the inspector should be on hand at the foundry when the first lot of castings are run through. This will give the foundry a chance to find out at the start what is required, and avoid the heavy loss incurred by making up the whole order with defective castings. It may seem to some that the loss due to making defective castings is borne directly by the foundry and is no concern of the purchaser, Experience however proves that the cost finally falls upon the purchaser, because when the foundries find out that, for any reason whatever the castings ordered by a certain firm infallibly bring a higher than usual percentage of reductions will raise their prices to compensate for this loss. Indeed we will always find in every district some one firm that is always quoted higher prices on its enquiries than any of the others because of some fault in the management which causes work executed for them to cost more than similar work for other firms. This fault may be lack of clearness in their requisitions, unusually high percentage of rejections, faulty design of the work to be executed, or what is probably the worst fault, the impossibility of foreseeing what slight defects will cause rejection.

The point should be well drilled into all employees of any firm ordering much material from outside firms, that the easier it is made for the contractor to furnish satisfactory goods, the lower will be the prices which they will quote, and that any obstacles or difficulties placed in the contractors way will infallibly be ultimately reflected in higher prices, to be paid by the purchaser.

A good inspector, which means a man who knows exactly what will injuriously effect the functioning of the parts he is inspecting, and what defects are of no importance, will, by preventing loss of time in continuing to turn out castings that will finally be rejected, be able to greatly expedite the deliveries, and ultimately the firm employing him will get their castings for a lower price, and of a suitable quality.

It may be objected that inspection will incur an additional cost greater than can be borne. Where quantities of the same piece are to be purchased, experience proves that inspection at the maker's actually lowers the final cost, and the experience of Mr. Hampson, who states that bad castings cost him $6,000 last year is a case in point, as the total cost of inspection could not very well exceed one third of this amount.

A GOOD IDEA

The Fosdick Machine Tool Co. have a good plan of transporting their machine tools to the testing department. They built a special testing outfit and mounted this on a three wheel truck. This truck has four lag screws that are driven into the floor to anchor the testing rig in place for use. When it is to be moved, it is only necessary to disconnect the electric feed wire, loosen the lag screws, and connect the pulling handle to the swivel or third wheel, which is arranged to make a complete revolution when it is necessary to turn short in the shop.

When a machine is to be tested the 3-wheel truck is set at right angles to it and belted up. An idler pulley makes the use of a very short belt possible. A friction clutch controls the transmission.

CLEANING BURRS FROM THREADS

We had a screw used in our manufacturing that was milled flat across the end after it came from the automatics. The amount removed varied from 1/16 to 1/8, which was necessary to bring the starting of the thread in relation to other parts. After milling, the burr had to be entirely removed from the last thread to facilitate assembling. This was a slow, laborious job as accomplished with a file. The thread was a special 29 degree type.

The head of the department hit upon a scheme for removing these burrs that is worthy of wider use. We had sectional wire brushes, eight inches in diameter, that were used to clean up discolored drawn brass and steel parts and were discarded when worn within half an inch of the flanges which retained the bristles. A section of such a worn brush lying around served as the germ of the idea that proved so successful. One of these mounted on an emery stand became instantly a flexible, revolving file. With the screws resting in a V rest just at one side of the brush, they were revolved by hand against the wire brush and every particle of burr cleaned from the thread in an instant. The little burr thrown up, or left, on the end of the screw was unimportant. Ninety-five per cent. of the former time was saved and a better grade of work performed.



WELDING AND CUTTING



Production Welding of Varied Steel Products

Gas Welding Industry Has Made Rapid Progress—Method of Welding Barrels—Housings—Tapered Tubes and Other Articles —Types of Machines Used—High Speed Welding

THE rapid progress made in gas welding in the past ten years and the wide application it has found in industry is a subject too broad to cover in detail in any small space, so I will confine my remarks to the machine welding of steel products. The advent of gas welding has gone down in industrial history as a memorable event which marked the resurrection from the scrap heap of much valuable equipment which could not be restored to service by any process known to industry previously. And, for a considerable period of time application of the art of gas-welding was confined to reclamation work and job welding on a small scale. But industrial leaders soon saw the possibilities of the process in production work and hand welding was adopted as a standard method of fabricating metal parts.

In due course hand welding yielded to the trend of the times and efforts were made to supplant the slow manual operations with automatic machinery. The early gas-welding machines were built for the production of iron and steel pipe of heavy gauge and usually were equipped with a pre-heating furnace in which the formed material was preheated prior to welding. After leaving the furnace the pipe passed through vertical rolls which fed the stock up to a pair of horizontal pressure rolls at which point the seam was welded without the addition of a filler by passing under a stationary welding torch which melted the two edge of the stock together as they were being held in contact by the pressure rolls.

The preheating furnace was advantageous from purely a welding standpoint but there were so many disadvantages from the production standpoint that it was discarded; hence, the present day machines in general utilize a special water-cooled multiple jet torch to do both preheating and welding with the same tip, although in some processes independent flames are provided to preheat ahead of the welding flame,—some designers going even so far as to operate a preheating torch on the underside of the seam in cases where the dimensions of the article to be welded will permit.

This type of machine can be used to weld long lengths of tubular shaped stock such as round, oval, square, rectangular and also the more complex sections such as are used for windshield frames , etc., in which the stock is of constant cross section throughout its length. The welding of barrels, housings, tapered tubes and other articles in which the cross section is variable, presents a different problem, since these cannot pass through rolls as in the case of round tubing. Two types of machines have been designed to handle this class of work, the one comprising stationary metal dies over which the welding torch is propelled along the seam, and the other a stationary torch under which the stock clamped in moving dies travels forward under the flame.

A machine of the stationary-die type can be readily built from an old lathe by placing welding dies on each side of the lathe parallel with the bed and with the welding torch supported on a swinging arm attached to the lathe carriage. In this manner the torch will travel forward over one die the length of the weld and is then swung to the opposite side of the lathe where stock has been placed in the dies preparatory to welding. By reversing the travel of the carriage, the torch will move back over the second die completing the weld while stock is being replaced in the first die for a repetition of the welding operation, and so the cycle continues. This type of machine has the widest application of any and the length of the article welded is governed solely by the travel of the carriage.

Cast of Welding Dies

The torch is secured in an adjustable holder which permits of movement in three planes; hence the operator can easily regulate the movement of the torch along an irregular seam. The cost of welding dies is comparatively low and dies can be replaced for a new job with little delay and at a small expense. However, where large quantity production is dealt with on a standard article and the size of the piece to be welded is not too great, a moving die machine will prove very economical.

Here the welding dies, either one piece or sectional, are mounted on two parellel chains which are driven by sprockets at one end of the machine and pass around idlers at the other end. One operator feeds the pieces to be welded into the dies as they move forward. The second operator regulates the torch and welds the work as it progresses under the torch. The welded articles are released from the dies as the chain passes around the sprocket and drop into a truck ready to be moved on to subsequent operations.

The welding of seams on circular, square or polygonal shaped containers can be accomplished by rotating the work under the welding torch either vertically or horizontally depending upon the location of the seam. Stock up to ¼ in. in thickness can be welded in these seam-welding machines without the addition of a filler. This in general is a brief description of the various types of seam welders in use today and gives the principles of operation of each although they will differ in detail according to the peculiar problems encountered in the various jobs.

Many modifications of the various types of welders have been built, as for

POINTS OF INTEREST

Describing Various Types of Machines used for Welding

The welding of seams on circular, square or polygonal shaped containers can be accomplished by rotating the work under the welding torch either vertically or horizontally depending upon the location of the seam.

From a welding standpoint the best commercial steel is open hearth, either hot or cold rolled, with an analysis as shown in present article.

*Author is superintendent of tube department Standard Parts Co., Cleveland, Ohio, and presented this matter before the American Welding Society.

example, a tube welder in which the forming, welding, sizing, grinding, straightening and cutting operations have all been combined in one automatic machine, but since the welding is done in the same manner as we have described we will not attempt to go into further mechanical details of each at this time.

The next problem after deciding upon the proper type of welding machine is the determination of the most suitable material from which to manufacture the article. From a welding standpoint the best commercial steel is open hearth, either hot or cold rolled, with the following chemical analysis:

Carbon ..... .05 to .15
Phosphorus, not above .... .045
Sulphur, not above ..... .050
Manganese ..... .30 to .60

(This analysis is the same as the S.A. E. specifacations No. 1010 for carbon steel.)

The steel should be free from segregated crystallation, laminations, slivers, cracks, pipe flaws, slag or oxide inclusions and other injurious defects. The surface and edges of the stock should be free from lime, rust and dirt which will form slag inclusions in the weld and decrease the cohesion of the metal as well as retard the action of the welding flame.

The above specifications can be revised to get higher carbon and manganese contents when required in the article to be welded, but the sulphur which causes the most trouble in the welding operation, should never exceed .050 or you will encounter "hot short" metal which will not flow readily under the flame.

The chemical and physical properties of the steel must be maintained at a high degree of uniformity since any appreciable variation will have a great effect upon the welding qualities of the material, as for instance, a high carbon steel will become burnt if subjected to the heat required for low carbon and a light gauge tube will melt through under the action of a flame, which is proper for heavy gauge stock.

We have considered at some length the types of welding machines and their application in the industry as well as look into the material we are to work with.

Material Used

Let us now start with our raw material and follow it step by step to the finished stages in one of the processes we have been discussing. The most important application of steam-welding, as well as the most interesting in my opinion is the tube-welding, as well as process. Here, our stock is received from the mills either in coils of variable length depending on the gauge and width of stock, or in flat strips of suitable length for handling in shipping, or else in mill sheets. If the stock is received in sheets these must be cut into strips of desired width by passing through slitting rolls prior to the forming operation. Strip stock is usually received from the mills slit to width, but if not, this stock too, should be trimmed to desired width to remove the selvage or round natural edge which will not produce a uniform high-grade weld.

This stock of proper width is run through a continuous rolling machine consisting of several pairs of gear driven companion rolls of such design as to gradually form the stock from a flat strip to an open seam tube. These flat strips which have been cut to proper length prior to entering the forming rolls pass through the tube forming machine at a speed of from 50 to 250 feet per minute depending on the size and gauge of the stock and come out uniform in cross section and with a straight seam, both of which conditions are essential to good weldin.

The open seam tube is placed in a trough in front of a seam-welding machine equipped with a pair of vertical rolls which propel the tube forward at a comparatively slow speed under the stationary welding torch and through pressure rolls where the weld is completed. A stationary guide blade riding between the edges of the tube prevents the seam from twisting and getting out of line with the welding flame. After leaving the pressure rolls, the hot tubing passes into a pair of sizing rolls which restores it to proper cross section Here water is poured on the tubing to cool it prior to the straightening operation which takes place in the final pair of rolls.

Our tubing is now welded and straightenend and sufficiently true in diameter and smooth in finish for many purposes for which it can now be cut to length and fabricated or shipped as straight tube. If further refinement of finish is desired, the tubing can be polished on an emery coated felt or canvas wheel to remove the slight excess of metal left along the seam and then be sized in rotary swaging machine.

A single size of welded tubing can be drawn to any number of smaller sizes and various shapes by first annealing to refine the grain of the steel and then passing thru dies or rolls on a drawbench. The weld that has been produced in this process in a combination of steel casting and compression weld and unless refined, will not have as good physical properties as the original metal. As the abutting edges of the tube come under the influence of the welding flame, the upper surface of the stock is heated to the fusing point and a puddle of molten metal is formed while the lower portion not in direct contact with the flame has received sufficient heat by the conduction through the metal to become plastic, or, in other words, is at a welding heat. The pressure exerted by the pressure rolls completes the weld by forcing together the edges of the stock now plastic and the result is a compression weld on the underside and a fusion weld on top. When you consider that the majority of gas-welded tubing is manufactured from stock 1-32 in. 1-16 in. in thickness it is evident that very close regulation of the heat is necessary to produce a perfect weld.

If a single jet torch is used for welding it becomes necessary to raise the temperature of the metal 2600 deg. F., or in other words, from room temperature to the melting point of steel, in a fractional part of a second while on the other hand if several jets are acting upon the stock as in the case of the multiple-jet torch, the metal will be preheated gradually up to the proper temperature and the lower section of the steel will be allowed sufficient time to reach a plastic stage.

On a given gauge of tubing the faster the welding speed desired the greater the distance between jets to obtain maximum economy in the welding flame.

High Speed Welding

The tendency toward high speed welding in the past few years has resulted in much bad welding due to the fact that the necessary concentration of the heat was so great to obtain proper penetration that the upper surface of the steel was burned by the time the lower section had reached a welding heat or else the upper section was properly fused and the lower portion never reached a welding heat and resulted in what is known in shop practice as a "cold weld" or "sweat weld."

A machine welding torch requires for its operation a larger volume of oxygen in relation to acetylene than is the case with a hand welding torch, due to the inability of the flame to derive as large a percentage of its oxygen from the air while burning in a confined space between dies or rolls where there is not a free cultivation of air.

The chemical reaction for the complete combustion of acetylene is as follows:

$$2(C_2H_2)+5(O_2)= 4(CO_2)+2(H_2O)$$

Here we see that it requires 2½ parts of oxygen to one of acetylene for the complete reaction. But, in the welding flame this reaction takes place in three stages:

No. 1. $2(C_2H_2)+2(O_2)= 2(H_2)+4(CO)$

No. 2. $2(H_2)+4(CO)+2(O_2)= 2(H_2)+4(CO_2)$

No. 3. $2(H_2)+4(CO_2)+(O_2)= 2(H_2O)+4(CO_2)$

In a hand torch one part of oxygen is mixed with one part of acetylene in the torch and reaction No. 1 takes place at the tip of the first cone of the welding flame.

Reactions No. 2 and No. 3 should obtain oxygen from the surrounding air as the torch is moved about in the hand welding operation.

However, since the machine torch is either stationary or operating in a confined space where air curents are more or less obstructed it is necessary to furnish -¼ to 2 parts of oxygen to one part of acetylene for proper torch operation.

This excess of oxygen is detrimental to the weld as the free oxygen will strike against the heated metal and cause oxidation. This can be remedied

Continued on page 52

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

We promised to give two scales to the two winners of this contest, but unfortunately for readers, there is only one contestant with a correct list. This is from Lorne M. McKenzie, of D. McKenzie Machinery Co., Guelph, Ont. A scale is being forwarded to him today.

CONTEST FOR SEPTEMBER 8th ISSUE

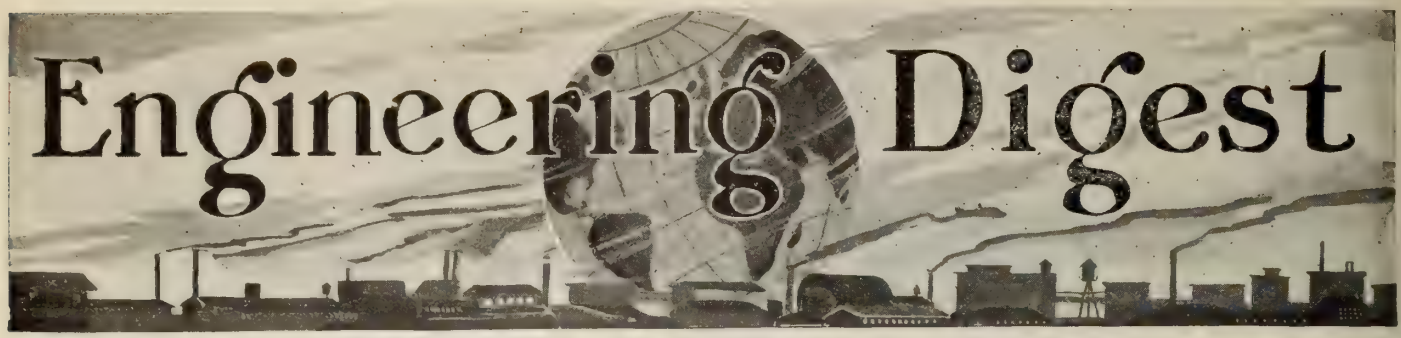
Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something a best man appreciates.
2—Done just right in half a mo'.
3—Turning mill to a 35-foot swing.
4—Seven decades to solve a problem.
5—A brush with strength of a pyramid.
6—A canine clamp made to stand up.
7—A Spring Maid (made) over 50 years.
8—An appliance for enlarging.
9—Locked joints, strength about the dash but no waste.
10—Specialty 20 years old and still going strong.
11—A 35-inch swing over a bed.
12—Something twice as large, bigger and better than ever before.

These are Correct Answers for List from August 18th Issue:

1—Bilton Machine Tool Co.
2—Pratt & Whitney Co.
3—L. S. Starrett Co.
4—The Heald Machine Co.
5—E. W. Bliss Co.
6—S. F. Bowser Co.
7—The Bristol Co.
8—Wright Mfg. Co.
9—Algoma Steel Corporation.
10—Ford-Smith Machine Co.
11—S.K.F. Co.
12—Canadian Fairbanks Morse Co.

Closing Date for This Contest is Sept. 29th



Accounting For Scrap

THE subject of spoiled material, in other words "Scrap," has, and always will be a live one. We hate to admit that we have a considerable amount of spoiled work on our hands, yet the pile of wasted effort shows itself month by month. C. B. Williams tackles the subject boldly in the official publication of the National Association of Cost Accountants. Speaking on a sensible method of accounting for scrap he says:

"Scrap credits are frequently made to general overhead or to miscellaneous income account. The unsoundness of this procedure is at once apparent if it be remembered that scrap is an item relating entirely to material cost and cannot, by any line of reasoning, be associated with the items making up general overhead. Of course, the ideal method would be to credit the scrap value directly to individual orders or items, but this procedure is often impossible. In each case investigated, an attempt to deduct scrap from raw material costs has proved itself to be well worth the initial trouble. The problem which presented itself in each case was the same, namely:

"The production of scrap of high raw-material value. The impossibility, under the conditions, of crediting the orders with actual values produced. How to handle the values in such a way as to distribute them as equitably as possible to the several items entitled to these credits. The solution which to my mind is the most feasible and at the same time the most logical, may be summarized as follows:

"Establish a standard unit raw material quantity charge for each item, and also a standard salvage credit if this be possible. Charge each order or item with the total raw material requisitioned against it.

"Credit each order or item with its proportion of salvaged material as determined from the standard unit quantity charge or credit, charging salvage account with the amount of the credit adjustment. Salvage value must be determined in each case according to the use to be made of the salvaged material.

"Credit salvage account and charge, according to requisitions, the order or item using the scrap as raw material, pricing it at the same figure as that at which salvage account is charged.

"The step in this solution which has been the most difficult to apply in practice, and which, therefore, is liable to cause the greatest hesitancy, is the fixing of standard unit quantities. After this first and most difficult part of the problem has been worked out, the succeeding steps can be easily followed because they are largely a matter of adapting routine that is likely to be already present in any efficient cost system, to the special needs of a particular problem."

Application of Compressed Air

A RATHER humerous anecdote is related concerning what is claimed to be the first time that compressed air was employed to eject work from a power press. A young fellow applied for a job as a die-setter in a power press shop of considerable size, and was engaged on the strength of the glowing capabilities he claimed for himself. The first task given him was to set up and try out a die for stamping a simple circular blank of very bright metal, and he was given the choice of two presses for the purpose. Both presses were small and of equal capacity, but one was of the straight-sided type, while the other was an inclinable press. He chose the latter for the work. The boss kept his eye on the young die-setter because, from a previous inspection of the construction of the die, he knew that the stamping would not lift out and slide away from the press of its own accord, even though the machine was inclined at a generous angle.

When the die had been set up and was tried out, continues the writer in a recent issue of "Machinery" the result was not as the die-setter expected, but, of course, as the boss had anticipated—the work would not slide off the die. The young fellow seemed puzzled for a minute; then his worried look changed to one of hope and understanding. He left the press for a few minutes and returned with a hand bellows. This he gave to his helper and stationed the latter in a sitting position on the floor and under the press. The helper was then instructed to place the nozzle in a vent in the bottom of the die and to squeeze hard immediately after each tripping of the machine. The helper followed the instructions faithfully and the stampings kept flowing out of the die and rolling from the press after each operation. Thus, the young genius not only made good on his new job, but also instituted the first compressed-air device for the removal of small stampings from a press, even though it was operated by a "human knock-out."

Machining of Aluminium

ALUMINIUM enters so largely into machine construction today that it is necessary to study closely its characteristics from the machining standpoint. Some excellent advice on the subject is given in a handbook published by the British Aluminium Company. This company has investigated thoroughly alloys with a view to determining their machining qualities and the most suitable treatment.

For turning, drilling or milling a high speed is found best, and the tools should have acute cutting edges, preferably finished on an oil stone. or the clearance angle of a lathe tool 15° to 20° is advised, and with the smaller angle a 5° top rake may be given. This top rake should be modified according to the rigidity of the work, as with light work there is a tendency for the tool to dig into the metal. Cutting speeds of about 600 ft. per minute are permissible, and a heavier and faster feed than with brass may be employed.

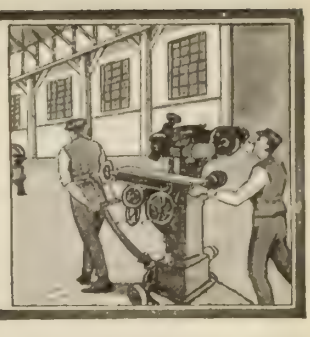
For screwing purposes they use a special alloy, and recommend the use of a paraffin as a lubricant instead of turpentine, which tends to leave a resinous deposit that may cause the screw to bind. In milling, the best results are said to be obtained by the use of a built-up tool, the cutters being ground with sharp corners. The cutters should only cut at the extreme points and not have a scraping action as with brass. Cutter speeds of 500 to 600 ft. per minute are commonly used.

When grinding aluminium the wheel should first have a piece of paraffin wax held against it to fill up the pores. A wheel so treated will not cause the metal to adhere to it and will not require to be so frequently dressed. Any kind of grinding wheel may be used (emery, corundum, carborundum, etc.) but crystolon wheels are said to give the best results.

It is advised that filing be done with a single-cut file, as cross-cut files are readily clogged and require frequent cleaning with a wire brush. A quicker method of cleaning is to immerse the file in a strong solution of caustic soda, which rapidly dissolves the aluminium. Files so treated must afterwards be washed in water and dried in sawdust or they will quickly rust. For finish filing, the file should be kept wet with paraffin or even with water.



DEVELOPMENTS IN SHOP EQUIPMENT



REVOLVING CAR DUMPER

The Wellman-Seaver Morgan Co. Cleveland, Ohio, have marketed a revolving car dumper. This apparatus has been developed to meet the demand for a low capacity machine of simple construction, adaptable to plants where the first cost of installation is a governing factor, but here high efficiency, low operating cost and minimum labor are required.

All sizes and capacities of cars are handled by this machine. The cars may be short or long, high or low, wide or narrow, the clamping arrangement automatically adjusts to the size of the car the machine is handling. It is only necessary to place the car in the machine and turn the control lever and the car is inverted, discharging the contents into the bin underneath. After dumping, the car is returned to its original position by simply turning the control lever in the opposite direction. With the single exception of the revolving operation, all of the functions are entirely automatic, and that operation is controlled by a single lever.

The machine consists of a car-loading cradle which is supported at either end by equalizing rollers upon which it revolves. These rollers are carried in structural steel bases securely bolted to the foundation. The end frames of the cradle are in the form of circular girders which are partially surrounded by gear segments. Rotation is accomplished by two pinions meshing with the gear segments and driven by a single motor supported on the main foundation at the rear of the cradle. Two sets of car clamps are used to hold the car in the cradle while dumping these clamps are normally held in their upper position when the cradle is ready to receive a load or discharge an empty car, and in this position ample clearance is allowed so that the largest car or even a yard locomotive can enter the cradle.

The machine is operated from a cab at one end of the cradle, elevated to such a point that the operator has a clear view of his work at all times.

It is to be noted that only a single motor is required for the operation of the machine. There are no electrical connections on the cradle and no complicated interlocks to get out of order. It is impossible for the operator to make a wrong move which would cause a serious accident, as he has only one lever to operate. By varying the size of the motor, any practical speed of operation may be secured. For instance a capacity of 15 cars per hour requires a 40 h.p. motor. If a smaller number of cars per hour is required, a correspondingly smaller motor may be used. Either direct or alternating current may be used.

VERTICAL DRAWING BOARD

The Simplex Tool and Instrument Co., Camden, N.J., have added to their line of drafting outfits, a style C vertical drawing board. The board is equipped with a Simplex drafting machine. It is regularly made 42 inches in width and to any length desired. It is intended for use in making large drawings such as require a draftsman to be in a standing position while developing them. The board is counterweighted, and slides up and down on a pedestal, this being especially advantageous when a draftsman wishes to work at the top of a large drawing. The drafting machine is operated entirely by the left hand, thus leaving the draftsman's right hand free to use a pencil. The board can also be supplisd with a frame to enable it to be attached to a wall, instead of being placed on the floor.

CENTERING MACHINE

The Hendey Machine Co., Torrington, Conn., has developed and marketed a double head centering machine which is intended chiefly for centering both ends of bars simultaneously. Instead of the usual belts driving to the spindles from an overhead drum, a single belt drives a countershaft running on ball bearings and supported on brackets on the rear of the bed. From the countershaft the power is transmitted to the spindles by means of silent chains. The spindles are fitted with spring collets to hold the centering tools. The work-holding jaws are operated in unison through the medium of bevel gears on a splined shaft, and it is said that the machine can be operated by a 1-2 h.p. motor.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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B. G. NEWTON, Manager
A. R.. KENNEDY, Managing Editor
J. H. MOORE, Technical Editor
T. H. FENNER, Associate Editor
J. H. RODGERS, Montreal Editor



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Danger of Government Work

IN another portion of the present issue, we publish a letter received from one of our regular contributors. It touches upon the "treatment of undesirable Workers," and to our mind presents the matter in a rather unfair light. The writer, Mr. John Homewood, evidently has the impression that employers in general are dead on the employee who does work for himself in the firm's time, or to use the shop expression "does a lot of government work."

No one will question for a moment the fact that anyone doing "government work" is nothing short of a thief. This may be a blunt way of putting it, but the truth is often unpleasant. When a man takes his employer's money, he is supposed to work for the latter and not for himself. Any other line of conduct is dishonest. The fact that hundreds of mechanics do little jobs for themselves in the firm's time does not lessen the evil. Some meet this argument with the wail that masters make enough out of them to stand this loss, and that the rate of wage they receive is less than they are worth. In such a case the only remedy is to demand what you're worth and prove you are worth it. In the event of a refusal bide your time then make a move to a firm that can appreciate your work. The evil of "government work" cannot hide behind any wall of excuses. The fact remains that anyone doing work for himself in someone else's time is dishonest, much as he may try to disguise the fact.

It is only very rarely that such an incident as Mr. Homewood cites occurs. The average employer does not take the trouble to hound a man after he has been discharged. Usually he refuses to give him a recommendation and with good cause. Suppose a worker made a practice of doing work for himself. Should the employer give such a man a good character only to wish him on to some other employer? The writer of this editorial has done "government work", been caught at it, then forgiven. Not once, but many times, so that he speaks from experience. A superintendent who fires a man for such a cause, does so, not because of the deed, but for some other deeper reason. The worker may be a very poor mechanic, or perhaps one who is always late for work, etc. A good worker seldom gets discharged for such a complaint, but then a first class worker is too busy producing to steal the employer's time. In fairness to Mr. Homewood we have published his letter verbatim but we cannot see that he has proved his case. The only way to stamp out this evil is for the workers themselves to discourage any attempts at it.

* * * * *

The U. S. Shipping Board

AN American contemporary has come out with a bold plan for straightening out the tangle into which the U. S. Shipping Board fleet has got itself. This is a simple, but withal heroic remedy. The idea is to sell the ships if possible, and if not, sink them. This is perhaps not so wild a suggestion as it would appear at first sight. The fleet as it stands today is costing the U. S. taxpayer millions of dollars annually, for which there is not the slightest prospect of any return. The appointment of three practical shipping men as vice-presidents in charge of actual operation is a good move, but good as these men may be they cannot perform miracles. The whole of the wooden tonnage represents a hopeless loss, as these ships are utterly impossible from any commercial standpoint. From the value of the steel fleets, millions have been or are about to be written off, which will enable them to be offered at a lower price but there are many of them which are unsuitable in size and design for world trade. Owing to the penalty of high wages and high operating costs those that can be kept running are so kept at a loss in every voyage, while from the standpoint of efficiency in operation they are notoriously lacking. The real reason behind the refusal of the Egyptian cotton exporters to charter American ships at a lower figure than they could get British ships at, was due to this inefficiency.

The contemporary in question gives some appaling figures as to the cost of the fleet. The wooden ships are costing $135,000 per month to keep in idleness, while the recent losses of the whole fleet are put by President Lasker of the Board at $300,000,000 per annum, and to keep the Board alive till the end of the year will need a sum of $125,000,000. The losses according to the board's books in operating the fleet amount to $10,000,000 monthly, while repairs consume the neat little sum of $2,000,000 per month.

On the face of these figures the suggestion that the ships be sunk if no other way presents itself of getting rid of them is on the whole not a bad one, and from the point of view of private shipping interests, an excellent one. We are afraid that the suggestion carries little prospect of fruition. The U. S. taxpayer is not yet fully alive to the cost of his bid for sea supremacy.

* * * * *

A Foolish Action

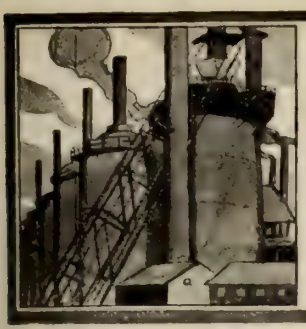
A FEW days ago an onlooker at one of the exhibits in the Machinery Hall at the Toronto exhibition almost ruined a first class turret lathe through his search after knowledge.

The operator at this particular booth was showing to a crowd of interested spectators the lathe's productive capabilities. Naturally, he was very much on the job and had no time to pay attention to the crowd's actions.

Suddenly, an inquisitive onlooker noticed a pretty looking lever which did not seem to be in use. To satisfy his whim he leaned over the railing and pressed the lever to see what would happen.

Whoever he was he must have been quite satisfied for it was the quick traverse lever which he had operated. Luckily, the machine was of rugged design, otherwise the danger would have been very great. It would be pleasing indeed is the party responsible were to read this editorial. Unfortunately this is very unlikely for no real mechanic would have done such a foolish action. Evidently some irresponsible youth had wormed his way through, pushed the lever, and caused the trouble. Let us hope this solution is correct, for we would hate to think a grown-up man would be guilty of such foolhardiness.

From our point of view, a man caught in such an action deserves to be kicked, and kicked hard. We will not stipulate where, but readers can use their own judgment. Anyone viewing such an exhibit should adopt the slogan "Hands off,' and should they see anyone forgetting the motto, warn them first, and if that does not work then use our former advice making the action of the foot swift and decided. Exhibitors pay their demonstrators to operate the machines, and they require no outside help (?)



MARKET DEVELOPMENTS



Business Outlook Is Much Brighter This Week

Machine Tool Trade Has Picked Up Considerably—Orders Are Worth While And Deliveries Good—Small Tools Are About The Same As Usual—Steel Market is Making Headway.

'BUSINESS is improving.' This seems to be the thought uppermost in everybody's mind at present. The machine tool trade occupies premier position in this respect. One dealer claims that last month was the best he had witnessed this year and that he expected the improvement to continue. The orders secured were of such size as to be considered well worth while.

This fact brings out an interesting situation namely, that when a would be purchaser is really anxious for equipment, yet cannot make a quick payment, he can sometimes secure from the manufacturers a reasonable extension, always providing, of course, that his rating is what it should be.

The steel market also shows an upward tendency. Sheets, tubes, and reinforcing materials are all going strong. There is a specially good demand for the latter as building is picking up considerably in some quarters.

The small tool market is about the same as usual, and the least said about the scrap market the better. Stocks are still high so that dealers do not care to buy any further material. Pig iron prices continue to stiffen, and it looks as if this will continue as time goes on.

MARKET IN PITTSBURGH IS BETTER PIG IRON CONTINUES TO HOLD ITS OWN

Special to CANADIAN MACHINERY.

PITTSBURGH, September 8.—After the little backset a week or two ago the improvement in the demand in the steel mills is in swing again. The turn in the tide occured about the middle of July, but the improvement is more impressive by the time it has lasted than by its amount, for even now the demand represents only about 30 per cent of the mill capacity. At the middle of July, however, the mills were scarcely operating at 20 per cent of capacity.

Improvement from week to week has been very slight, only barely perceptible, but longer range comparisons make more pronounced showings. One of the large steel companies finds that its bookings in August were more than 50 per cent greater than its bookings in July, and there are several that show increases between 30 and 40 per cent. There is probably not a single case of any steel producer or steel finisher of any size not having at least a little better business in August than July.

Nearly all the improvement to date, in demand on the steel mills, is traceable to exhaustion or partial exhaustion of stocks in the hands of distributors or manufacturing consumers. According to all accounts there is some improvement in general business, and that of course is a good thing in its way, but the outstanding feature of the steel situation recently was that the demand on the steel mills was far below what it should be in view of the condition of general business. That was due simply to the existence of stocks, as all holders of steel or of things made of steel desired to liquidate. Some had abnormal stocks, but the general policy was not to reduce stocks to normal but to reduce them to nothing. Such a policy is likely to be pursued too far and it is quite possible that in a few weeks there will be a disposition to build stocks up towards normal. If buyers of steel were afraid that steel prices were artificial and would break so as to cause losses there is good ground now for them to abandon such fears, for it is quite certain that steel prices now are at the bottom or are so near the bottom that no material loss can be sustained. It is true that steel prices are up, on an average, about 71 per cent over their minimum in December, 1914, but the prices at that time were quite unprofitable, and the fundamental items of cost have advanced fully as much. Prices cannot come down much from their present level, if at all, except by these fundamental items going down, as by a general reduction in freight rates and by wages coming down farther, and such things will require time. At the top level, the common labor rate was 46 cents an hour, with time and a half for hours in excess of eight, while now the standard rate is 30 cents, without overtime. That is, a man used to be paid, for 12 hours' time, 14 times 46 cents, while now for 12 hours time he is paid 12 times 30 cents.

In the case of bars, shapes and plates, the regular or open market (subject to occasional shading) is 1.75c, which is 67 per cent above the open market in December, 1914, which was 1.05c., subject to shading in some cases to 1.00c. The 67 per cent is $14 a ton. Thus the market cannot "break,' the only change possible being one of say $1. or $2 a ton or something like that, altogether insignificant compared with the many dollars a ton by which the market has receded up to this time.

In the case of sheets, which recently had quite a drop, there is a possibility that there will soon be an advance from the present level of 2.75c. for black and 3.75c. for galvanized, as these prices are lower, relative to cost, than are prices of other steel products.

Shapes and plates are quoted rather openly now at 1.75c. against 1.80c. a week or two ago, and there is a little shading on desirable orders. Bars are rather stiff at 1.75c., with little shading. Late in July the open market declined to 7.75c. on bars and 1.85c. on plates and shapes, but some mills were shading freely on attractive orders, and it is a question whether the extreme price is any lower now than it was then. In other words, the market is steadier, with less of a spread between carloads and large lots.

Buying of steel products, as for several weeks past, is widespread, there being many orders, coming from all parts of the cauntry and almost all classes of trade, the orders all being small. The buying is of course of strictly hand to mouth character, no one taking any more steel than can be

liquidated at once. Among manufacturing consumers, the agricultural implement trade is conspicuous by its absence, there being scarcely any other line of consumption that does not show a little demand. The electrical goods market is rather quiet. There is quite a fair demand for sheets for eave trough and conductor pipe, and there is a very fair demand for all classes of steel from the automobile trade. Jobbing demand is decidedly fair, particularly in the south and southwest.

Railroad demand is light all along the line, except that there is a heavy demand for galvanized sheets for car roofs. A few releases have been received in the past fortnight, for shipments of rails on contracts made for the present year. Some of the rail tonnage billed for this year will undoubtedly be held over, partly because the railroads are short of funds and partly, perhaps, on account of hopes that the price of rails will be reduced.

Pig Iron

The stiffening in pig iron prices continues. The Chicago maret has gone up a total of $3 from its recent low point, Buffalo being up a dollar or so. The valley market on foundry is up another 50 cents, or to $20.50, valley, against $19.50 at the low point.

One way of putting it is that pig iron is advancing because freight rates on ore, coke and limestone have not been reduced and may not be reduced for months. Months ago nearly all the merchant furnaces went out of blast, with stocks, and of course they wished to liquidate the stocks as costs were expected to decrease. By and by prices had gone below the current cost of production, but perhaps not below what would be the cost of production when freight rates should be reduced. The condition now, however, is that the stocks are pretty well liquidated and the freight rates are not down. A furnace might sell its stocks at any price, but it would not blow in to make pig iron at a loss.

Connellsville coke prices are plainly defined and it is made clear that reports in circulation in some quarters for some weeks past, as to low prices that could be done, were without foundation. While $2.75 was reported possible on furnace coke, a contract has been made at $3.10, the American Rolling Mill Company buying 9,000 tons a month, September, October and November, from the Hillman Coal and Coke Company, and this is considered the market level. For one month the price might be $3.00, but for delivery beginning October 1 and running through December the price would probably be $3.25. Spot foundry coke remains quotable at $4.00 to $4.50.

Gotfredson Joyce Corporation, have opened a sales office at 144 Bleury St., Montreal, which will be under the management of Mr. G. L. Ellis, who was for several years connected with the White Company.

POINTS IN WEEK'S MARKETING NOTES

Salesmanship is now a big factor. Firms are finding the competition very keen, therefore they must use capable salesmen to dispose of their goods.

Although the war finished almost three years ago, many firms are still wiping off losses. This causes price lists to be almost non-existent, as stocks are being disposed of for whatever the market will bring.

The sale of small tools and high speed steel in the Montreal field is of the hand to mouth variety. Shops are only purchasing what they actually require.

Although sheets in the Pittsburgh Market had a drop recently, there is a possibility of their advancing from their present level.

Shapes and plates are being quoted at $1.75c against 1.80c a week or two ago. Even at these prices, shading is being done where the order is large enough.

Buying of steel products is of the hand to mouth variety. Railroad demand is light, and some hope is expressed that the price of rails will be reduced.

Sheets and Tubes are moving very nicely and there is a good demand for reinforcing material. Prices on boiler tubes remains the same.

The machine tool business has picked up splendidly this last month. According to one dealer August was the best period this year. The orders secured were of good proportions, and the deliveries with one exception, were very good, the reason for the delay in the one case being the fact that the machine was special.

TORONTO MARKET SHOWS IMPROVEMENT

Market Can be Truthfully Said to be on Its Feet Again. Confidence is Evident and Machine Tools Are Active

TORONTO, Sept 9th. There is a decided upward trend in the market at present. No matter what line you talk to the answer is the same, viz, "Business is picking up."

The machine tool business especially has come to life. One dealer mentioned to Canadian Machinery, that August had been the best month of the year, so far as he was concerned. People are at last realizing that machine tools cannot be bought for next to nothing, therefore they are purchasing the new equipment they so badly need. One machine alone, which was sold in August, cost over $23,000, and this was only one item on the order. More detail on this particular tool in next weeks issue.

Manufacturers of machine tools are being very decent these days regarding financial arrangements. According to one dealer, a prospect of his wanted some machinery pretty badly, but could not stir up the cash just at the moment. It looked as if the business would not go through for the banks refused to loan money for the purchase. The dealer naturally was loath to lose such an order so he wrote the firm he was representing explaining the situation clearly. Back came a prompt reply offering the would be purchaser such splendid inducements that he immediately closed the deal. This shows clearly that now is a good time for buyer, maker, and dealer to get together.

Collections in some quarters seems to be rather poor. One dealer reports that he has been forced to take back a few tools at a loss, while another states his collections are improving. The chief point is people are buying, and as a general rule they are in a good position to pay.

The Steel Market

This section of the market is also picking up. One concern told Canadian Machinery that last month was the best since the break. Over 1000 car loads were shipped last month from this particular firms premises.

Reinforcing material is going strong. One dealer explains the sudden spurt by pointing out that the material bought at present is not so much for new buildings as for those already in course of erection. "Many builders" he said, "are simply buying material as they progress." One party asked us to quote on the material for one floor only, and wanted us to protect him against a decline in prices. I said I would if he in turn protected us against a sudden rise." That finished the argument and the order for the complete building was secured at the current market rate.

Sheets are moving nicely, especially the blue annealed variety. Boiler tubes are also being sold in good quantities, so that no further drop in this commoity is looked for.

Small Tools

The small tool market is much the same as usual. One dealer claims that if he took every month since the first of the year and compared figures they would almost be alike. "We cannot complain" he concluded; for we are doing as well as can be expected."

The scrap market sails along unconcerned. Nothing has happened during the past week. Buying is of the very light variety, and as far as prices are concerned they vary depending on the size of the order. Stocks are still high so that dealers are not in the market except the price asked is very favorable.

PRICE LISTS NON-EXISTENT IN MANY LINES—PIG IRON IS STRONGER

MONTREAL Sept. 8—The slight general improvement shown in general business conditions last week, throughout the Province of Quebec was a source of a great deal of satisfaction to the trade generally. This week's reports show that the improvement has continued. Of course, trade is far below normal in all lines, but a slow steady improvement is an indication of a healthy and permanent move in the right direction. During the war years when business was stimulated to such unnatural and abnormal growth, dealers and manufacturers had to adjust themselves to the conditions as best they could. Everyone had to alter their ideas and methods. The art of salesmanship was not a factor in business. In many lines orders came in unsolicited and each additional one is often an embarrassment.

To-day, with trade as abnormally quiet, as it was previously abnormally good, firms are again participating in competitive selling. Revenues being small it is a great problem to organize a really efficient and representative sales department. Many firms, including dealers and manufacturers, carried heavy stocks previous to the present slump in business. To-day, almost three years after the cessation of the war, and almost one year after the break in general business circles, liquidation is still going on. Such conditions cause price lists in many lines to be non-existent as stocks are being disposed of for whatever the market will bring. Until this liquidation has been completed and new stocks procured, a settled condition cannot be obtained. The railroad situation is one that has a very direct bearing on the machine tool, and iron and steel markets. Not for over twenty years have the purchases of the large railways been of such conservative nature. They are only purchasing in small quantities and then only what they require for immediate use.

Building throughout the large centres is fairly active. This line of work, though far below normal, is one to be reckoned with, and next year's programme promises to be up to, and will perhaps exceed, that of normal years.

Steel Industry

Throughout the States the steel mills are producing but a small percentage of their capacity and this condition, generally speaking, applies to Canada. A nominal tonnage in rails is being produced. Structural steel is in good demand. Most firms have to-day a fair stock of structural shapes and purchases are limited to stock replacement orders only. Bars are in little demand and most jobbers are carrying little or no stock. No British bars are being imported. The small consumption is being taken care of by American and Canadian mills. Sheets and plates are moving out slowly with little tendency toward an increasing volume of business.

Pig iron has shown a slight tendency to strengthen in price. Orders for small to medium lots are reported from many sources. However, the large foundries are doing little or nothing. The foundries in the railway shops are doing nothing to speak of. The small and medium sized foundries in both the city and the rural districts are operating and it is from them that the demand for pig comes. The low price of two weeks ago was considerably below production cost. The low level was caused by some American steel companies entering the field with their surplus of pig iron and cutting prices. Of course, there are many furnaces idle throughout the country and should the demand for pig iron increase it is not likely that these furnaces would "blow in' until the prices had increased to a point where at least production cost is assured. Anticipating a probable shortage some firms have approached the producers for contracts covering several months. This the companies are refusing, and present quotations are for immediate deliveries only. Thus, there is every reason to believe that if the demand continues to improve, the price will increase until there is a fair bargain for the producer.

High Speed Steel and Small Tools.

Sales of small tools and high speed steel are of a "hand to mouth" variety. The volume from week to week changes but little. None of the large shops are operating to any extent and thus the smaller shops are furnishing the demand. Prices are not stable as many dealers still have stocks purchased at prices higher than the present general schedule. Therefore quotations are usually made for each order. There is a great deal of competition in this trade and the manufacturers are working hard to place their goods with the jobbers and dealers.

Business is not showing any improvement in the scrap metal trade. A small amount is being done but for several weeks prices have been at a low level and very little business offering. In the non-ferrous metal market business continues to be very dull. Prices have weakened a little and but a small amount of business is moving.

CHEMICAL MEN DISCUSS PROBLEMS

Prominent British Scientists Discuss Chemical Problems. Interesting Three Day Program.

The Society of Chemical Industry held their Fortieth Annual Meeting in Montreal on August 29, 30 and 31. Many of the leading chemists of Great Britain were in attendance and it is the intention of the visitors to investigate several of the Canadian industries with a view to finding out the application of chemistry to these industries.

According to Sir William Pope, K.B.E., F. R. S., president of the society, the pulp and paper industry is attracting great interest among British chemists. The members visited several of the large pulp and paper factories in the Province of Quebec. The carbide industry and similar works connected with the hydro-electric plants were also a source of great interest to the chemists and they were shown Shawinigan Falls. Grand Mere and other points where there are plants using chemical and electric forces for commercial purposes.

As yet Sir William could not say in what particular way the chemists might be able to aid these industries, but great things were being done by research work and occasionally aid was forthcoming where least expected,

The party left Montreal on Sept. 2nd for New York, where they will attend the annual meeting of the American Chemical Society, but while in Montreal several interesting papers were presented.

BELGIUM PRODUCES AUTOS SUCCESSFULLY

The manufacture of automobiles in Belgium has progressed steadily since the armistice, and several works have been successful in the production of one, three, and five-ton lorries at competitive prices. According to reports no American trucks have entered the country for some months. A number of well-equipped makers at Liege and Brussels are turning out luxury and touring cars. With their first-hand knowledge of the country's special requirements they are able to supply a chassis of very solid construction, capable of withstanding the strain of Belgium's rough roads. Under similar usage certain American chassis are reported to have broken down in a few months.

France, however, still manages to compete in the Belgium market, thanks to her mass production of small 10-14 h.p. cars, which are very popular. The importation of these and of other French makes is increasing to some extent, whilst purchases from other countries are negligible. Owing to the large number of excellent coachbuilders in the country, the Belgian customer prefers to buy a chassis and have a body built for it either in Brussels, Liege, or Antwerp, where the wheels are at the same time fitted with locally made tires.

Belgian manufacturers are obtaining good orders in countries where road surfaces resemble their own, notably the Balkans and northern Africa. Their motor cycles, too, are going overseas in increasing numbers, fairly large sales having recently been made for Poland, Greece, Brazil, China and the Congo. The tire factories in Liege, Brussels, and Ghent are naturally benefiting by this activity in the motor vehicle business.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	2 10
Tank plates, Pittsburgh	2 20
Structural shapes, Pittsburgh	2 20
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 00	17 50
Castings, copper	16 75	18 00
Tin	34 00	39 00
Spelter	7 00	7 50
Lead	6 50	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$5 00	$3 90
Plates, ¼ up	4 50	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 50	$ 9 00
Copper, crucible	11 00	11 00
Copper, heavy	10 50	11 00
Copper wire	11 00	11 00
No. 1 machine composition	9 50	9 75
New brass cuttings	6 00	8 00
Red brass turnings	8 00	8 00
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less.	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	45
Can. carbon cutters, plus	10
Standard drills, all sizes	45
3-fluted drills, plus	10
Jobbers' and letter sizes	45
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	10 to 15 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$6.75	$5.25
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 50	7 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	.....
Queen'sHead, 28 B.W.G.	9.00	....
Fleur-de-Lis, 28 B.W.G.	8 25	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28. U.S.	6 85	6 75
Premier, 10¾-oz.	7 25	7 15
Zinc sheets	11 50	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	27 00
1¾ in.	29 75	24 00
2 in.	29 25	22 00
2¼ in.	33 00	25 50
2½ in.	44 75	28 00
3 in.	49 25	34 00
3¼ in.	.....	42 50
3½ in.	63 50	37 50
4 in.	85 00	48 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21	Atlas	19
Peerless	22	X Empire	15
Grand	21½	Ideal	18
Superior	21½	X Press	13½
X L C R	16½		

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	17	Dark colored	13
Mixed colored	14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 10% Best grades 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



PRINCIPLES GOVERNING DEVELOPMENT OF CANADA'S EXPORT TRADE

DURING the annual report on export trade conditions, the Commercial Intelligence Dept. quoted several principles governing the development of Canada's export trade which are well worth repeating. They state that at the present time great care and caution should be taken in entering foreign fields. There are in Canada good facilities for obtaining credit information on foreign firms and buyers. Reliable information should be secured before entering into any contract with a foreign firm or individual.

Exporters should not be impatient of results in foreign markets. It is better to remain established in the export trade with no immediate profit, than to drop out and enter at another time. A sound, permanent market is what is required. All contracts must be lived up to. Orders should be punctually filled to the satisfaction of the customer. In many countries Canadians are classed as Britishers and Britishers have the reputation for keeping contracts and being punctual. This is to our advantage and we should live up to it.

The customer should be given what he wants, and not what we think he should have. Shipments should always be up to sample. We must please our customers and not ourselves. Courtesy in correspondence is doubly necessary. While much trade can be secured through export commission houses, and resident agents in foreign countries, it is a much better method to send Canadian travellers abroad. Canadian goods can best be introduced by Canadian salesmen; and whatever means we finally employ for the distribution of our goods abroad, it is a great advantage to have some principal or trusted employee, connected with the firm, who knows conditions in our export markets.

Holding Our Trade

If we are to hold and extend our export trade, it is becoming more and more essential that quotations should be made c.i.f. foreign ports. Agents and buyers from other countries emphasize this. Exporters from other countries follow this practice, and their agent is thus enabled to quote the foreign buyer a laid-down price on short notice. A foreign buyer is generally not in the position to work out freight, insurance and shipping charges from a Canadian port. Many Canadian exporters keep up-to-date price lists of their various commodities laid down in foreign countries, overcoming the fluctuations of exchange rate for a set period, giving the customer the benefit of any improvement between placing of order and due date of payment.

Proper packing, with due consideration to character of goods and special hazards of ocean or difficult overland shipping is an important factor in retaining the goodwill of customers. It is essential, as in domestic business, that the utmost economy in production costs must be obtained.

In many countries Canada is judged by the actions of her citizens doing business there. In every export trade transaction the Canadian exporter has in his keeping not only his own reputation for integrity and fair dealing, but also the reputation of all other Canadians who are doing or who may seek to do business in export markets.

Generally speaking, in the absence of many of the accessories facilitating export trade with which longer established trading nations are equipped, it can scarcely be gainsaid that the most favorable markets for Canadian products remain those countries where English is spoken, trading customs similar, and in some cases preferential treatment accorded to Canadian producers. Next in order should come possibly South America, France, African protectorates and the Far East.

MACHINERY EXHIBITORS WILL GET TOGETHER

"IF THE machine tool dealers and manufacturers, and exhibitors who are interested in Machinery Hall want a better place in which to place their exhibits, then let them get together and go to the president and directors of the National Exhibition and state their case."

Such is the advice given to the machine tool men by J. Murray, one of the directors of the Fair, and a man who has interested himself many times on behalf of securing a better place in which to house the exhibits.

The suggestion made above was put up to a number of the exhibitors in Machinery Hall at Toronto Fair, and seemed to meet with a ready response from all of them. Apparently all the agitation of past years has failed because those doing the agitating and the objecting did it individually. The new move, now proposed, brings with it something in the line of strategy.

The exhibitors, on their part, will be expected to enter into some sort of an understanding with the management of the exhibition. They would probably be required to state definitely what amount of floor space they would be willing to take, so that the directors would have something definite on which to work in the matter of estimating the revenue for the upkeep and depreciation of the new building which might be erected.

Time for a Change

Exhibitors, especially those who place heavy equipment on the floor of Machinery Hall, know only too well what they have been up against this year, and every preceding year, in the attempts to place their exhibits without tearing the building to pieces. There is not even a block and tackle to assist in the work of putting goods along by means of rollers. There is no overhead crane, and there is a very indifferent shipping platform. Brute force and awkwardness are the principal assets in the unloading and placing of exhibits, while the same tactics have to be re-employed when the day comes to take the stuff out again.

Many of those who have been in the building in past years are not to be found there to-day, and the reason for their absence is to be found in the quality of the accommodation provided—or not provided—for them. One firm stated to a representative of this paper that of the exhibits made by them in various cities all over the world, the bill for taking the one to Toronto fair and getting it out again would be the largest ever sent to the home office.

It seems certain that some concerted action will now be taken by the exhibitors themselves, and the agitation in new form for a decent Machinery Hall is under way. It is also understood that it is the intention to greatly enlarge the scope of the exhibits to take in a great variety of machinery, also electrical exhibits, etc.

The scale of wages of the Amalgamated Iron, Steel and Tin Workers, at Hamilton, has been settled for the next year. A general reduction of 4 per cent. is in force.

* * *

Th Sheet Metal Products Co. of Canada have protested against the high tax rate. They claim the rate amounted to 126.3 mil's in Toronto, against 28.3 in Montreal.

LOCOMOTIVE HAS BEEN THEIR SPECIALTY

anadian Locomotive Co. at Kingston Has Always Specialized On Locomotives

The Canadian Locomotive Company, the year ended June 30, 1921, experienced earnings greater than in any ner year in the history of the organiation save one. The net was $827,091.62 against $892,976.32 in 1919, the best ar yet recorded. The earnings in 1920 ell to $367,969.02 owing to labor, troules, which began the previous year and xtended well into that year, and this, ogether with the difficulty of securing aterials owing to the strike and emargoes on American railways, affected e company's output at the time very aterially. The current decline in earngs has, of course, to do with the genal inactivity in trade circles; the railays are not securing traffic in the customed volume, and are not as a nsequence placing as many orders for comotives.

Capacity Was Increased

It was in 1911 that the Canadian comotive Company underwent a reganization and was placed in a more vantageous position to carry on the erations in which for a great many ars it had been engaged. The comny had its beginnings at the Kingston comotive Works, and, as such, was for a great many years the only conct shop in Canada devoted exclusively to the building of locomotives. It was probably under this title that it rned out the first locomotive ever onstructed in Canada. The date of this being 1855. With a few interptions, the company has been workd on locomotives, and on locomotives ly ever since; and at the time of the reganization mentioned it had expandd until it had a yearly output of about locomotives. The lack of facilities for turning out a yet larger number necessitated the refusal on the part of company to accept further orders, and it was this which, in the main, ought about the reorganization. A rious reorganization, for a very simia reason, had also taken place in 1901, the late Hon. William Harty beame connected with the concern. The reorganization—the benefits of which still are being felt—brought Aemilius Jarvis, sr., forward as the conrolling factor, and under his administration the facilities of the company have been greatly extended. The company last year was working on locomotives for the Canadian and Jamaican railways between ten and twelve of which were turned out each month, but during the war, when construction was underway for the British, French and Russian Governments, as high as 80 of the smaller locomotives were built every month. So that the capacity of the works, while much larger than it has ever been, varies according to the type and size of the locomotive under construction.

SHOULD PRICES OF MACHINE TOOLS DROP?

"That machine tools are selling for very much less than they should sell for." "That at no time, even including the war period, did manufacturers receive anything like a proper return on their capital invested:" "That machine tools generally are selling below the cost of production:"—Such is the consensus of opinion of several well known machine tool manufacturers in the United States.

"In machine tools, the price of a ton of pig iron has little bearing on the total price" says one company. By way of illustration they quote the following case:—

Pig iron selling at $25.00 per ton means 6c. per pound to the machine tool manufacturer purchasing his castings, and in relation to the total price of the finished tool, the price of the pig iron represents about 5%; so that a $2.00 change in pig iron would mean perhaps one-tenth of a cent per pound on the tool. Skilled mechanics prior to the war were poorly paid in comparison to other trades. Today they are still receiving less than other trades, and whilst the cost of skilled labor has receded slightly from the high point of 1920, it is about twice what it was prior to the war, but its efficiency is about 80% as compared to pre-war periods. Most machine tool manufacturers find themselves in the position that whatever profit may have been accumulated is invested in drawings and patterns and extra equipment.

"It is difficult to make a comparison between former and present prices," says another firm "because few manufacturers are selling the same tools today that they were selling before the war. More tools have been completely redesigned since the beginning of the war than has probably ever been the case in a like period before. Even in those cases where there was not a complete redesign, features have been added and improvements made, which, while adding to the efficiency and convenience in operation, have also raised the cost of construction.

"The skilled machinist was underpaid previous to the war," they continue, "but at present his wages are much better. To say how far machine tools rose during the war would be very difficult, and it is equally impossible to say they will go back to any percentage of pre-war prices. So far it would look as if a 25% reduction from the peak figures of 1920 would be the limit of drop, but of course such is only a guess on our part, based on certain assumptions as to manufacturing conditions. Even the latter cannot always be depended upon, however."

The A. B. Ormsby Co., Toronto have secured the following contracts: at Kingston, Ont., the furnishing of continuous steel sash for addition to plant for Canadian Locomotive Agency and at Montreal, steel sash for power house for Molson's Brewery.

TRAFFIC AT SOO; DECREASE IS NOTED

The traffic through the Canadian and United States canals at Sault Ste. Marie continues to show decreases, due almost entirely to the great reduction in shipments of ore. Iron ore shows a decrease from July, 1920, of 4,887,009 tons, or over 52 per cent. Wheat shipments were about the same as last year, but other grains show increases of 7,409,149 bushels. Bituminous coal going up shows an increase of 1,192,871 tons, or over 92 per cent. Since the opening of navigation 8,076,824 tons have gone up through the canals, as against 2,842,750 tons for the same period of 1920. The traffic through the Canadian lock does not show much change from last year, except that there were no iron ore nor pulpwood shipments through, and there was quite an increase in barley and oats.

The traffic on the Welland Canal showed considerable increase over last year, namely—520,856 tons, against 362,626. This increase was almost entirely in grains. Corn increased from 3,493 tons in 1920 to 196,652 tons. Oats increased from 306 tons to 15,596 tons; wheat from 40,700 tons to 94,252 tons. The corn was United States corn for export, and about 10,000 tons of the wheat was from the United Staes.

The freight on the St. Lawrence Canal increased from 490,543 tons in 1920 to 615,588 tons in July, 1921. As on the Welland Canal, the main increases were in grain, especially United States corn that is moving via Montreal. Wheat and oats also show considerable increases. Both hard and soft coal show decreases.

The decrease in freight on the Chambly Canal was in pulpwood, 5,481 tons, as against 14,325 tons in July, 1920, and in lumber, 6,478 tons against 12,482 tons.

Mr. T. J. McFadden, Ontario representative of the Diamond State Fibre Company of Canada, Limited, has just completed a two months course in technical work at their Toronto head-quarters and is now back on the road again. Mr. J. Alexander Regan, Quebec, representative of the same company has been getting a few pointers in the technical department at Toronto and Bridgeport during his vacation, and has now returned to his duties in Quebec.

A new process by which sand-iron, or magnetic sand, may be converted into pig iron, and thence into steel, has just been made public by Goro Matsukata and Dr. Azobu Nailo. The discovery, scientists say, will not only revolutionize the steel industry in Japan, but of the world. The process is carried out by means of combining the sand iron with coke, using hot gas flames and making ferro-coke from which iron can easily be taken.

* * *

R. S. C. Bothwell has been appointed superintendent of construction at the Canadian Johns-Manville Co., Toronto

EXPANSION IS THE RULE OF THIS SHOP

Some Railroad Orders Are Coming In And Others Are Expected—Taking On More Men Now

Mr. G. B. Frost, president of Smith's Falls Malleable Castings, Limited, reports improving conditions in their particular line of industry. While they have never found it necessary to shut down their main plant, they have been running with a reduced staff of about 75 men. Within the past few days, however, they have increased their force by 15, as the result of some improvement in railway demand. Orders from this source have been considerably below normal. In fact, it would appear that the railways have been starving themselves, apparently awaiting a price adjustment. By October railway business should reveal an absolute necessity for certain lines of equipment and repairs, due to increasing traffic in moving crops.

A report from Brockville indicates a development in this direction. The motive power of that division of the G. T. R. has recently reinstated three drivers who have been acting as firemen, and has taken on four new firemen. The business being handled is not far behind the same period last year. Two hundred and ninety engines are now being handled out of Brockville as compared with three hundred and thirteen this time last year. During the past week or two there has been an increase of forty engines per week over previous periods due largely to movement of grain from Georgian Bay ports and cattle from Western Ontario for export.

PRICES DROP IN AGRICULTURAL GOODS

British Manufacturers Cut Prices Considerably—Fear German Competition Ridiculously Low Prices Quoted

British makers of agricultural machinery have adopted a new scale of prices. According to the "London Times" the move has been made principally with a view to combating foreign competition. Drastic cuts have been made in many cases. Following are the amounts of drop in English currency. Readers can convert these figures for themselves, considering of course the current rate of exchange.

Certain farm tractors are £50 to £60 cheaper than they were in the spring, and others formerly offered at £350 to £400 are now obtainable at well under £300. Ploughs, harrows, and cultivators for horse and tractor use have been reduced 15 per cent; food-preparing machinery, such as chaff-cutters, root graters and pulpers, corn kibbling and grinding mils, etc., are also down 15 per cent, and harvesters are quoted £10 per machine cheaper. Farm engines are another line which show a downward price tendency, and the larger size threshers are quoted at lower figures, possibly owing in some measure to the large number of small and cheaper threshers for the farmer's own use which now is finding a ready market at home and overseas.

German competition seems to be most feared by British manufacturers. Although there is no great tonnage being imported into this country from Germany as yet, such goods as have arrived and also those sent to the British Dominions have been offered at ridiculously low prices, in some instances at figures which do not represent the cost of the raw material to the British manufacturers.

A Serious Omission

In reporting the various exhibits in the Machinery Hall at the Toronto Exhibition, the name of **Mechanical Leather's Toronto**, was left out. This was of course unintentional, in fact the copy was all set up but was evidently lost before use. We therefore take the first possible opportunity to acquaint readers of Canadian Machinery that the above concern are showing a very complete line of belting goods, this including rawhide gears, pinions, cups, mallets, hammers of all kinds, belt lacing, round belting, also many other belting lines. Belt fasteners are included in the exhibit, in fact everything necessary in the line of mechanical leather goods is shown. R. W. Coleman and H. R. Alley will be pleased to meet anyone interested.

Trade Gossip

Sudbury.—The indications are that it will be next June before any steps are taken by the International Nickel Co. at Copper Cliff to increase operations.

* * *

Messrs. Hutton & Souter, architects of Hamilton, Ont., have been appointed to supervise the construction of the new building to be erected at the Guelph Collegiate Institute, Guelph.

* * *

The Fireproof Warehousing Co., London, Ont., have plans and will receive tenders for the erection of a warehouse which will cost around $100,000. Those interested should write W. Webster, 717 Richmond St.

The painting and glazing contracts for oxygen plant costing $25,000 for Dominion Oxygen Co., Ltd., 120 Elm St., Montreal, are placed with Brinkworth & Sons, 281 Coloraine St., of the same city.

* * *

A town planning a housing convention will be held in Toronto some time in October. Some 2500 delegates are expected and efforts will be made to have several experts come to deliver papers on this most important subject.

* * *

The Standard Supply Company have opened the sales offices at 390 Notre Dame St. W., Montreal, where they will act as distributors for the Canadian Roofing Mfg. Co., Ltd., Windsor, and for the Hamilton Tar & Ammonia Company, Ltd. The Montreal office is under the management of Mr. E. D. Bellefeuille.

* * *

The rate of exchange in connection with shipments of freight between points in Canada and the United States from September 1 to 15 inclusive, will be 10 7-8 per cent.; the surcharge on international freight shipments will be 7 per cent. The rate of surcharge on international passenger business will be based on 11 per cent. exchange.

* * *

Mr. H. Coplan, Managing director of the Hull Iron & Steel Foundries, is said to have made an important discovery in the steel industry. Some years ago "Chromite" came into being, but now Mr. Coplan has adapted this alloy to the manufacture of grate bars for use in steamships, locomotives, etc. The heat resisting power of the new meta is claimed to be even far beyond the inventor's hopes.

* * *

The Leaside munitions plant at Toronto has been purchased by W. C. Durant the founder of General Motors Ltd It is said that the manufacture of Durant automobiles will be started shortly Present plans call for a manufacturing capacity of 100 finished cars per day It is hoped to have the plant producing by next March. The building program calls for the construction of a three storey assembly plant 130x160 ft. and in present intentions are carried out every important part of the new cars will be made in Canada.

* * *

Dr. R. F. Ruttan M.A.M.D. etc., Montreal has been elected to presidency of the society of Chemical industry Great Britain. This is the first time such an honor has come to Canada The presidential chair has been previously filled by many distinguished British chemists, notably Sir Henry Roscoe, Sir William Perkin, Sir James Dewar, Sir Edward Thorpe, George Bailey Rudolph Messel, Henry Louis and Sir William Pope, the present president; also by two eminent Americans, Ira Remsen, late President of Johns Hopkins University, and W. H. Nichols, of New York.

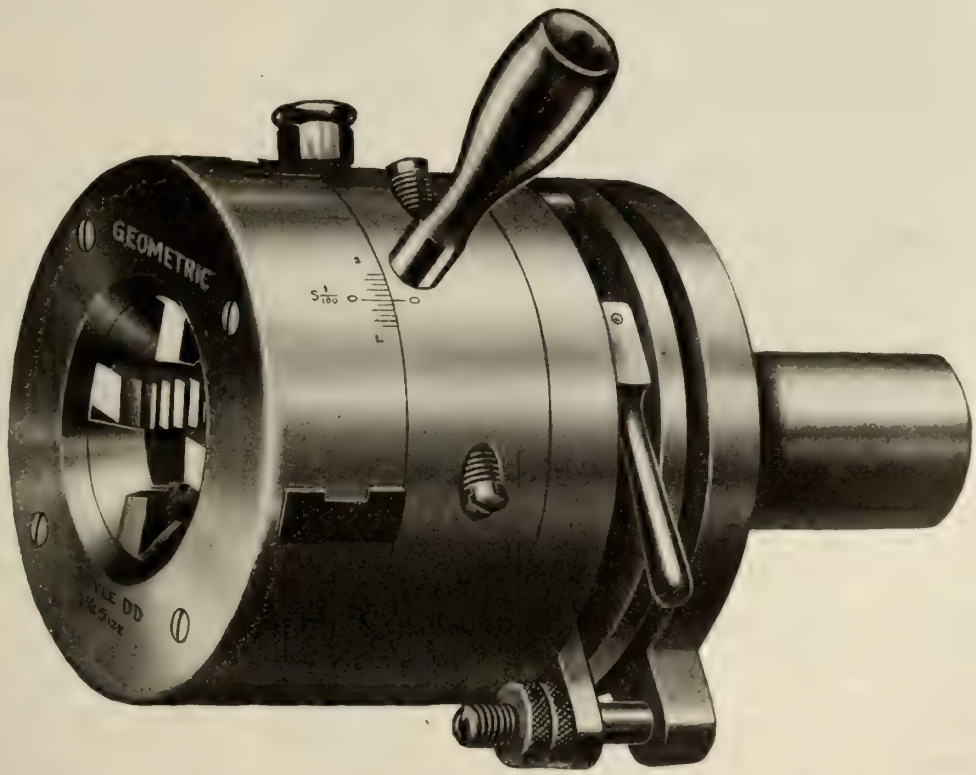
* * *

The English Electric Co. of Great Britain, said to be one of the largest manufacturers of electrical equipment and machinery in the British Empire is associated with the English Electric Company of Canada. The Canadian Company is associated with and holds the exclusive manufacturing rights in perpetuity for the English company; having use of all their patents, designs processes, etc. In addition they will secure the benefit of the preferential tariff and the present favorable exchange rate. The entire undertaking of the Canadian Crocker-Wheel Company St. Catharines has been acquired so that all the patents and designs are available.

After Ten Years' Test
He Finds the Geometrics of Greatest Merit

Right on the Lead

The Superintendent of a Trade School says he has used Geometric Die Heads for the past ten years and finds them superior to any other make.
The Geometric Tool Company for twenty-five years has specialized in Screw Cutting Tools that combine closest accuracy with greatest production.



Geometric Style DD Die Head for Hand Operated Turrets

In perfecting a Die Head for certain Automatic Screw Machines, features were developed that made the Die Head quite as desirable for hand-operated turrets. Compensating spring mechanism overcomes any inaccuracy of adjustment of the turret. Chasers compensate automatically for any slight irregularities that may exist.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N. B., Halifax, N. S.

PRODUCTION WELDING

Continued from page 38

to a large degree by inducing air currents around the welding flame in such a manner as to feed the flame without too great a cooling action.

There are many other combustible gases that are used for welding purposes and I have used acetylene for illustration here since it is most commonly used. The efficiency of the welding process is a subject that few regard very seriously in production work so long as the workmanship turned out is of good quality but when you consider the waste that can occur through improper design of equipment, condition of the welding gases or the low thermal efficiency of the welding flame in practice you will readily see the necessity of extensive tests to determine best conditions for operating.

Tests should be conducted to determine the length of seam welded per unit of gas consumed and also the ratio of oxygen to acetylene under each different condition of operating and from these the best can be adopted. You will find that by having the jets very close together a large percentage of the heat is dissipated by radiation while if the jets are too far apart the conduction of heat away from the seam by the adjacent metal will cut down the thermal efficiency of the flame materially, so it is necesary to strike the proper balance of the number of jets, the spacing of the same and the welding speed for a given condition. If the ratio of oxygen to acetylene indicates an excessive consumption of oxygen it is necesary either to remove the obstructions that are cutting off their air currents or else supply air to the flame by induced draft.

Moisture in the gases will reduce the heat of the flame as well as cause the flame to sputter due to condensation of the moisture in the water-cooled tip, but this can be remedied by passing the gases through suitable driers. Dust and dirt should be removed by passing the gases through filters to prevent the dirt from clogging the passages in torches and regulators.

The gas welded tube industry has in the past five years outdistanced all its rivals in the production of light gauge steel tubing and millions of dollars have been invested in tube welding plants, some of which have a capacity of several million feet per month.

This tubing combines light weight, strength and smooth finish with a relatively low production cost and has found a wide use in the manufacture of automobiles, bicycles, motor-cycles, furniture, munitions, aeroplanes, go-carts, conduits, tools, farm implements, gas engines, conveyers and an almost endless list of articles in the construction of which tubular steel parts are required.

The manufacture of gas welded tubing has advanced in a very few years from a small specialty line to a vast industry serving so extensive a field of manufacture that I would weary you with its description. Manufacturers in the past have offered a spirit of secretiveness regarding gas weld production work and are likened unto the servant in the parable who buried the talents for fear that they would be stolen from him instead of allowing them to increase in value through use, to his own enrichment and the benefit of others.

We pride ourselves in some of the achievements in production welding on steel products but the possibilities for the future in welding the other commercial metals in a similar manner are limited only by the skill and imagination of those conversant with the industry.

Trade Gossip

The Works Committee of Hamilton, Ont., are going to ask their board of control for $26,000 for repairing of old asylum sewer.

* * *

The Wallace Barnes Co., of Bristol, Conn., have started a factory in Hamilton,Canada. They have taken over a modern plant formerly occupied by the National Machinery & Supply Co. of the same city, and in their new abode will manufacture their regular lines of screw machine products, cold rolled spring steel, wire, washers, stampings, springs of all kinds, etc. Their line of products is well known on both sides of the line, so that Canadian manufacturers need hardly be acquainted that the establishment of this firm dates back to 1857, and that at present they have membership in the Rice leaders of the world association.

* * *

The Empire Steel Corporation have announced the following appointments:- George D. Macdougall, latterly general superintendent of the Nova Scotia Steel and Coal Co., as chief engineer of the corporation; A. McColl, for many years secretary of the Nova Scotia Steel Co. and assistant to the president, as general manager of the Nova Scotia Company, including the consolidated properties of the Corporation centred around New Glasgow. These appointments are in continuation of the policy of utilizing the best executive material in the staffs of the consolidated companies, so as to restore former efficiency and give the Corporation the benefit of technical direction by specialists already trained and acquainted with local conditions.

* * *

Sheffield steel makers are protesting against the prohibitive duties placed upon their products under the Fordney Tariff Bill. A committee from Great Britain have placed their grievances before the senate committee on finance at Washington, with a hope of having matters readjusted. Arthur Balfour, Sydney J. Robinson, of Willian Jessop & Sons; Peter MacGregor, of Sanderson Bros. & Newbould; and John Cecil Ward, of Edgar Allen & Co., are all members of the visiting committee. Mr. Balfour is the managing director of Arthur Balfour & Co., and in addition to the above Sheffield firms the committee also represented the Manchester firm, Armstrong, Whitworth & Co. All these firms, it was pointed out, have for a great many years enjoyed an extensive trade in the United States.

* * *

As a result of experiments in Melbourne in the production of the bases for dye from coal tar and its by-products a new firm has been established and a small but well-equipped factory will soon be in operation. It is expected that within twelve months the output will be 150 tons a year and that in two years the whole of Australia's requirements can be met. When in full working order the plant will employ between 250 and 300 persons, in addition to a highly trained staff of chemists and other experts. The concern will be entirely an Australian business, carried on with Australian capital, labor and plant. So far a range of fast colors, comprising 54 different shades, has been proved, but every day this number is being added to. Acid, basic, chrome, alizarine, nigrosine, and other types of dyes are to be made.

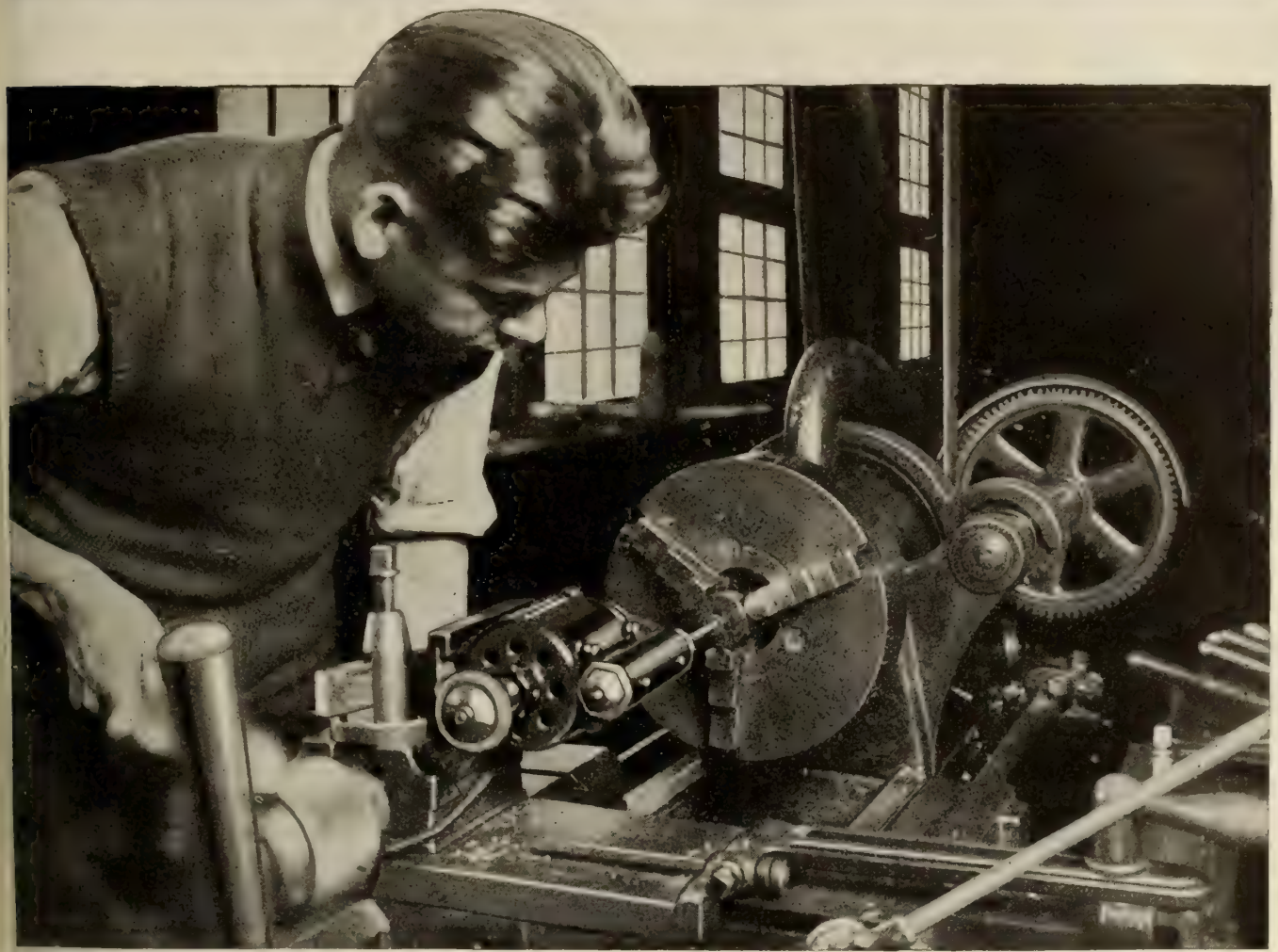
* * *

New Incorporations—Notice of the incorporation of the following business firms appears in this week's Canada Gazette: Southern Alberta Oils, Ltd., Capital, $10,000,000, Calgary; Thomas Harkness & Sons, Ltd., $100,000, Montreal; International Vending Machines, Ltd., $250,000, Montreal; Geo. S. Dingle, Ltd., $50,000, Montreal; The Safety Gas Key Company, Ltd., $200,000 Montreal; La Compagnie Criterion d'Automobiles, Ltee., $50,000, Montreal; Lepage, Soubliere, Ltee, $100,000, Hull, Que.; Saxonia Fruit Preserving Co. Ltd., $50,000, Montreal; Wigham Wire Co., Ltd., $250,000, Hamilton; John Garde & Co., Ltd., $100,000, Toronto Canadian Brill Co., Ltd., $3,000,000 Preston, Ont.; Highway Light House Co., Ltd., $1,000,000, Toronto; Canadian Gary Motor Truck Co., Ltd., $250,000 Toronto; Western Canadian Exporters Ltd., $50,000, Windsor, Ont.; Dairy Products Co. of Canada, Ltd., $500,000 Toronto; Commercial Export & Import Co., Ltd., $100,000, Montreal.

* * *

To Press Damages Claim

W. C. Reilly, general superintendent of Youngstown Sheet and Tube, has been chosen by the government of Nova Scotia as its representative in arbitration proceedings with the Dominion eel Co., in settlement for steel used in the war involving $9,000,000. During the war the company erected a large plate mill Nova Scotia at the request of the Dominion government and entered into a contract for plates to be used for military purposes. When contract was half completed the armistice was signed and the government suspended specifications. The Company asks for payment of the contract and damages resulting from expenditures in erecting the mill.



Grinding Diameters on Ring Gages to Close Limits

n the Terry Turbine Company of Hartford, Conn., Dumore Grinders are used on jobs where accuracy is of the utmost importance.

The job shown here is a special Gage—diameter .750-in. with plus or minus limits of .0002 in. Because the Dumore grinds to extremely close limits it is just the tool for work of this character. Besides, the ease with which it can be set up for service wherever necessary gives it an advantage over other methods of handling many kinds of work.

Dumore Grinders can be used anywhere, taking their power from the nearest lamp socket; extremely simple and durable, they offer an economical method for accurately finishing work without changing the setting.

See the Dumore at work. Ask a man who uses one. Or have your dealer give you a demonstration.

Wisconsin Electric Company

2939 Sixteenth Street - Racine, Wisconsin

DUMORE HIGH SPEED GRINDERS



THE "FLU" stayed out of this PLANT

PURO SANITARY DRINKING FOUNTAIN

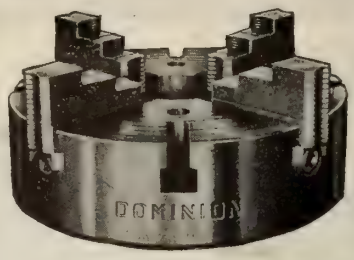
(MADE IN CANADA)

The only fountain with a bowl that prevents lips touching the bubbler paid its moderate cost over and over in all those well-ordered plants whose precautionary measures successfully barred the Spanish influenza. PURO saves lives, time and water. Write

Puro Sanitary Drinking Fountain Co.

888 F. St. Andre St., Montreal, P.Q. Canada





DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

DOMINION STEEL PRODUCTS CO. LIMITED

Engineers • Manufacturers

BRANTFORD, CANADA

MINERAL OUTPUT.

The mineral output of Austria in 1920 was 134,400 tons of coal and 2,398,354 tons of lignite, as compared with 90,472 tons of coal and 2,006,773 tons of lignite in 1919. Her imports in 1920 were: Coal, 2,547,880 tons; lignite, 1,192,073 tons; coke, 255,072 tons; briquettes, 1,005 tons; pig iron, 36,972 tons; bars, plates, sheets, and wire, 39,972 tons; other finished iron and steel, 40,552 tons; machinery, 19,615 tons. Among her exports were: Ores (mostly iron ore to Czecho-Slovakia), 126,854 tons; magnesite, 62,530 tons (to Germany, the United States, France and Great Britain); pig iron, 75,812 tons; bars, plates, sheets, and wire, 41,875 tons; other finished iron and steel, 66,947 tons; machinery, 30,834 tons.

POWER FROM WOOD REFUSE

At a recent agricultural exhibition in England, several different British makes of suction gas plant were shown, some of them in operation driving engines. They ranged from 2 to 65 horse power, the largest making gas from saw mill refuse, bark, shavings, or other wood waste, and the smallest using charcoal The big plant takes only two and a half, to three and a half lbs. of wood per brake horse power per hour, according to the quality of the wood refuse, and the little one is mounted on its engine on a wooden truck so that it forms a complete portable power plant.

PATENTS

Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd
Brantford, Canada

Rubber Mill MACHINERY
BERTRAMS LIMITED
SCIENNES EDINBURGH

HAMILTON ENGINEERING SERVICE
LIMITED

Consulting and Designing Tools, Jigs, Fixtures Special Machinery. us shoulder your blems.

195 KING WILLIAM ST. HAMILTON

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Classified Opportunities

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES shapers, milling machine and planer, etc Hourly or contract basis. Prompt delivery. W. H. Gumbling Machinery Co., Toronto. (ctfm)

MACHINE WORK WANTED

We are equipped to handle all kinds of general or special machine work. All operations in our plant are done under the most careful supervision and we can satisfy you as to price. Always available for consultation.

PERFECT MACHINE COMPANY, GALT

Builders of Reliable Machinery.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.

ASK US.

THE KATIE FOUNDRY, GALT, ONT.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

SUNCLO BRAND

WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (ctfm)

FOR SALE

ELECTRIC STORAGE BATTERY LOCOMOtives for sale. Two. 36-inch gauge. Complete and in good condition. R. T. Gilman & Company, Dept. "E," 211 McGill Street, Montreal. (ctfm)

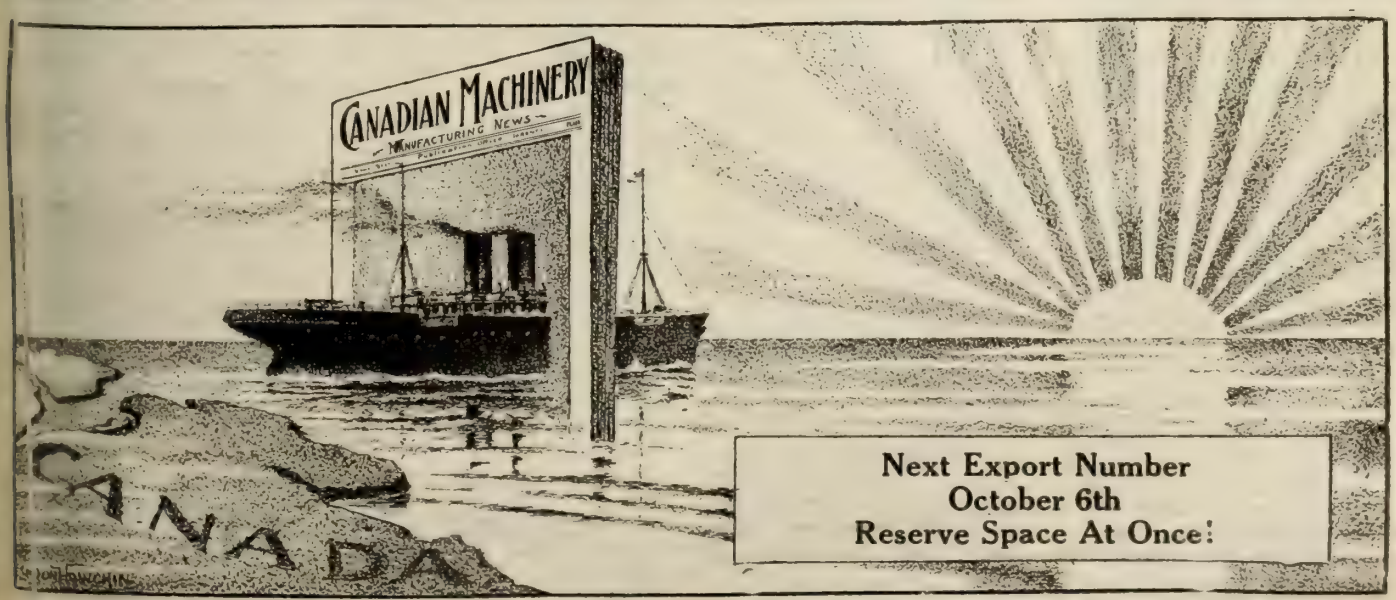
Used Belting, Pulleys, Etc.

We carry right in stock a large quantity of used Belting, Pulleys, Hangers, Shafting, etc., in good condition, which we sell at half the price of new. Inquiries solicited. In writing mention sizes wanted. L. S. Tarshis & Sons, 92 Wellington St., Montreal.

REGO
WELDING
and
CUTTING
APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
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If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd , Mimico, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Independent Pneumatic Tool, Chicago, Ill.

Analyses, Chemical
Toronto Testing Laboratory, Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Columbia Hdwe. Division, Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Madison Mfg. Co., Muskegon, Mich.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Bronze Cored
Moore & Son, Thos., Montreal, Que.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Chapman Double Ball Bearing Co., Toronto, Ont.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Tallman Brass & Metal Co., Hamilton, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lang Mfg. Co., Guelph, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.

Belt Fasteners
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
Clipper Belt Lacer Co., Grand Rapids, Mich.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belt Tools
Graton & Knight Mfg. Co., Worcester, Mass.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd. Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.
Tullis & Son, Ltd., John, Glasgow, Scot.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Gutta Percha & Rubber, Toronto, Ont.
Quaker City Rubber Co., Philadelphia, Pa.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Ford Chain Block Co., Philadelphia, Pa.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

For list of Dealers see the last page of This Buyers' Directory

Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford Chain Block Co., Philadelphia, Pa.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
General Combustion Co. of Can., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.
Victor Tool Co., Waynesboro, Pa.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Bolts, Machine and Carriage

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boosters
Sturtevant Co., B. F., Boston, Mass.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Bridges
Hamilton Bridge Works Co., Ltd., Hamilton, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machine
Blount Co., J. G., Everett, Mass.
Can. Hanson & Van Winkle Co., Ltd Toronto, Ont.
Ford-Smith Machine Co., Hamilton, O
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati,

Bulldozers
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, O

Burners, Oil and Gas
General Combustion Co. of Can., Ltd Montreal, Que.
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton,

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.
Morrow Screw & Nut Co., Ltd., John Ingersoll, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto,

Calipers
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
MacKinnon Steel Co., Sherbrooke, Que.

Cars, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Castings, Aluminum
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Electric Castings Co., Ltd., Orillia.
Can. Hanson & Van Winkle Co., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.
Can. Hansen & Van Winkle Co., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.
Tallman Brass & Metal, Ltd., Hamilton,

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Hanson & Van Winkle Co., Toronto, Ont
Canada Electric Castings Co., Ltd., Orillia.
Canna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Naval Bronze
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Nickel
Can. Hanson & Van Winkle Co., Toronto, Ont

Castings, Semi-Steel
Davidson Mfg. Co., Thos., Montreal, Que.
Dill Iron & Steel Foundries, Hull, Que.
Galt Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
British Crucible Steel Co. of Can., Ltd., Windsor, Ont.

Cements, Iron
Smith Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Greenwald Tap & Die Corp., Galt, Ont.

Chain (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Mossberg Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia,

Reid (Hans) of Canada, Ltd., Montreal, Que
Whitman Mfg. Co., Lisbon, Ohio.

Chain, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenwald Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Mossberg Chain Co., Ithaca, N.Y.
Reid (Hans) of Canada, Ltd., Montreal, Que.
Whitman Mfg. Co., Lisbon, Ohio.

Chain
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chemists
Toronto Testing Laboratory, Toronto, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Columbia Hdwe. Division, Cleveland, O
Dickow, Fred C., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Bernard Industrial Co., A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Positive Clutch & Pulley Works, Toronto, Ont.

Coal and Ash Handling Machinery
Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air
Curtis Pneumatic Machinery Co., St. Louis, Mo.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Copper
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.

Cored Bronze Bars
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Cotter Pins
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Flexible
Holden Co., Ltd., Montreal, Que.

Couplings, Rigid
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Flue
Holden Co., Ltd., Montreal, Que.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Eclipse Counterbore Co., Ltd., Walkerville, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Madison Mfg. Co., Muskegon, Mich.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Milling Machine Co., Cleveland.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can
Cataract Refining Co., Toronto, Ont.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Holden Co., Ltd., Montreal, Que.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont
Turner Brass Works, Sycamore, Ill.
Union Carbide Co. of Can., Welland, Ont

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond, Carbon and Bortz
Joyce-Koebel Co., Inc., New York, N.Y.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Truing Tool Co., Detroit, Mich.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Die-Castings
Tallman Brass & Metal, Ltd., Hamilton Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.
Walcott Lathe Co., Jackson, Mich.

Die Sinkers
Kimber & Hillier, St. Catharines, Ont

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Banfield & Sons, Ltd., W. H., Toronto.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.

Dies, Hammer
Kimber & Hillier, St. Catharines, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Disc Cement
Ritchey Supply Co., Toronto, Ont.
Wausau Abrasives Co., Chicago, Ill.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Economy Drawing Table & Mfg. Co., Adrian, Mich.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York, N.Y.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drill Speeders
Canada Machinery Corp., Galt, Ont.

Drilling Machine Heads
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
Hoosier Drilling Mach. Co., Goshen, Ind.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Beacon Engineering Co., Tipton, England.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.
Terry & Co., John C., Birmingham, Eng.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Drilling Machines, Portable
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Beacon Engineering Co., Tipton, England.
Bilton Machine Co., Bridgeport, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Hoosier Drilling Mach. Co., Goshen, Ind.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Aurora Tool Works, Aurora, Ind.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Hoosier Drilling Mach. Co., Goshen, Ind.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Main Belting Co. of Can., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis.
Sturtevant Co., B. F., Boston, Mass.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

File Handles
Ingersoll File Co., Ltd., Ingersoll, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Fuel Oil Burning System
General Combustion Co. of Can., Ltd., Montreal, Que.

Furnaces, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
General Combustion Co. of Can., Ltd., Montreal, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
General Combustion Co. of Can., Ltd., Montreal, Que.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Electric Furnace Construction Co., Philadelphia, Pa.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence, R.I.
Electric Furnace Construction Co., Philadelphia, Pa.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto.

Gages, Comparator
Jones & Lamson Machine Co., Spr

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
hannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

ages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Chesterman & Co., Ltd., J., Sheffield, Eng.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

ages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
thins & Co., Inc., E C., Indianapolis
hannson Inc., C. E., Ploughkeepsie, N. Y.

ges, Thread
ckworthie, Ltd., John, Birmingham, Eng.
field & Sons, Ltd, W. H., Toronto, Ont.
reenfield Tap & Die Corp Galt, Ont
hannson Inc., C. E., Ploughkeepsie, N. Y
arrett Co., L. S., Athol, Mass.

, Coal Compressed
Air Liquide Society, Toronto, Ont.

, Compressed
est-O-Lite Co. of Can., Toronto, Ont.

kets
iamond State Fibre Co. of Can., Ltd., Toronto, Ont.
unlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
oodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
olden Co., Ltd., Montreal, Que.
ooth Mfg. Co., Jersey City, N.J.

ges, Vacuum and Pressure
ylor Instrument Co., Toronto, Ont.

r Blanks
nada Foundries & Forgings Co., Welland, Ont.
n Steel Foundries, Montreal, Que.
iamond State Fibre Co. of Can., Ltd., Toronto, Ont.
m. Foundries & Steel, Hamilton, Ont.
milton Gear & Machine Co., Toronto, Ontario.
iladelphia Gear Works, Philadelphia, a
minion Engineering Works, Limited, Montreal, Que.

r Counters
rt Mfg. Co., R. A., Battle Creek, Mich.

-Cutting Machines
tram & Son Co., Ltd, The John, Dundas, Ont.
son Machine Co., Bridgeport, Conn.
wn & Sharpe Mfg. Co., Providence, R.I.
Fairbanks-Morse Co., Ltd., Montreal.
lewa Gear Shaper Co., Springfield, Vt.
rie, Ltd., H. W., Toronto, Ont.
lton Machine Co., D. E., New London, Conn.

r Testing Machines
wn & Sharpe Mfg. Co., Providence, R.I.
Smith Machine Co., Hamilton, Ont.

s, Cast
Link-Belt Co., Toronto, Ont.
Steel Foundries, Montreal, Que.
Foundries & Steel, Hamilton, Ont.
er Motor Co., Ltd., Orillia, Ont.
Iron & Steel Foundries, Hull, Que.
minion Engineering Works, Limited, ontreal, Que.

s, Cut
wn & Sharpe Mfg. Co., Providence, R.I.
adian SKF Co., Toronto, Ont.
ent Machine Co., Ltd., Montreal, Q.
mond State Fibre Co. of Can., Ltd., ronto, Ont
minion Bridge Co., Ltd., Lachine, Que.
Steel Products Co., Brantford, Ont.
Smith Machine Co., Hamilton, Ont.
ner & Son, Robt., Montreal, Que.
lton Gear & Machine Co., Toronto, tario
burn Ltd., John T., Toronto, Ont.
ne & Co., A. B., Hespeler, Ont.
& Glasco, Montreal, Que.
n Tube & Supply Co., Montreal, Que.
Dougall Co., Ltd., R., Galt, Ont.
adelphia Gear Works, Philadelphia,
d (Hans) of Canada, Ltd., Montl, Que
minion Engineering Works, Limited, ntreal, Que.

s, Dressed
dy & Sons, Wm., Owen Sound, Ont.

s, Forged
da Foundries & Forgings Co., Welnd Ont.
n Tube & Supply Co., Montreal, Que.

s, Herringbone
Steel Products Co., Brantford, Ont.
lton Gear & Machine Co., Toronto,
adelphia Gear Works, Philadelphia,

Gear Machine Moulded
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Holden Co., Ltd., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont
Standard Optical Co., Geneva, N.Y.
Willson Goggles, Inc., Reading, Pa.

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.
Cateract Refining Co., Toronto, Ont.

Grinding Discs
Ritchey Supply Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Beacon Engineering Co., Tipton, England.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Terry & Co., John C., Birmingham, Eng.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Beacon Engineering Co., Tipton, England.
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Beacon Engineering Co., Tipton, England.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Beacon Engineering Co., Tipton, England.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Machinery and Window
Can. Wire & Iron Goods Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canada Machinery Corp., Galt, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Mo.
Skinner Bros. Mfg. Co., Inc., St. Louis,
Terry & Co., John C., Birmingham, Eng.
Montreal, Que.
Toronto, Ont.
Foss Machinery & Supply Co., Geo. F.,
Williams Machinery & Supply Co., A. R.,
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

pering

Heating
Chapman Double Ball Bearing Co., Ont.

Hardness Testing Apparatus

Hardening, Case-Hardening and Tem-
Montreal Que.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Garlock-Walker Mchy. Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Foamite Firefoam Co., Hamilton,

Hydraulic Leather
Graton & Knight Mfg. Co., Worcester, Mass.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation

BUYERS' DIRECTORY

Diamond State Fibre Co. of Can., Ltd.
Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co.
Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Burgess & Marchand, Montreal, Que.
Crescent Machine Co., Ltd., Montreal.

Japanning and Varnishing Ovens
Brantford Iron & Rack Co., Brantford, Ont.

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Rapid Tool & Machine Co., Lachine, Que.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lacing Leather
Clipper Belt Lacer Co., Grand Rapids, Mich.
Main Belting Co. of Can., Montreal, Que.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Pans, Portable
Canada Machinery Corp., Galt, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Hardinge Bros., Inc., Chicago, Ill.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Lehmann Machine Co., St. Louis, Mo.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Sidney Machine Tool Co., Sidney, Ohio
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Walcott Lathe Co., Jackson, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Blashill Wire Machy. Co., Ltd., Montreal.
Sidney Machine Tool Co., Sidney, Ohio.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Spinning
Terry & Co., John C., Birmingham, Eng.

Lathes, Threading
Canada Machinery Corp., Galt, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Canada Machinery Corp., Galt, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto Ont
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont

Lockers, Clothes
Can. Foamite Firefoam Co., Hamilton.
Dennis Wire & Iron Works, London, Ont

Lubricants
Cateract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill.
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Deloro Smelting & Refining Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hoyt Metal Co., Toronto, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Magnolia Metal Co., Montreal, Que.
Moore & Son, Thos., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill
Terry & Co., John C., Birmingham, Eng.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockford Milling Machine Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cleveland Milling Machine Co., Cleveland.
Ford-Smith Machine Co., Hamilton, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gooley Edlund Inc., Cortland, N.Y.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.
Terry & Co., John C., Birmingham, Eng.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd. Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nickel Silver
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co.
Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto Ont
Cateract Refining Co., Toronto, Ont.

Oil Hole Covers
Can Winkley Co., Ltd., Windsor Ont

Oils, Soluble
Cateract Refining Co., Toronto, Ont.
Imperial Oil Ltd., Toronto, Ont
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Graton & Knight Mfg. Co., Worcester Mass.
Guildford & Sons, Ltd., Halifax, N.S.

Packing, Steam
Can. Consolidated Rubber Co., Ltd. Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Graton & Knight Mfg. Co., Worcester Mass.

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Qu

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal Que
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R I

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P Mfg Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont

Plumbers' Brass Goods
Plume Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthe, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas P., Montreal, Q.
Blount Co., J G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont
Ford Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Tann & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthe, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
E. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stuart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R. Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Ltd., Montreal, Q

Screens
Can. Wire & Iron Goods Co., Hamilton,

BUYERS' DIRECTORY

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Wm. & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont
Tallman Brass & Metal Co., Hamilton, Ont

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, I
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbroo Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The Jo Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., T Toronto, Ont.

BUYERS' DIRECTORY

ools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Burgess & Marchand, Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Chesterman & Co., Ltd., J., Sheffield, Eng
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, nt
Herbert Ltd., Alfred, Toronto, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Kimber & Hillier Mfg. Co., St. Catharines, Ont.
National Machine Tool Co., Racine, Wis
Rapid Tool & Machine Co., Lachine, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill
Starrett Co., L. S., Athol, Mass.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.
Wheel Trueing Tool Co., Detroit, Mich.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

ol Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont

orches, Blow
National Electro Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

ackwork, Railway
Can. Steel Foundries, Montreal, Que.

ackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

ansformers
Northern Electric Co., Montreal, Que.

ansmission Machinery
Can Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Leitrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

ansportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

eated Bits
Can. Atlas Crucible Steel Co., Toronto Ont.
Vanadium Alloys Steel, Latrobe, Pa.

olleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

ucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Maple Leaf Mfg. Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
National Steel Car Corp., Ltd., Hamilton, Ont.

ucks, Industrial Motor
Maple Leaf Mfg. Co., Montreal, Que.
National Steel Car Corp., Ltd., Hamilton, Ont.

ube Products
Tube Co. of Canada, Toronto, Ont.

ubing, Electric Welded or Oxy-Acetylene Welded
Tube Co of Canada, Toronto, Ont.

ubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

ubing, Seamless Steel
Tube Co of Canada, Toronto, Ont.

ubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Imman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Tillman Brass & Metal Co., Hamilton, Ont

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.
Holden Co., Ltd., Montreal, Que.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Vises, Pipe
Columbia Hdwe. Division, Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Superior Machine Co., London, Ont.

Vises, Wood Workers'
Columbia Hdwe. Division, Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Victor Tool Co., Waynesboro, Pa.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Graton & Knight Mfg. Co., Worcester, Mass.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Holden Co., Ltd., Montreal, Que.
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Holden Co., Ltd., Montreal, Que.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Bristol, Conn.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Cloth
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Rope
Can. Wire & Iron Goods Co., Hamilton, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal. Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

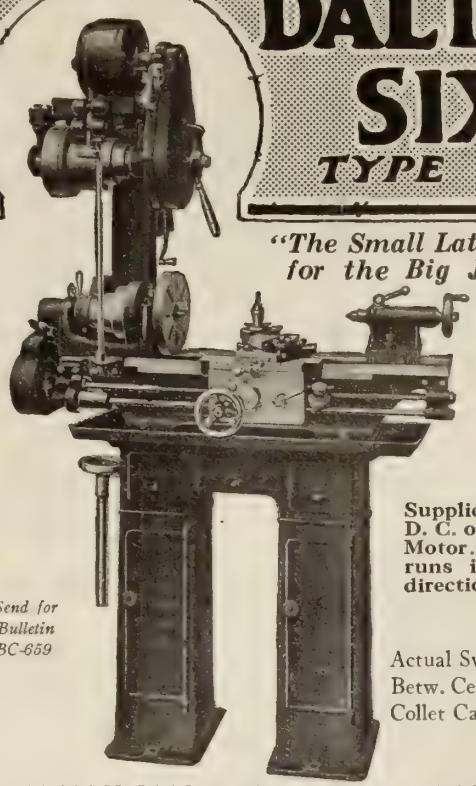
WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
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Torrington Co. .....

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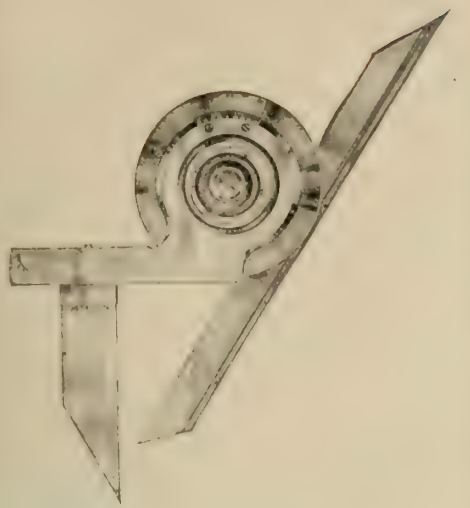
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W

Wheel Trueing Tool Co. ..
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"Next time you're near the hardware store check up your Starrett Tool kit, and get those tools you've been needing.

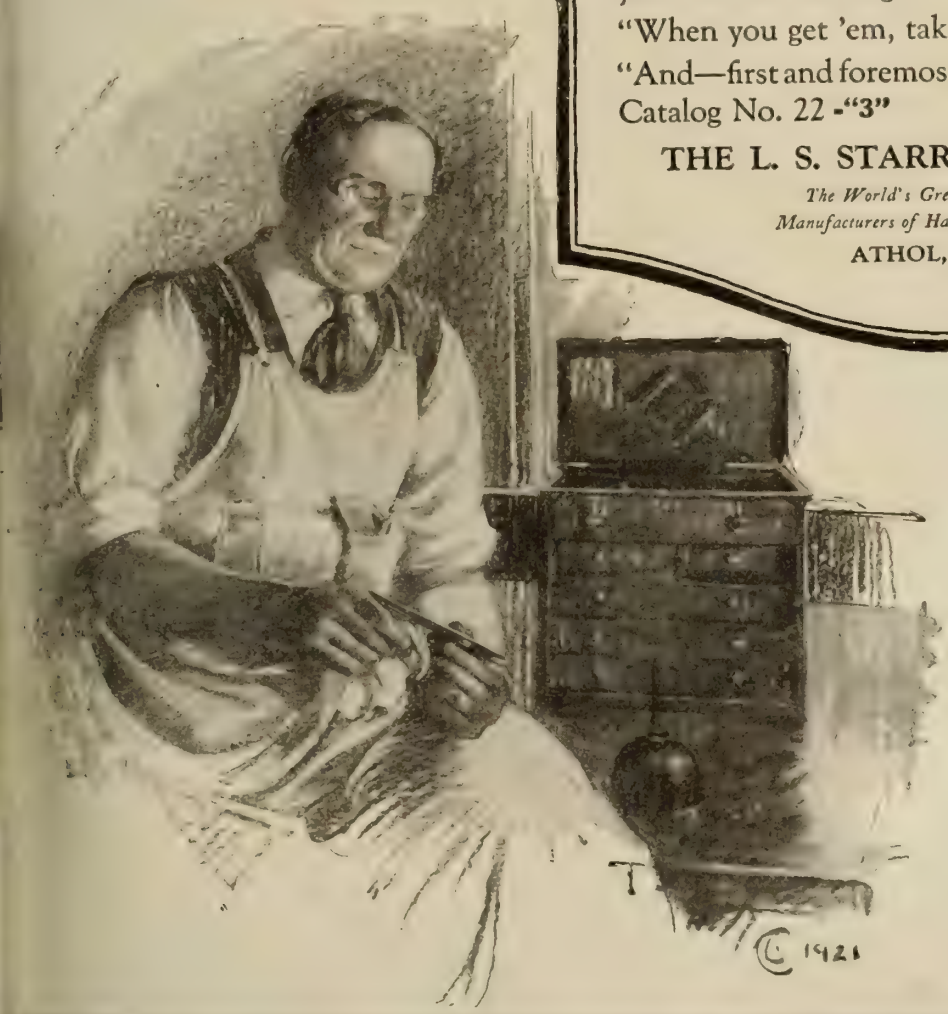
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Manufacturers of Hack Saws Unexcelled
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Little or big diameters, fine or coarse pitches, there's a NAMCO Thread-cutting Tool that's "just right" for your work. Find out.

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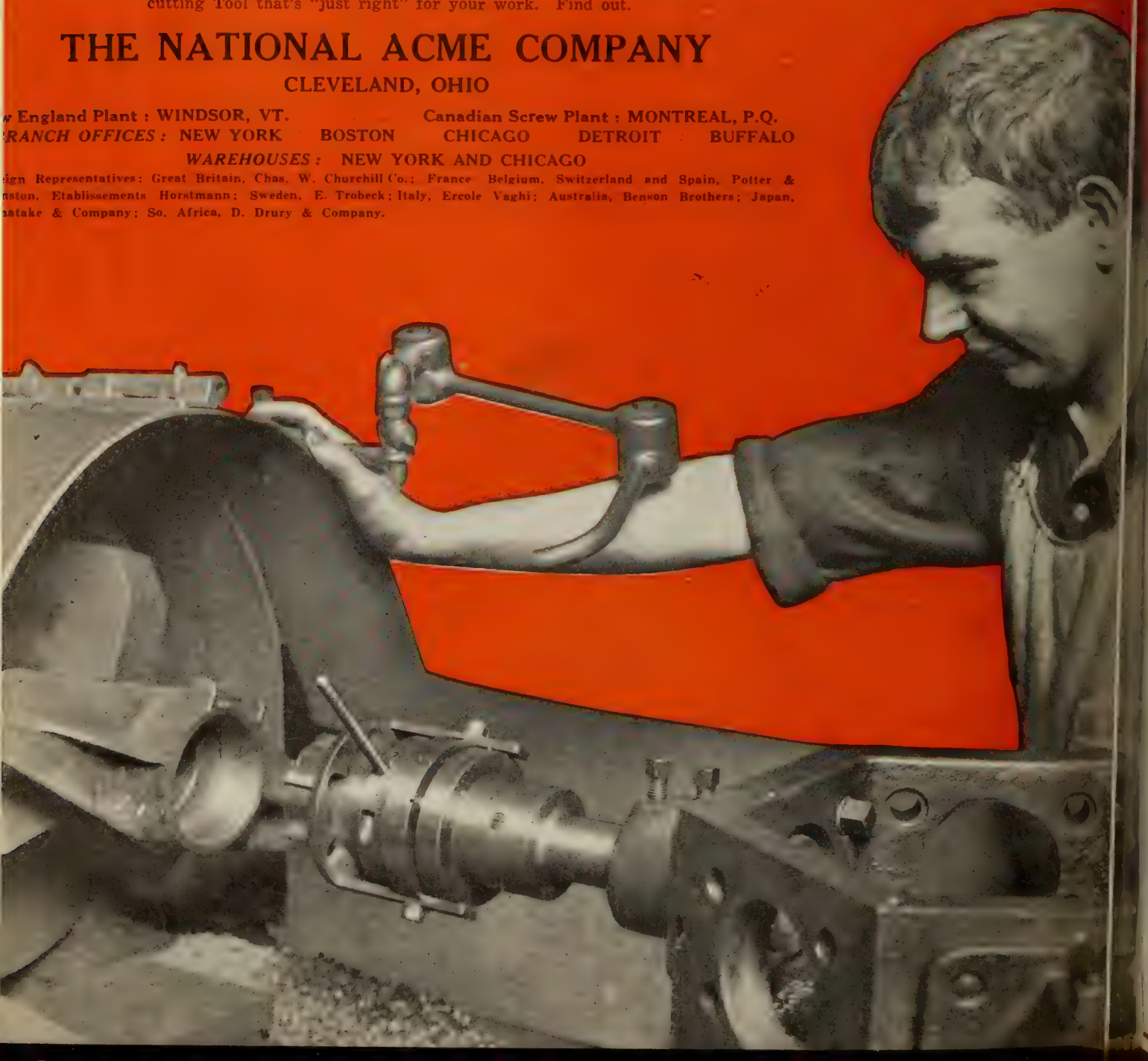
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CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVI., No. 11 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Sept. 15, 1921 | $4.00 a Year Subscription Price

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A new file costs less than the labor-time used up by waste effort with a file that is even slightly worn.

These brands give long service before losing their keenness—specify one of them when ordering:

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The BERTRAM Page

MACHINE TOOLS

JBS&Co

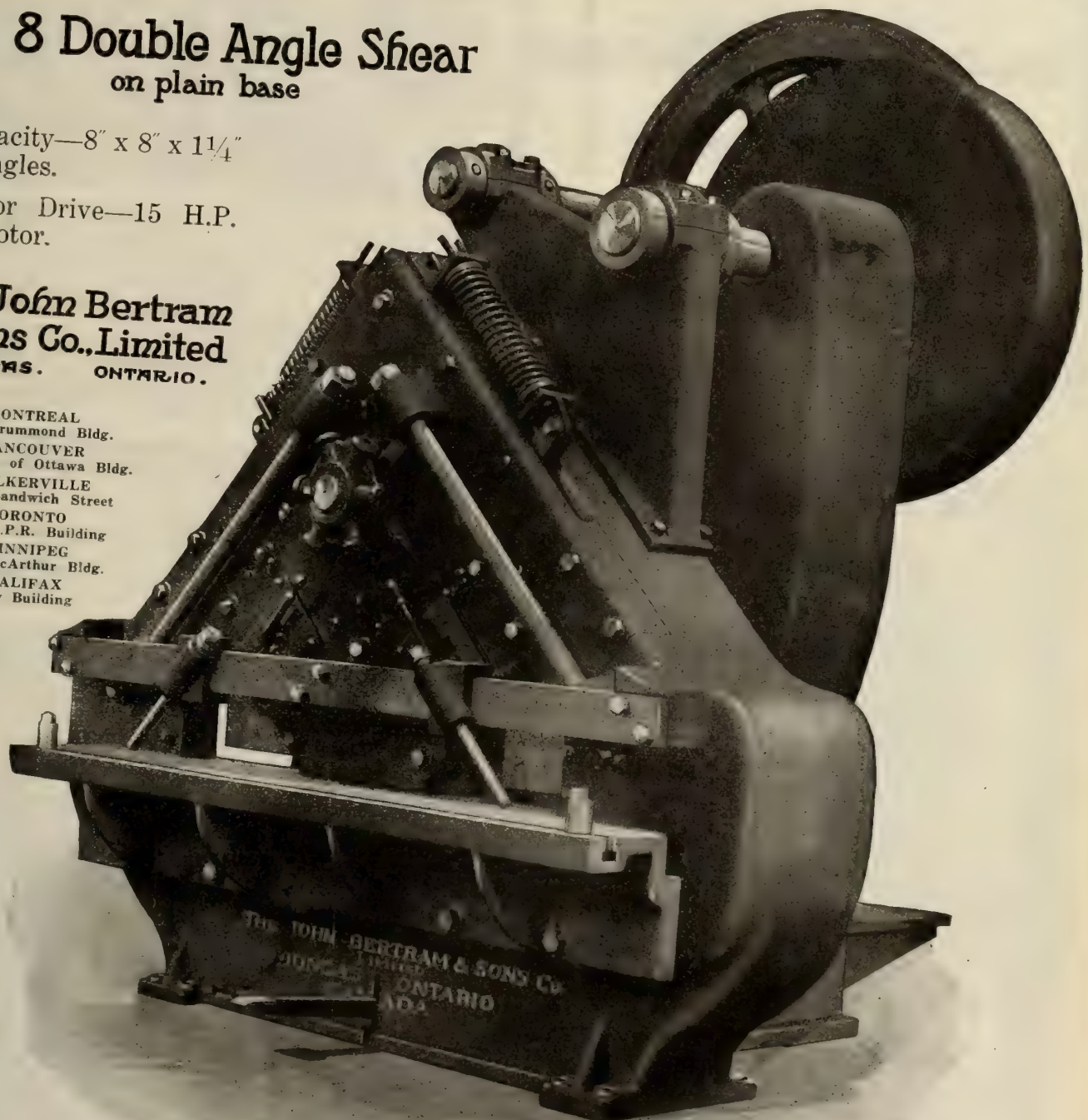
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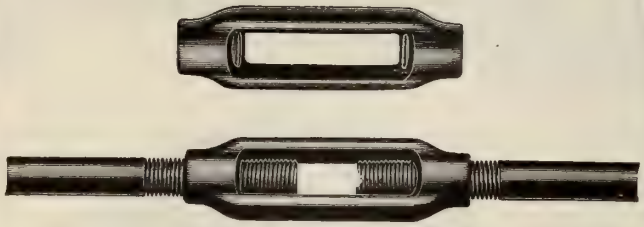
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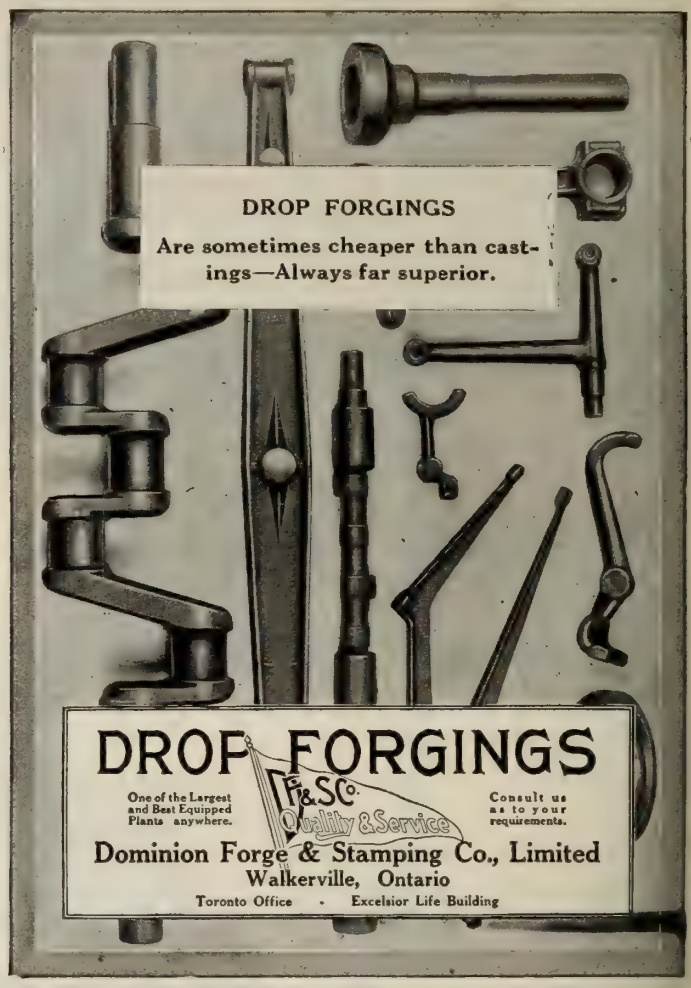
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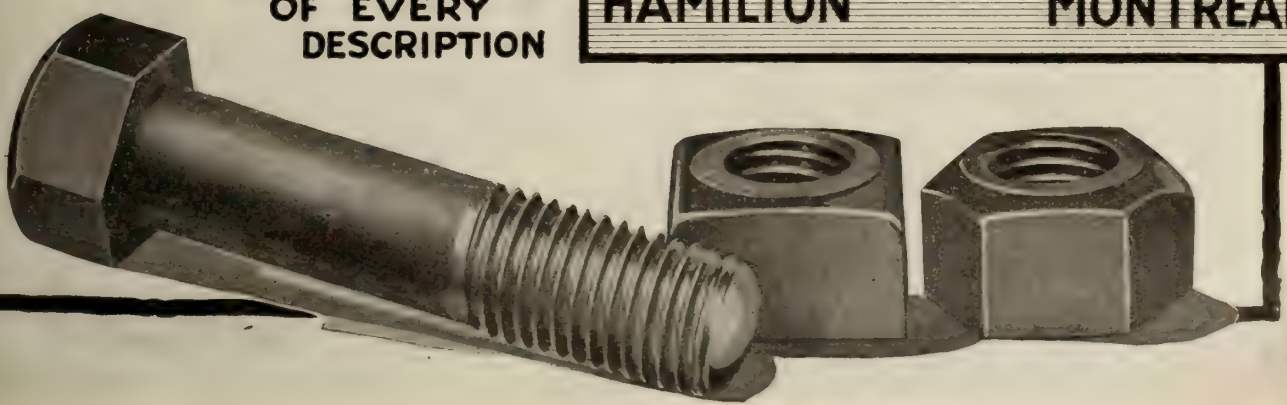
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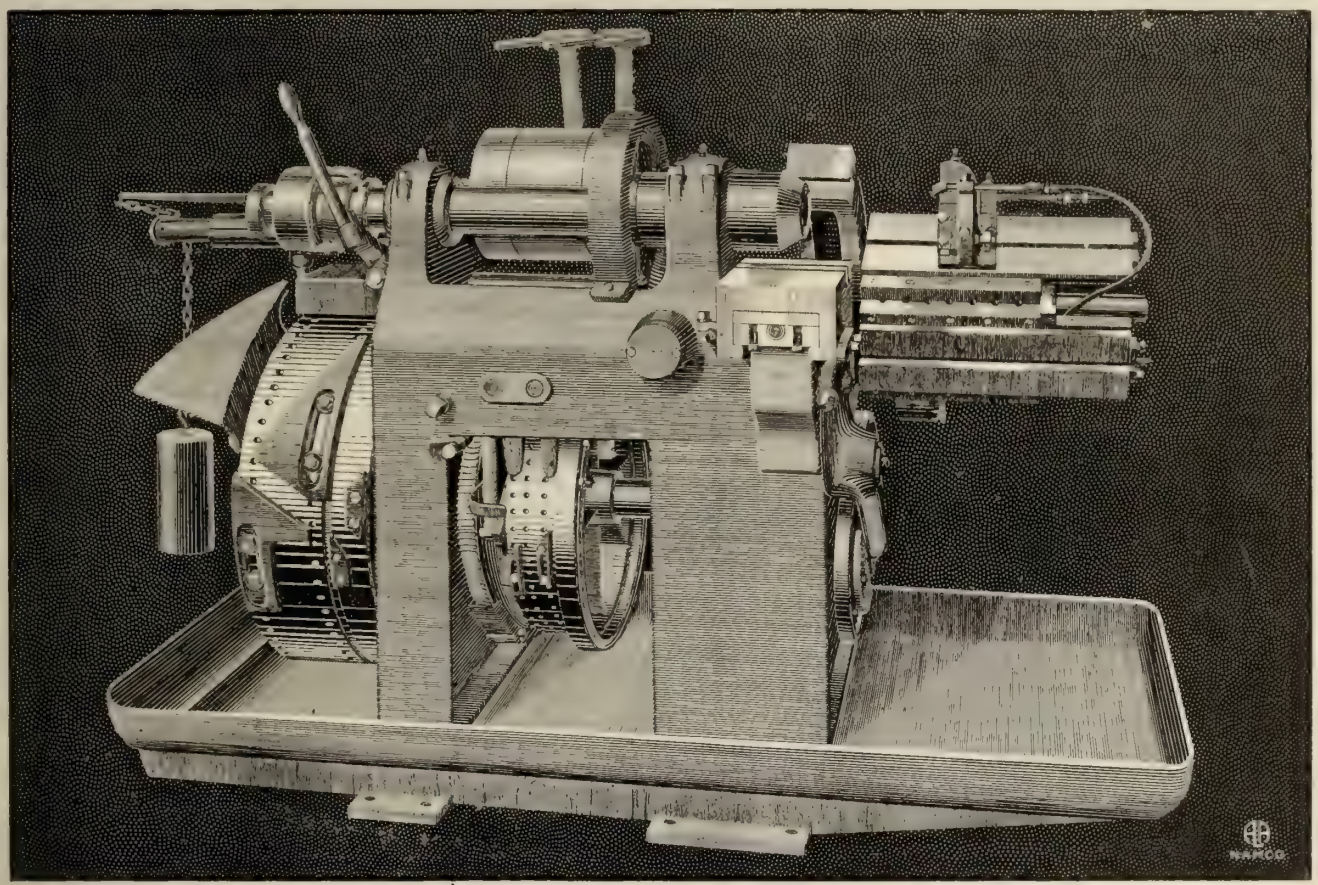
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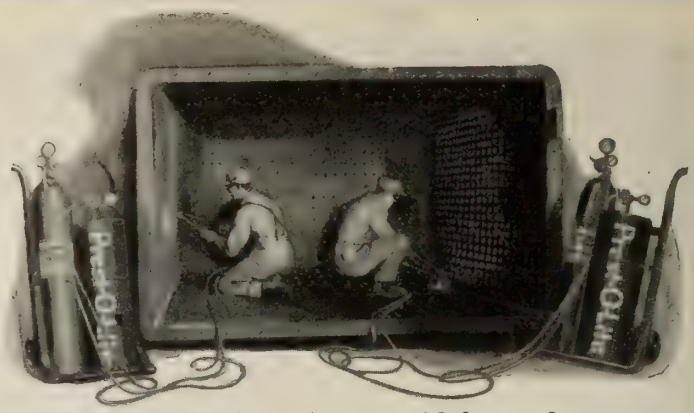
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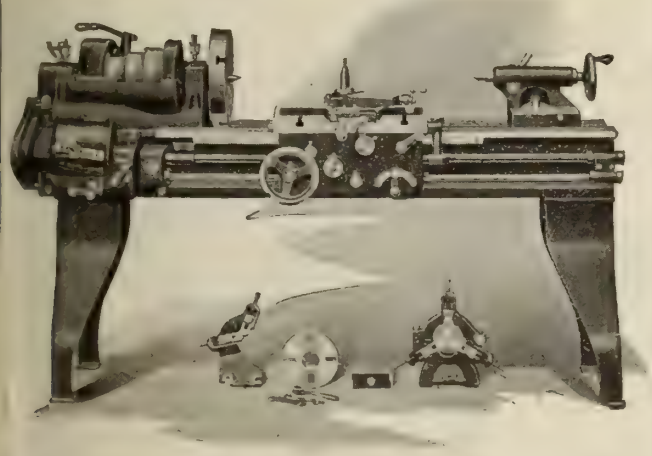
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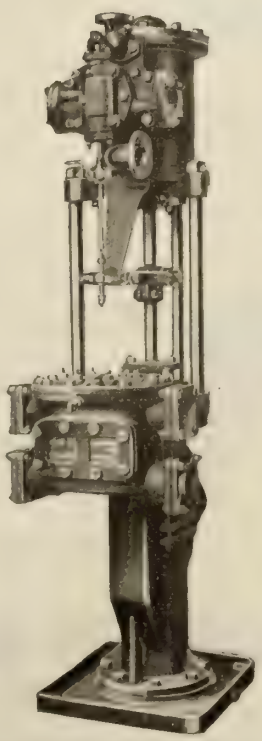
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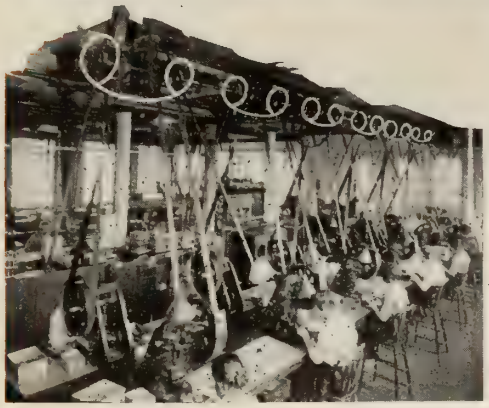


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LIMITED
Engineers and Iron Founders
18-60 Van Horne St.
Toronto, Ont.

THE JOHNSON FRICTION CLUTCH



It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

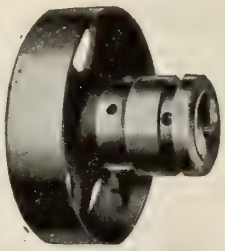
COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



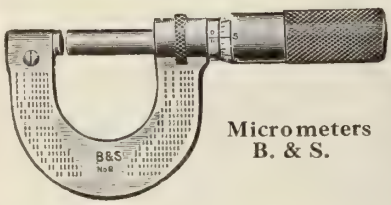
Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

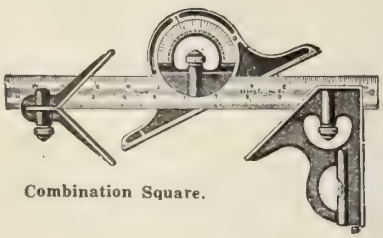
CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

This is an Age of Accuracy!



Micrometers B. & S.



Combination Square.

74 years' experience behind our products.

There is nothing new about the fact that good workmen and good tools have a strong attraction for each other. And the kind of tools good workmen like — Starrett, Brown & Sharpe, etc.—can be ordered promptly from the large stocks we constantly carry. There will be no reason for blaming it on the "tool" if you let us serve you.

CRESCENT Belt Fasteners





"VICTOR" Hack Saw Blades

Durable, fast-cutting blades that you can rely upon to cut true through the toughest metals. Users have found that these blades cut faster and last longer than ordinary ones. In ordering please mention the nature of your work.

Other small tools are Machine Screws, Set Screws, Cap Screws, Drills, (Carbon and High Speed), Files, etc.

Get quotations on Foundry and Construction Supplies.

RICE LEWIS & SON, LIMITED

Established 1847 TORONTO 19 Victoria Street



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

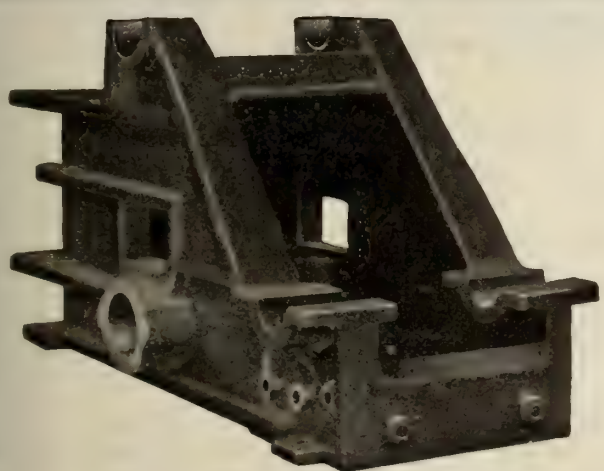
MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal



Cast Steel
Stone Crusher Frame

Machinery Parts

of every description
in

Cast Steel

Chrome-Nickel

and other forged gear blanks

Forged Shafts

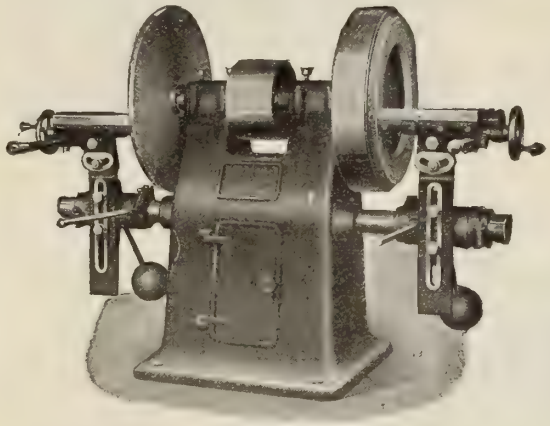
Dominion Foundries & Steel Limited

Hamilton, Canada

For Either Tools or Production

FORD-SMITH

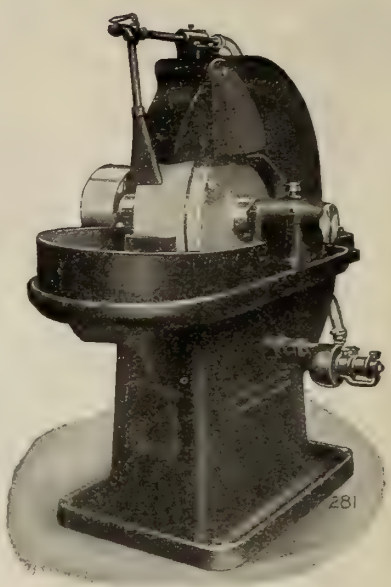
is the right grinder. Why? Because no matter how **different** the purpose, every Ford-Smith Grinder is alike in the fact that its capabilities include quality work, fast work and long life—all at a moderate cost.



Built in the following sizes:—
12, 18, 20, 24, 26, and 30 inches.
Thoroughly tested before leaving the factory.

By using the Disc Grinder with Ring Wheel Chuck for production shown at the left, unskilled help can turn out work in less time than on a milling machine, planer, lathe or special machine tool.

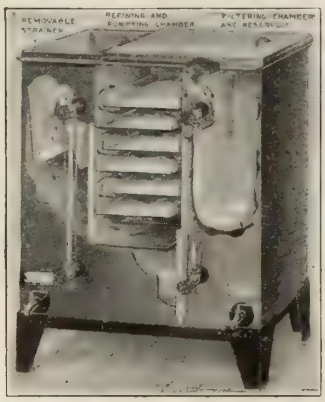
The Wet Tool Grinder at the right is a positive assurance of "bigger output." Its purpose is to keep tools sharp and not lose any time doing it.



Always plenty of belt power and rigidity with this type. In the following sizes:—
12, 16, 20, 24, 30 and 36 inches.

The Ford-Smith Machine Co., Limited
HAMILTON, CANADA

Foreign Agent: **W. E. Storey, London, Eng.**
McLeod & Co., Calcutta



The Life Blood of the Factory

Dirty, gritty lubricating oil will junk your machinery long before its time. *Friction is production's worst enemy,* and the wear and tear caused by dirt and grit in oil slowly but surely wears out expensive bearings and other machinery parts.

Clean oil prolongs the life of machinery. Bowser Lubricating and Filtering Systems assure clean filtered oil on all bearings and restore the oil to its original lubricating quality. Try the Bowser Perfected Process of Seepage Filtration.

Installation takes a minimum of floor space.

WRITE FOR
ILLUSTRATED BOOKLET **C-13**

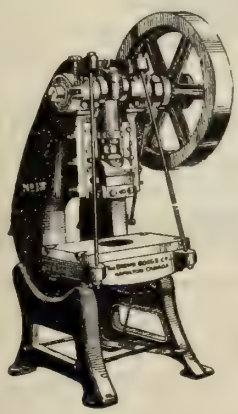
Bowser Equipment is MADE IN CANADA
by
S. F. Bowser Co. Ltd., 1368 Fraser St., Toronto, Ont.

BOWSER
ESTABLISHED 1885

BROWN-BOGGS

B B

Builders of Volume Production



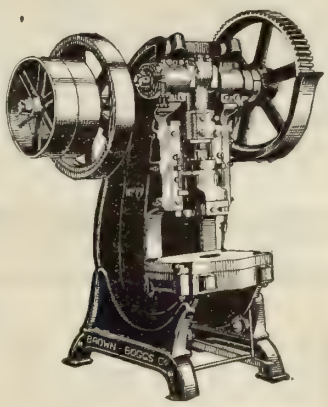
No. 15--Power Press

The "B-B" line consists of machines and tools for sheet metal, tinsmiths' tools and machine dies, shears and punches of every description.

Almost every present day manufacturer is looking for the same thing—a machine capable of turning out more top-notch quality work in a day than has ever been produced before. In this way—and in this way only—can present industrial conditions be met with profit.

You realize this fact. We realize it. That's why we earnestly urge you to investigate the sturdy quality and production ability of *B.B. Power Presses.*

Canadian Machinists and Metal Workers have, in the past, been well acquainted with the B.B. stamp of never-failing service. To-day it stands forth conspicuously as the mark of thorough workmanship — through and through.



No. 17--Power Press

A complete line of canners' processing machinery; evaporating machines, special machines. and power presses for punching, forming, embossing, blanking, etc.

Let us know the machine you are interested in and complete information will be promptly supplied. If you wish advice consult us freely.

B B

THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.

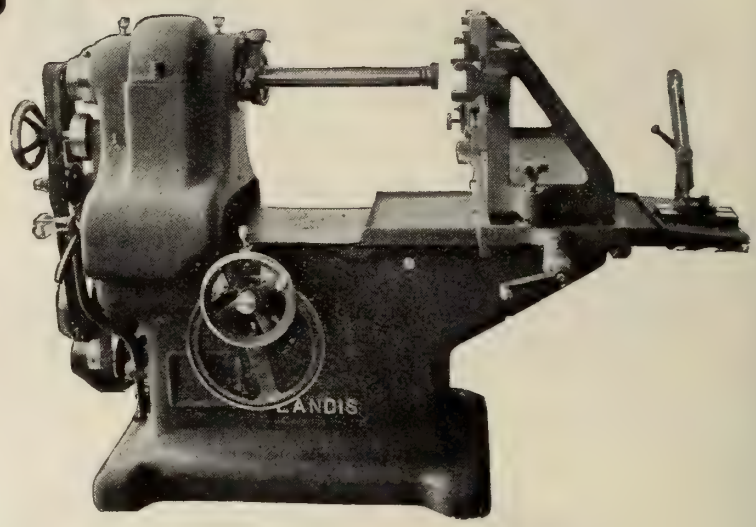
LANDIS

No. 5 CYLINDER GRINDING MACHINE

The Landis Cylinder Grinding Machine is particularly adapted for rapidly and accurately re-grinding all types and sizes of cylinders for automotive engines.

Garages and Repair Shops equipped with a LANDIS will be able to put new life into worn motors as well as their own business.

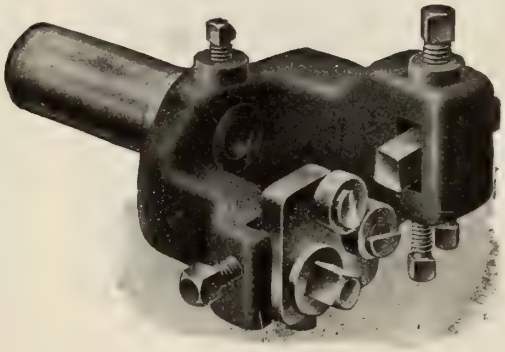
Write for full particulars immediately.



LANDIS TOOL CO.: Waynesboro, Pa.

NEW YORK OFFICE: 51 CHAMBERS ST.

TURRET-LATHE
TOOLS & HOLDERS



COMPLETE EQUIPMENT FOR CAPSTAN LATHES FULLY ILLUSTRATED IN OUR TOOL LIST E.

Sales Agents Wanted

J. ACKWORTHIE LTD.
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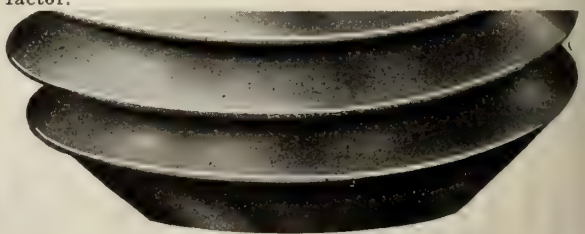
TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE

PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.

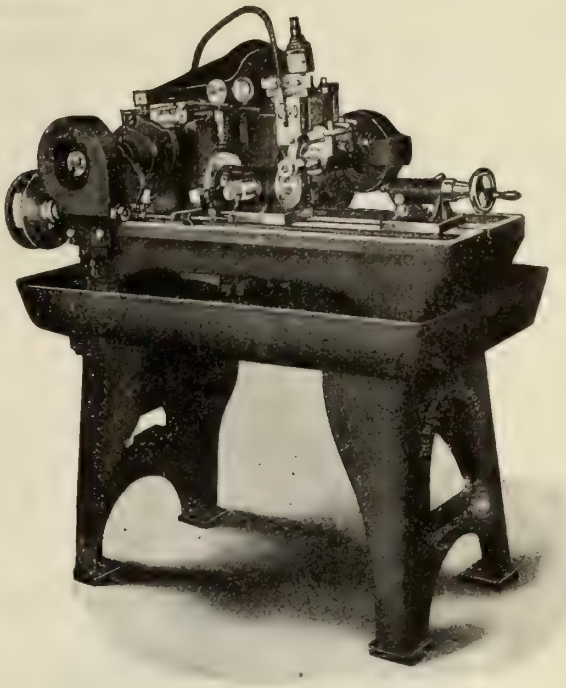


Get copy of new Bulletin I-810

THE BRISTOL COMPANY
Waterbury, Conn., U. S. A.

Bilton

MACHINE TOOLS Bilton BRIDGEPORT



Gives You the "Newest" in GEAR MILLER Practice

The "newest" in Gear Miller Practice as interpreted by Bilton, is *more* work, *faster* work, and *better* work per minute.

The Bilton is a compact, up-to-the-minute machine, that easily and accurately produces plain and form milling, as well as serrating, notching, slotting, fluting, etc.
If you are interested in lower costs, get the facts about Bilton. Catalogue on request.

Bilton Machine Tool Company
Bridgeport, Conn., U. S. A.

FOREIGN AGENTS
Chas. Churchill & Co., Ltd. M. Mett Engineering Co.
Alfred Herbert Ltd.

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.
The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



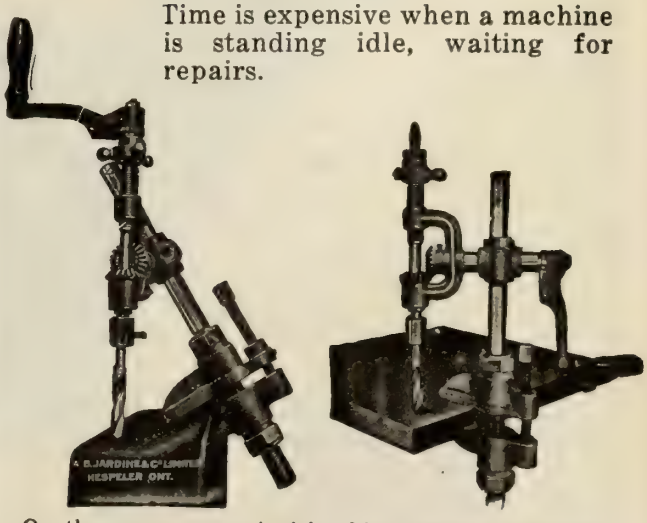
American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.
La Salle, Illinois, U.S.A.

Represented in Canada by
A. R. Williams Machinery Co., Ltd.
64-66 Front Street W., Toronto
Halifax St. John, N.B. Montreal Winnipeg Vancouver

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



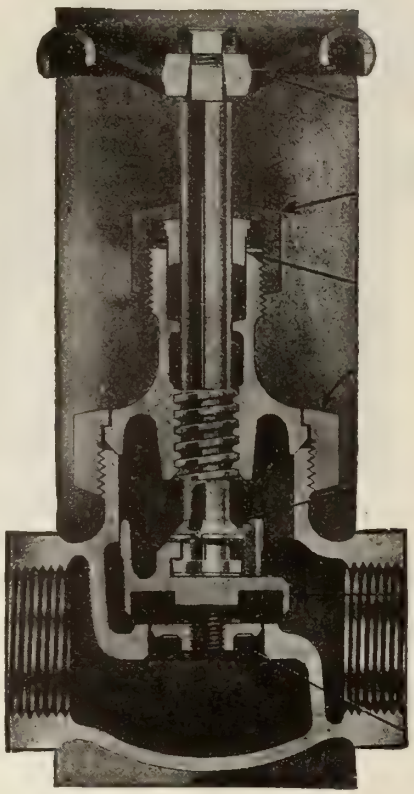
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

SEVEN FEATURES OF THE CRANE NUMBER 7

for use in plants where continuous service is required and where discs must be changed quickly without injury to the valve.



1—Easily removable malleable iron, non-heat wheel

2—Malleable iron nut

3—Brass gland

4—Malleable iron nut

5—May be packed under pressure when valve is wide open

6—Removable disc holder for quick change

7—Removable nut for changing disc

Made in sizes ¼-to 2-inch; for 150 pounds steam working pressure; discs for steam, air and water supplied as ordered. Body, Bonnet, Stem, Disc Holder, Gland, made of Brass.

Fully described in Circular No. 1 which will be sent upon request.

Manufacturers of Valves, Fittings and Piping Equipment and Distributors of Pipe, Plumbing and Heating Supplies.

Branches and Warehouses:
HALIFAX, OTTAWA, TORONTO, WINNIPEG, REGINA, CALGARY, VANCOUVER.

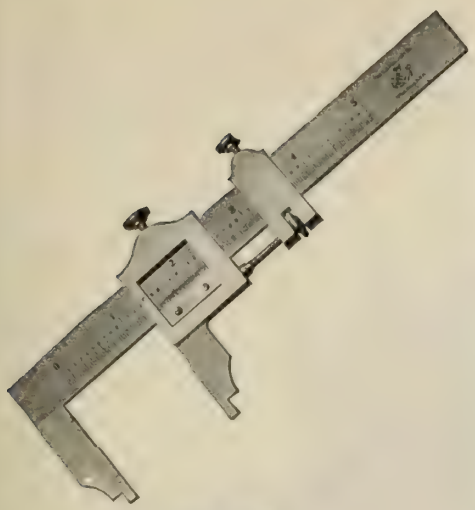
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Limited
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LONDON, ENGLAND.

Sales Offices:
MANCHESTER, BIRMINGHAM.

6



"The Accuracy of my Tools is what I depend on for the Accuracy of my Work.

"And that's what my living as a machinist depends on.

"I've used Starrett Tools for years. So I know their accuracy can be relied on.

"Whenever I buy a *new* Starrett tool I know it will have that same characteristic —absolute accuracy.

"That's why I say, 'Tell the hardware dealer you want Starrett Tools.'

"Write for a Starrett Catalog No. 22 ."

THE L. S. STARRETT COMPANY

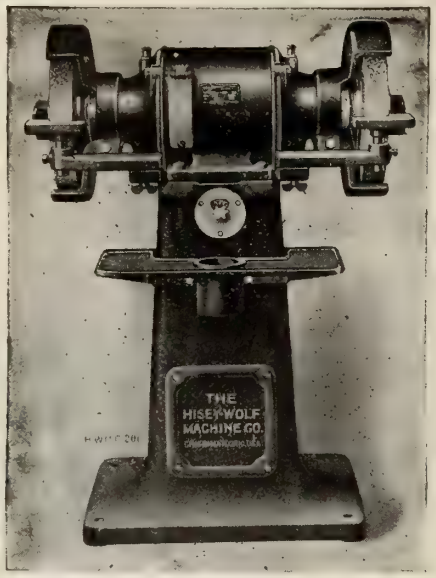
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

42-5:6





Use Starrett Tools



Making Ball Bearing Grinders Pay Dividends

Measured by dollars and cents, ball bearing grinders have a very definite value.

Because:

First, They will increase production. They are trouble-proof—no scraping of bearing linings nor complex oiling devices being required. **SKF** equipped grinders operate freely, quietly and without lubrication trouble. The housings are dust-proof.

Second, Motor efficiency is the most important consideration of any self-contained electrically operated machine, and to maintain the highest efficiency, it is necessary to have the most efficient bearing construction possible.

Write for special literature, also facts about **SKF** Bearings Service and the way in which it can help you with your bearings problems.

Canadian SKF Company, Limited
TORONTO - MONTREAL

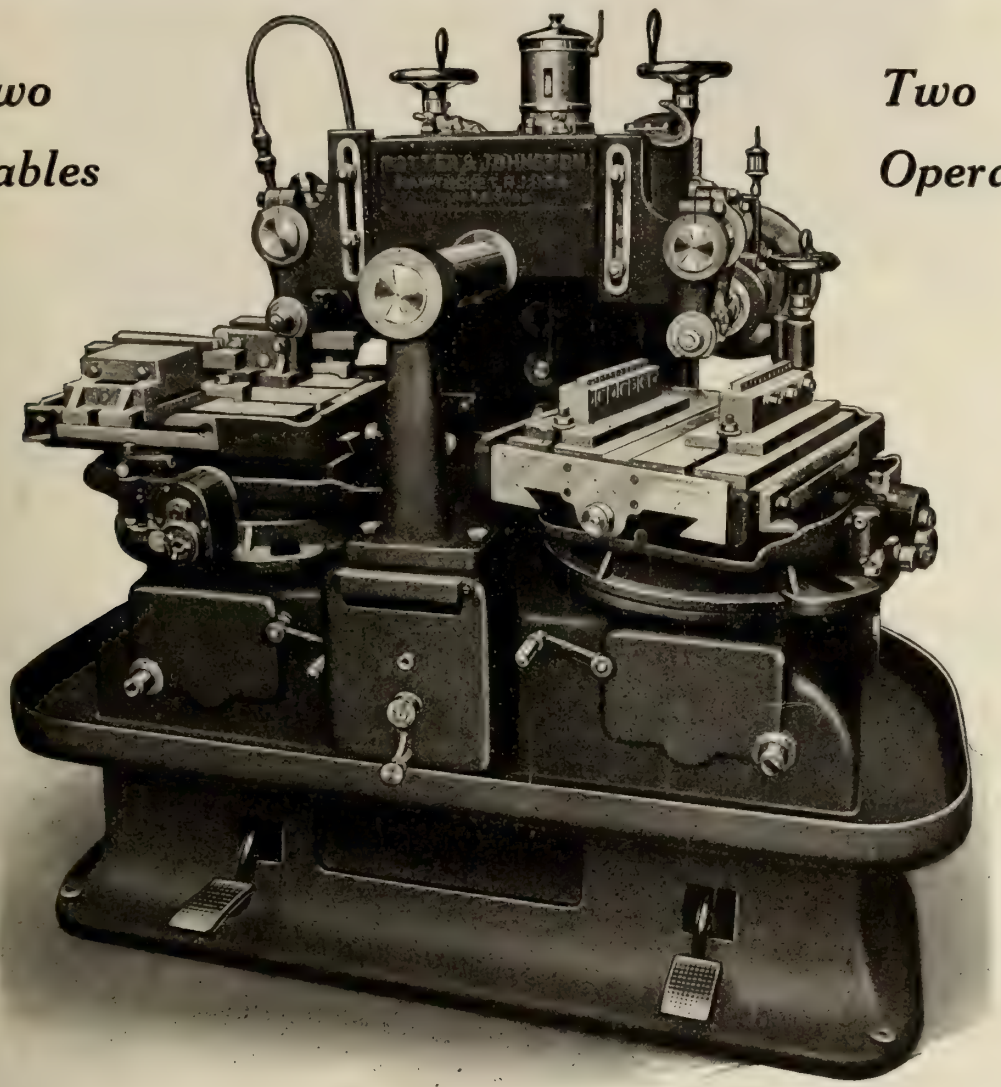


C-7

NO WASTE MOTION

Two Tables

Two Operations



P. & J. I-M Milling Machine

is turning out work every minute it is in operation. There are two tables enabling two operations to be performed without waiting for one operation to be completed. No power wasted—no time wasted. No marks from returning cutters. This machine has a history.

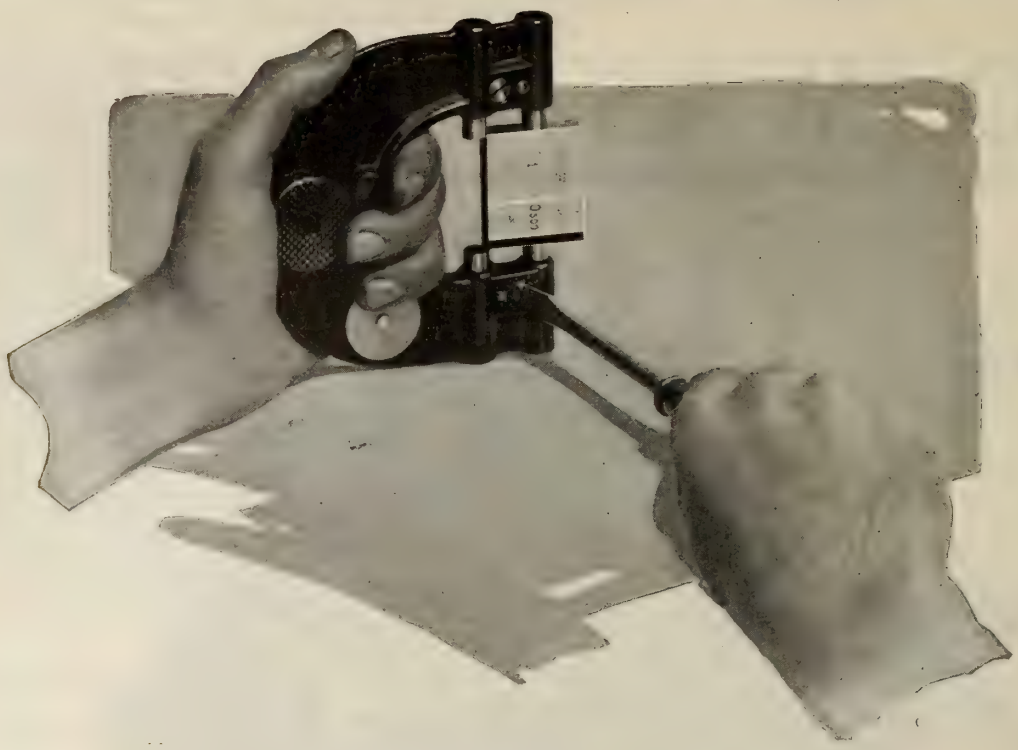
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Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., Ltd.

Head Office and Show Rooms:

11 Wellington Street East -- TORONTO, CANADA.



ECONOMY IN STANDARD EQUIPMENT

EVERY manufacturer recommends to his own customers standard machines or parts of regular design whenever they will actually fill the need. In this way he can offer the benefits of quantity production and carefully tested designs.

IT is the same with gages. Whenever a specially designed gage is specified, where standard equipment would serve the purpose, there is waste—waste in the original cost—waste in maintenance—and waste in the fact that the **special** gage has no permanent value for new work.

NOW is the time to systematize your gaging methods and standardize your equipment as far as possible.

JOHANSSON Standard Blocks offer a complete system of size standards f inside or outside measurements. Alrea adopted by the great majority of manufacturers in America and Europe. T surest basis of agreement as to si Permanent and dependable. Indispe sable in tool-room or inspection depa ments.

JOHANSSON Adjustable Limit Sn Gages have permanent value no mat how sizes or limits may be changed. A justing and locking arrangements so si ple and direct that gages can be quic and easily set to size.

SO much depends on relia gages, it is always econo to get the best. Write for vised catalog.

Johansson ACCURACY

CHAS. A. STRELLINGER CO. LTD., Windsor, Ont.

AIKENHEAD HARDWARE Toronto, Ont.

WILLIAMS & WILSON LTD. Montreal, Que.

C. E. Johansson. Inc.
POUGHKEEPSIE. N. Y.

Canadian Hart Wheels



Choosing the RIGHT Wheel!

By using the right wheel for the job it is possible to save a good deal of time and expense in your grinding operations. It takes a lot of experience and practice to choose the wheel of correct grade and grain. Tell us the class of work and we'll tell you the wheel you should use.

Canadian Hart Products Limited

Hamilton, Canada



Made In Canada



Photograph and data by courtesy of our customer

Sold in 1898

Roasters 18 x 12 x 4½ deep from 24 gauge nickeled and annealed steel at 350 per hour.

A "Bliss" No. 14 Toggle Drawing Press. It is here being run at 7 strokes per minute, the operator catching 85 per cent. of the strokes.

The owners bought their first "Bliss" Press in 1871, and to-day our records show the purchase of 66 "Bliss" presses of various kinds. It is neither our longest nor greatest record for a single customer, but it has been maintained with characteristically mutual respect and satis faction.

BLISS 1857

E. W. BLISS CO.

BLISS 1921

Main Offices: BROOKLYN, N. Y., U. S. A.

American Factories: BROOKLYN, N. Y., HASTINGS, MICH., CLEVELAND, O., SALEM, O.

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No. 54

Get this book free

The REMOVAL of Quenching and Tempering OILS



A Better Cleaning Job in ½ Time----

This Advertisement is one of a series based on actual occurrences.

AN Auto Factory uses Oakite materials for removing quenching and cutting oils from transmission gears before sand blasting, because the work shows better cleaning results and much time is saved.

Formerly soaked each batch of gears for 5 minutes in a prepared alkali solution followed by hot rinse and sand blast.

Now soak for only 2 minutes in Oakite solution, hot rinse and sand blast.

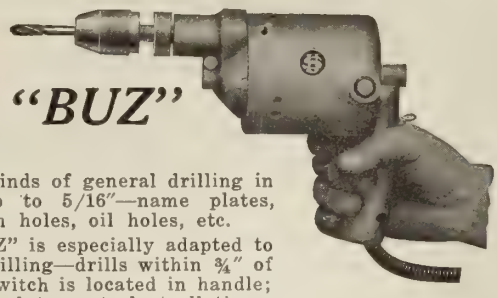
With former cleaner the parts had to be sand blasted while still somewhat coated with oil. The Oakite way leaves each gear thoroughly clean and makes sand blasting easier.

So many plants are today saving time, labor, money through the use of Oakite cleaning materials, that there is good reason to believe that your plant can also profit by their use.

WRITE FOR FREE BOOKLET TODAY

OAKITE
MANUFACTURED BY
OAKLEY CHEMICAL CO.
44 THAMES STREET · NEW YORK

United States Electric Drills and Grinders



The "BUZ"

For all kinds of general drilling in metal up to 5/16"—name plates, cotter pin holes, oil holes, etc.

The "BUZ" is especially adapted to corner drilling—drills within ¾" of corner. Switch is located in handle; under absolute control at all times. Attaches to any lamp socket, alternating or direct current, 110 or 220 volts. Guaranteed the most powerful electric drill of its weight on the market.

Order a few to-day for trial. Their time and labor saving ability will convince you you need more!

For Sale By

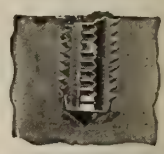
The Canadian Fairbanks-Morse Co., Limited

Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.

CINCINNATI, OHIO

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.

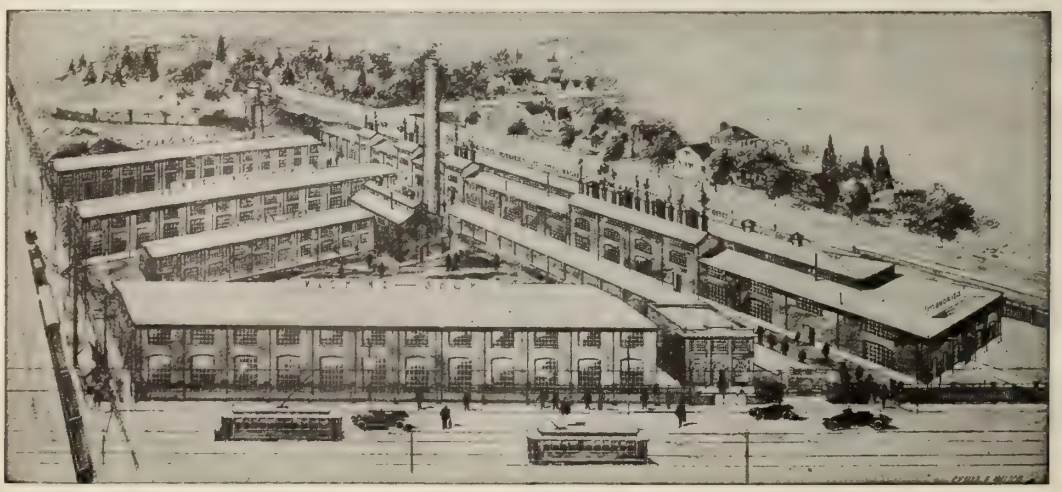
Hartford, Conn.

Hull Iron and Steel Foundries, Limited *Hull, Quebec*

Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"H I S C O" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

WHY EXPERIMENT ?
WE DID IT FOR YOU YEARS AGO



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

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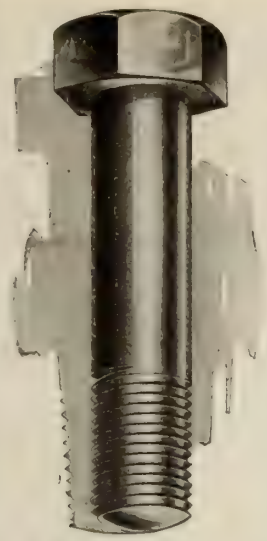
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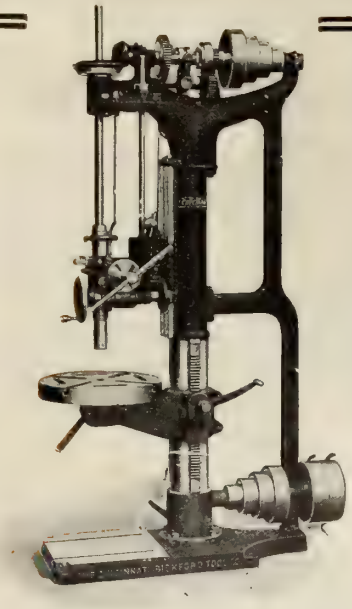


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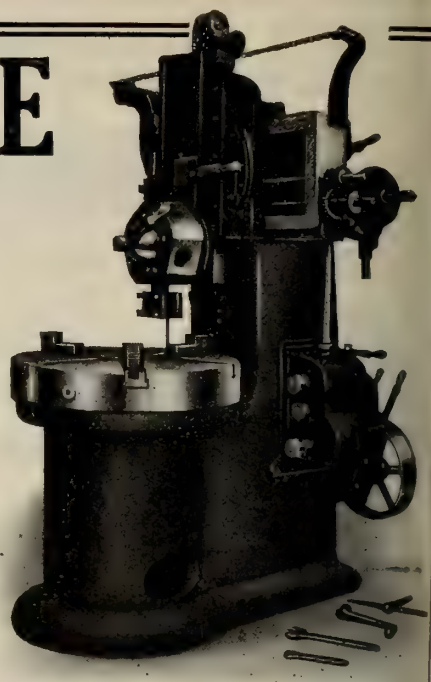
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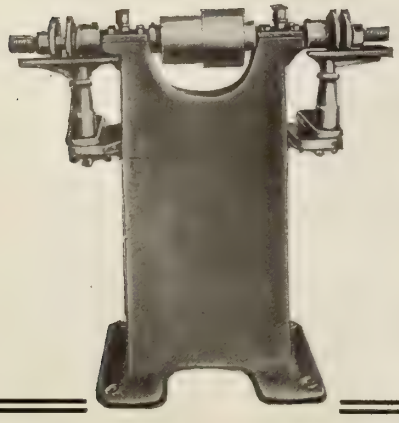
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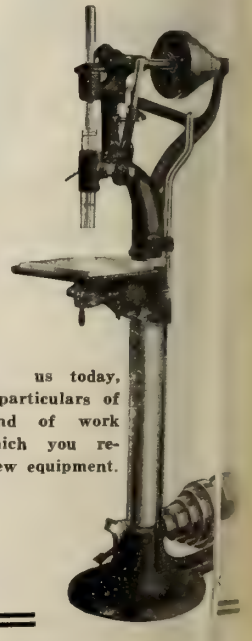
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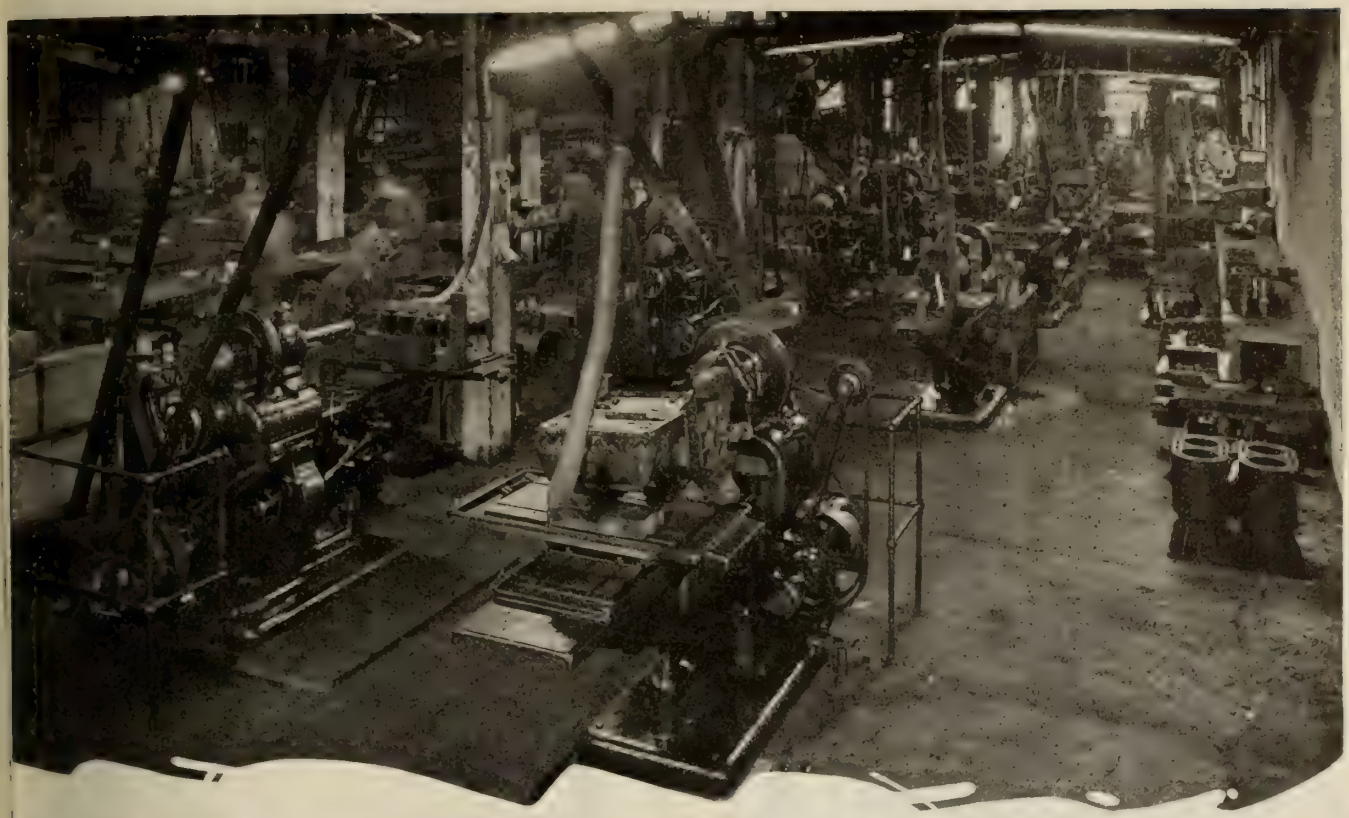


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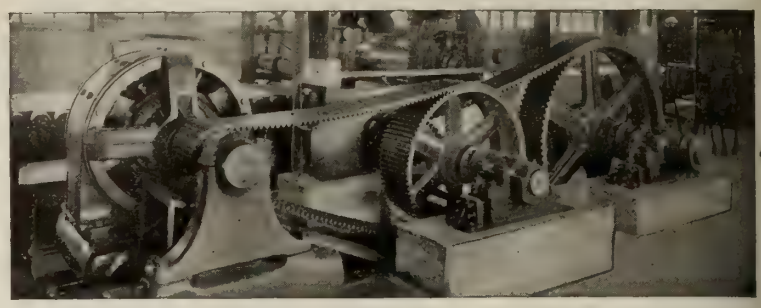
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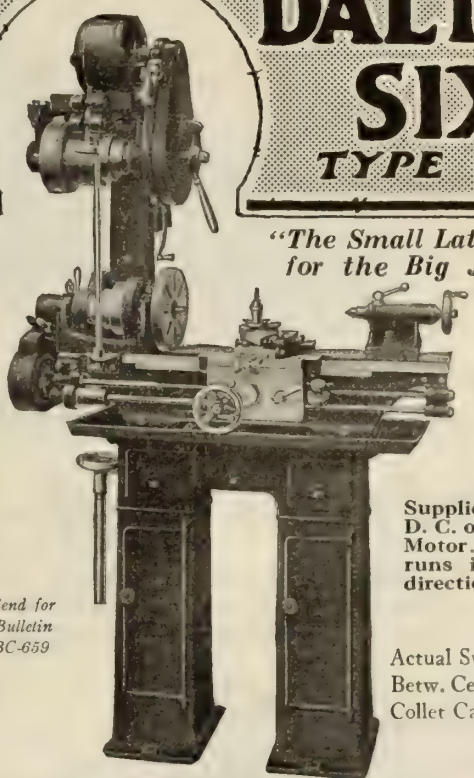
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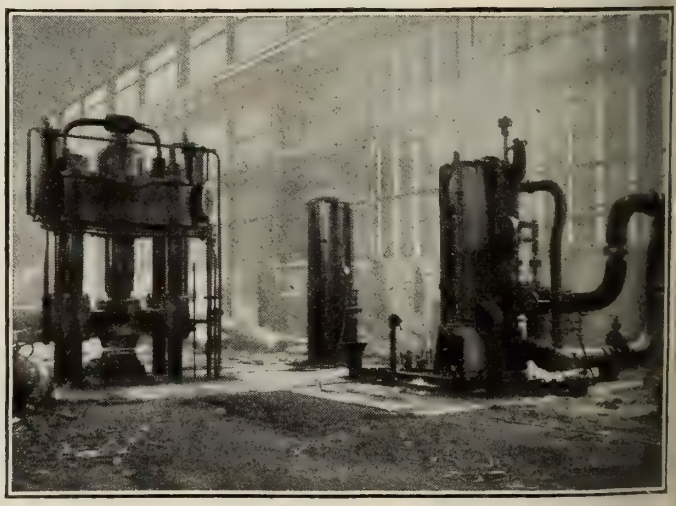
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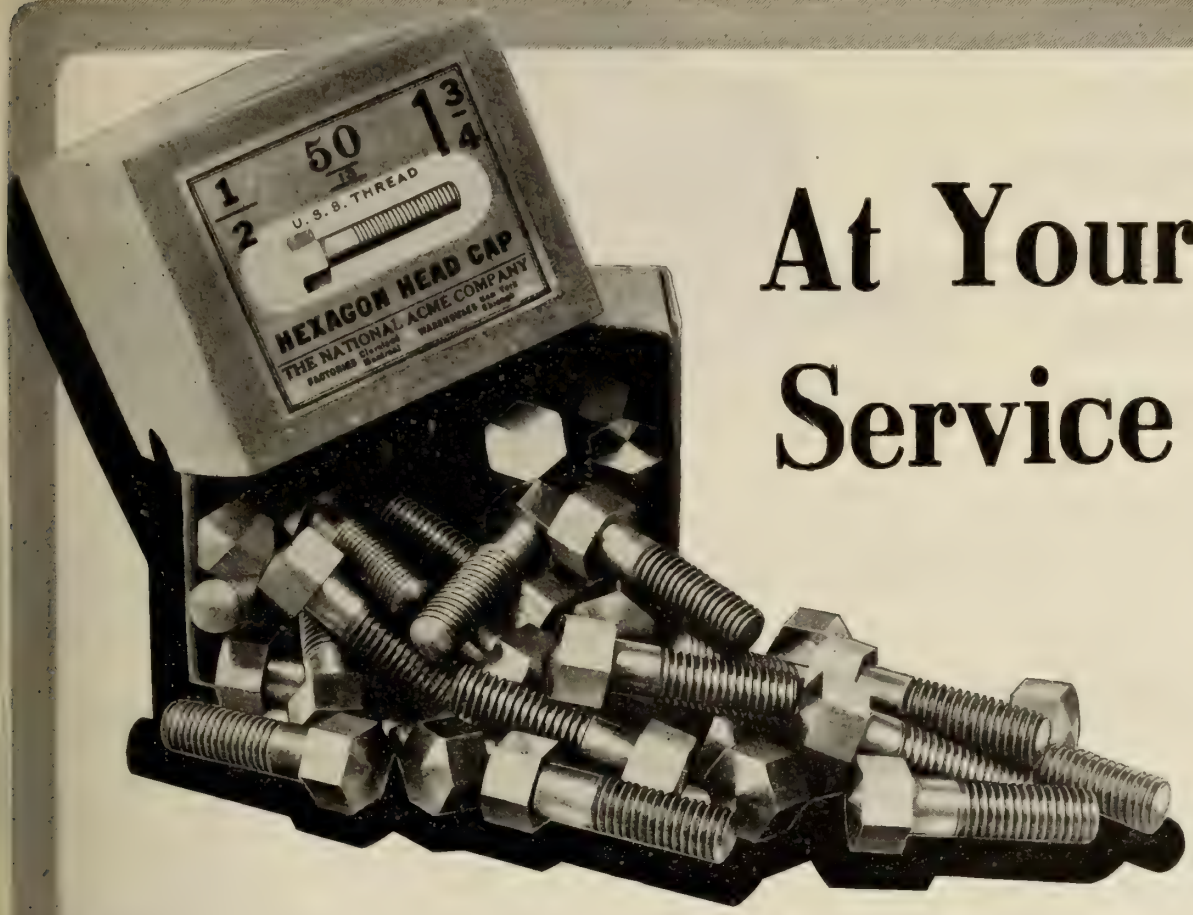
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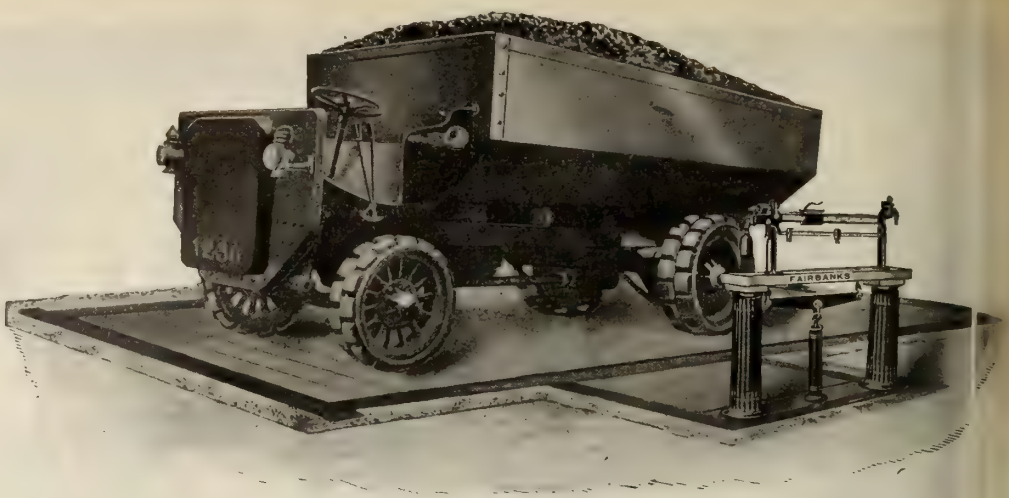
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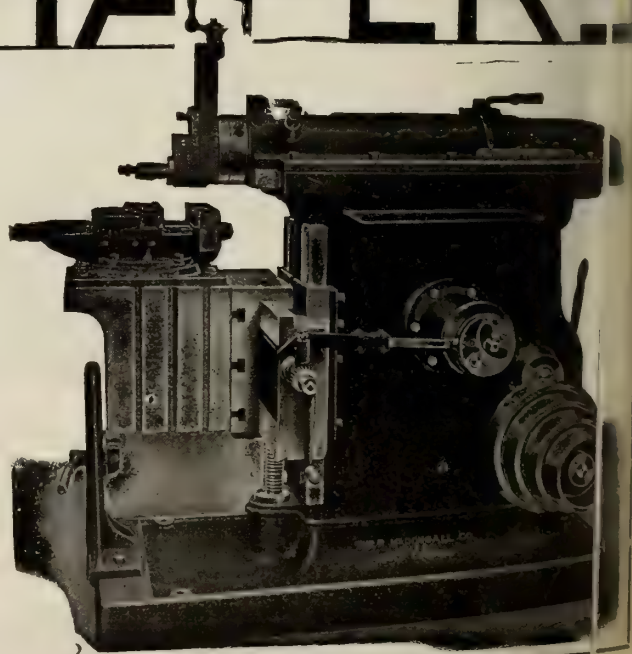
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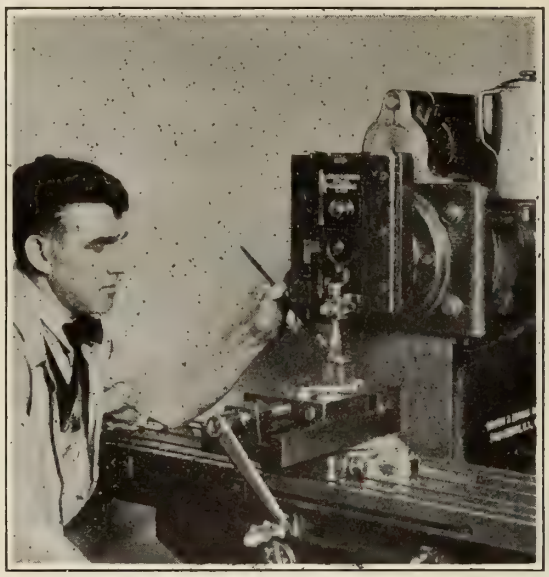
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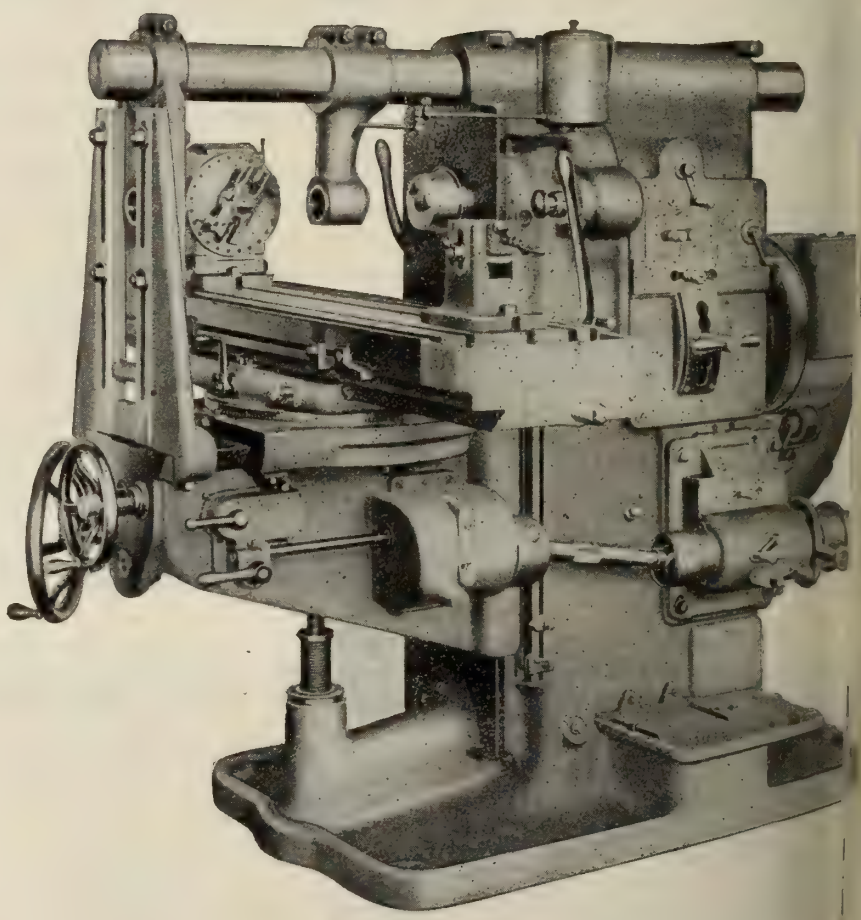
MACHINE SHOPS with a large variety of work in small quantities will find in our extensive line of Attachments new uses for their Brown & Sharpe Milling Machines.

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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVI, No. 11. , September 15, 1921.

Various Examples of Vertical Boring Work

Such Machines Cannot be Considered as Production Tools Only—Intelligent Operation Will Increase Production — Feeds and Speeds Important—Crowning a Large Pulley

By J. H. MOORE

LIKE many other types of machine tools, the vertical boring mill has become exceedingly popular during e past few years. There was a time hen shop superintendents doubted the ficiency of such tools, but this linger- suspicion has long since been swept ay. The evidence in their favor has en too strong to permit of any hesita- n in accepting them for their product- value.

t is not the intention of the present icle to touch upon the design of such chines, but rather to present in photo- phic form several jobs being success- y performed in various shops ughout the country. The variety of k which can be handled by machines his nature could never be fully cover- n a short article of this kind so we have to content ourselves with a scattered examples. General manu- ring plants find them very useful many operations where turning, bor- threading, grooving, crowning etc., to be accomplished and of course,

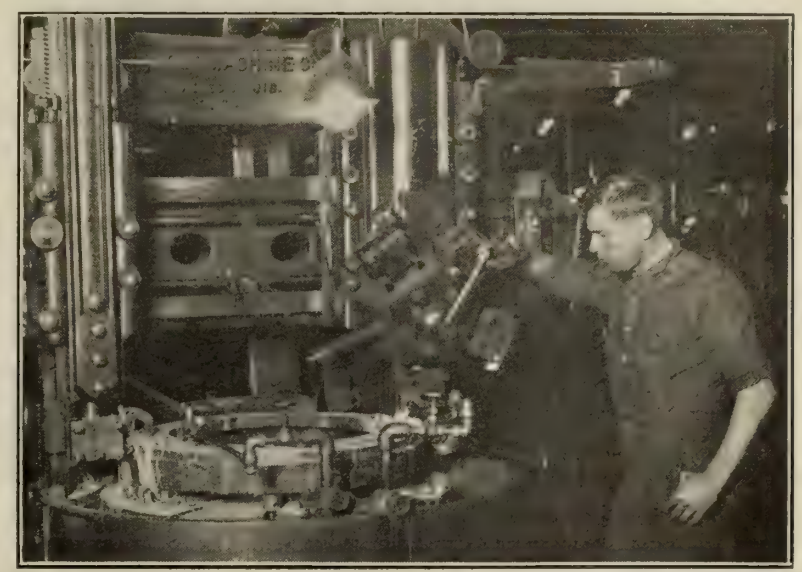


Fig. 1.—Turning a face plate gear.

as is well known, automobile factories have rows upon rows of such tools handling flywheels, cylinders, etc., etc. In the latter plants the usual practice is to set up each machine for one particular operation, turning out the work in the shortest possible time. Where the parts are being produced in sufficient quantities this is by far the best and most economical method.

tographic illustrations by courtesy of Gis- Machine Co. Zinc sketches by permission of ard Machine Tool Co.

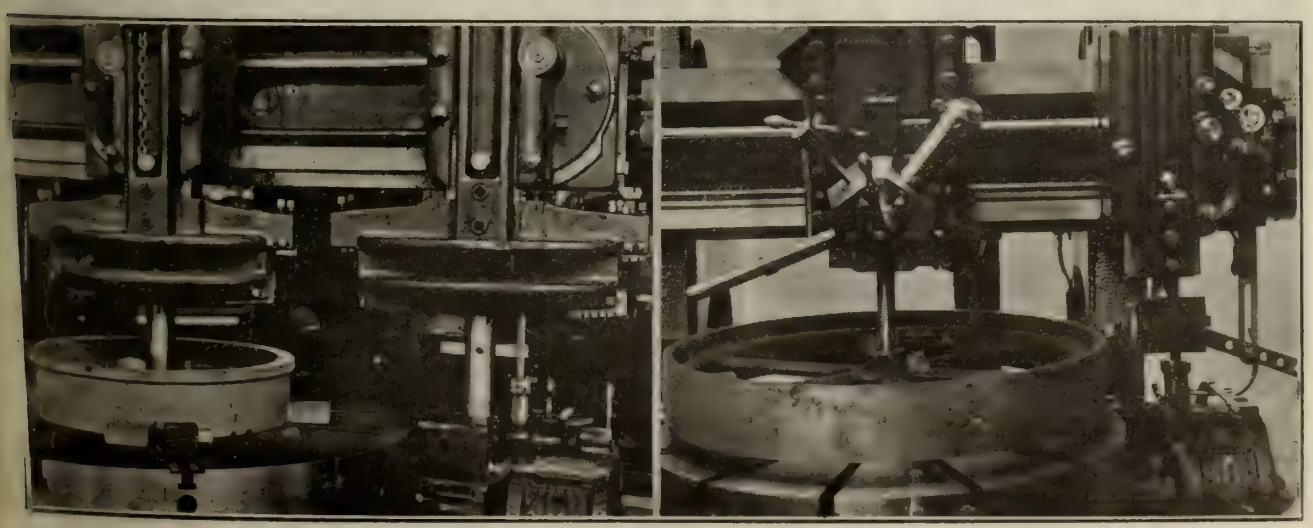


Fig. 2.—Mill equipped with special heads. Fig. 3.—Crowning a large pulley.

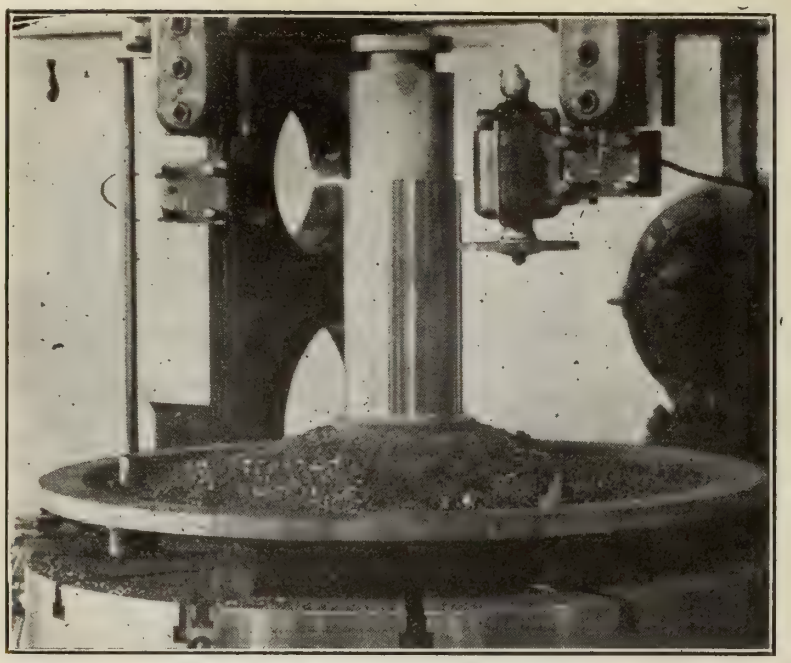


Fig. 7.—Grinding operation being performed on the vertical boring mill.

Such machines however, cannot be considered as production tools only, for in many cases they are used for general manufacturing purposes. The writer has seen as many as eight different jobs on a boring mill inside of 10 hours, each being handled quickly and efficiently.

Like any other machine tool, careful and intelligent operation is essential if maximum production is to be secured. An operator should become thoroughly conversant wtih the proper style of tool to use for the different operations; he should devise ways and means of setting up the work quickly, and should the foreman be doubtful of the need of a special fixture the operator should be able to point out convincingly, why he requires the same. Of course as a general rule the foreman is the first to see the need of the fixture and has it made to suit the mill. In spite of this assertion it is a good plan for the foreman and operator to talk things over before the jig is made, because in many cases the latter can suggest an improvement which has been overlooked.

For the general run of manufacturing work, the chuck jaws on the table are found to cover most of the requirements, so that operators have no difficulty in setting, providing they know the correct method of truing up work.

The question of feeds and speeds should also be gone into thoroughly. Manufacturers of such tools do not place a variety of speeds and feeds on their machines for the sake of saying they have a large number of gears. They are put there for a purpose, viz., to secure a large variety of conditions under which the tools can operate. An intelligent workman would never think of cutting a nickel steel forging at the same speed as yellow brass. This extreme is used to emphasize the importance of studying the proper speed to operate the machine at. Depending upon the type of finish desired, the feed will likewise be varied. There are boring mills running today which may not have come up to the plant owners expectations, but which could do so easily if they were intelligently operated.

True there may be jobs being tried on boring mills which could be better handled by some other method, but the shop manager, not the machine, is to blame in such cases. There is no need for this condition to exist for any manufacturer of boring mills is only too eager to give advice when asked. As a general rule advice of this nature is free, even to the sending of a competent operator to solve their difficulty. Having issued a few warnings as to what to avoid, we will next consider some operations accomplished on machines of this nature.

Face Plate Gear

At Fig. 1 is shown the turning of a face plate gear used at a later period for a Gisholt lathe. These castings are made of steel, and the first operation is facing the back, and turning of outside In the second operation the gear is bored in the center hole and finished on the reverse side. A special fixture for holding the part is used in the latter operation. The picture itself is well worth

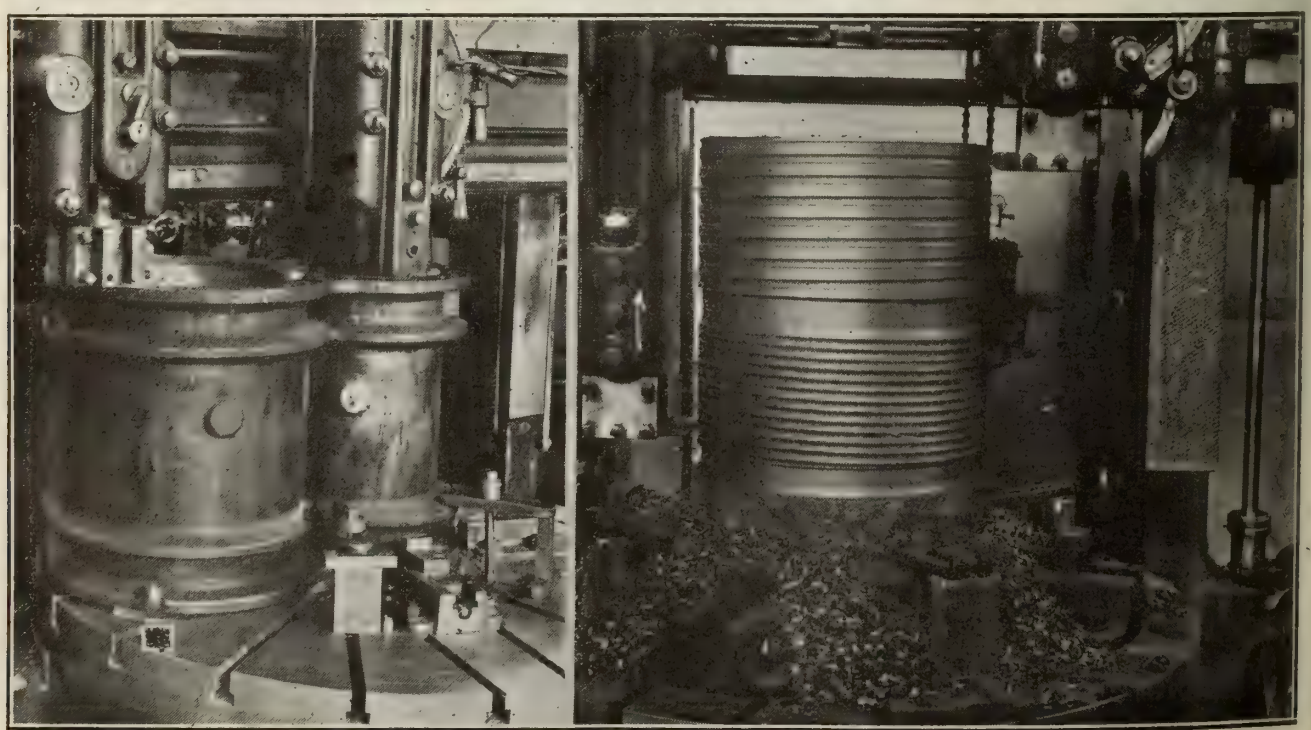


Fig. 5.—Boring out a double cylinder. Fig. 6.—Cutting heavy grooves in a drum.

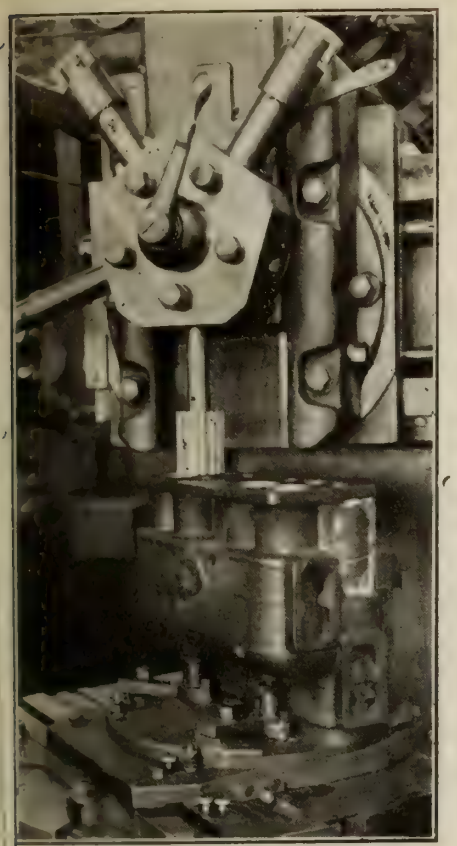


Fig. 4—Boring an automobile cylinder.

nsidering. Note the size of cut being ken, and the good stream of lubricant at is being played on each tool. If the ncern actually making these mills ink it wise to adopt this practice, why t follow out the same idea in the ps. This is a very simple operation, without further comment we will pass to Fig. 2.

Here we see a boring mill equipped th special tool heads, which have in- ased production considerably. The t shown on table is roughed out with t head to the right of machine, at t same time being rough faced on t with the upper cutters. Note the n d cutter blades which are found to b best suited for such work. The finish- r blades can be clearly seen in the e head. In addition to facing the bot- and top, a large hole is bored in the er of the casting. The finishing cut- e is hidden by the part in the photo- ph, but the roughing cutter for this can be seen in the roughing head. M boring bars used in conjunction h these heads enter a pilot bushing n e table thus guaranteeing the align- nt.

Crowning a Pulley

e next photograph Fig. 3 depicts n finishing of a large pulley even to the rowning. The first tool station fin- sh the hub and rim, and straddle faces the dius at rim, while the second sta- tion rough bores the center hole. The thir position finishes this hole, while the fourth station is used for finish rea ng. The fifth tool chamfers and face both sides of rim. After this has been completed the tool at side performs the crowning operation. The size of the pulley can be understood when we mention that the mill shown in the photograph has a table 52 in. diameter. It is hardly necessary to explain how the crowning tool is operated, for the method of securing the curve is apparent. Different curves, or crowns, can be secured by moving the connecting lever to one of the other holes.

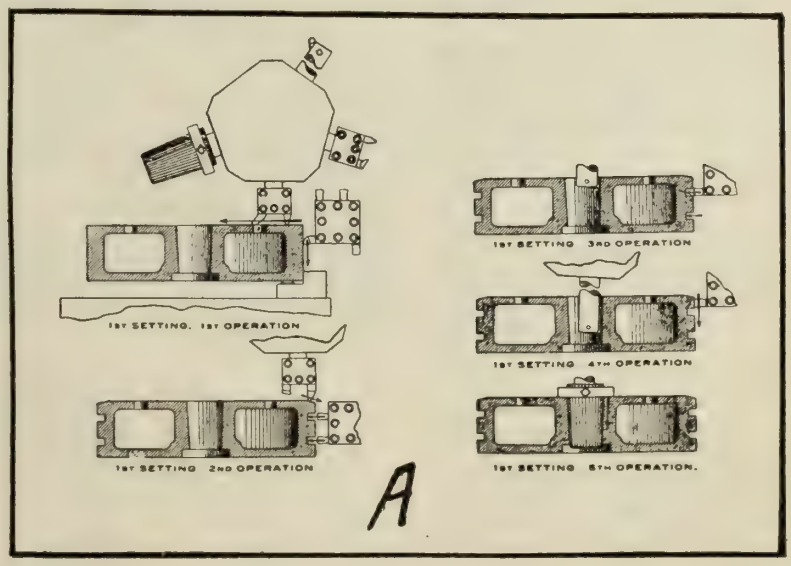
The next example Fig. 4 shows an automobile motor being machined on a 36 in. machine. The first station rough bores the cylinder; the second position finish bores and faces the bottom; the third position reams, while the fourth tool recesses. Without removing the work from the jig which is mounted and revolves on an eccentric plate, the cylinder is revolved until the valve holes come under the boring head. When in this position these holes are rough bored, tapped, finish bored, seats faced, etc. The value of using a special fixture on work of this kind cannot be overestimated. Think of the saving in set up time, not to mention the greater accuracy secured through the two operations being completed without moving the cylinder from the fixture. The work is located in the jig by means of a C clamp which hooks over the inside of cylinder.

Large Cylinders

Fig. 5 shows a boring mill engaged on work of a general manufacturing nature. The double cylinder is placed on the table as shown, and of course the boring and facing operations are easy of accomplishment.

A rather interesting operation for a boring mill is shown at Fig. 6, this being the cutting of heavy grooves on a drum. The machine being used has a table 52 in. diameter so a good idea can be formed as to the size of the work. The upper head is cutting a double thread of 2⅝ in. pitch, the lower thread being single and 1 5/16 in. pitch. As steep as 3 in. pitch is cut on these machines. The scoring attachment can be adapted to either side of the machine, or to both as shown in the photograph. It will be noted that the left head is travelling up, while the right hand head is moving downward.

The next illustration Fig. 7 shows how grinding can be accomplished after the other operations have been completed. The piece in this case is first turned, necked and faced; after which it is



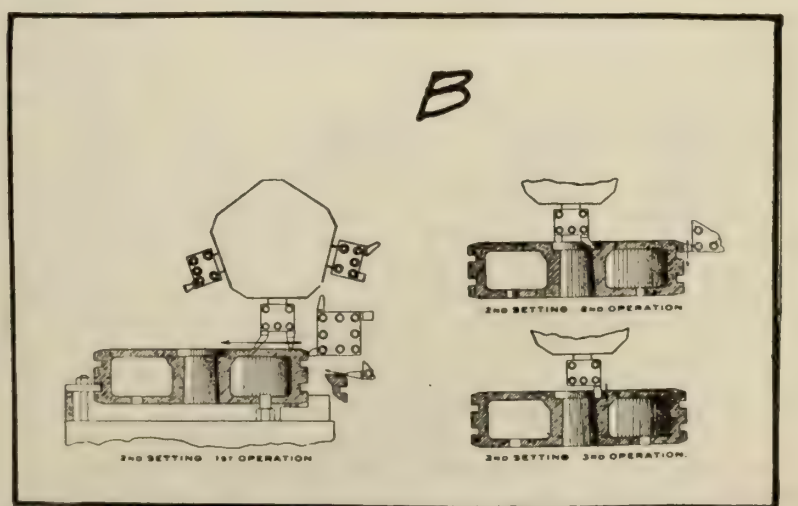


Fig. 8.—Tool layout for solid piston.

ground. A portable electric grinder is simply fastened in the regular head, the slide fed down at a suitable speed and the spindle portion ground.

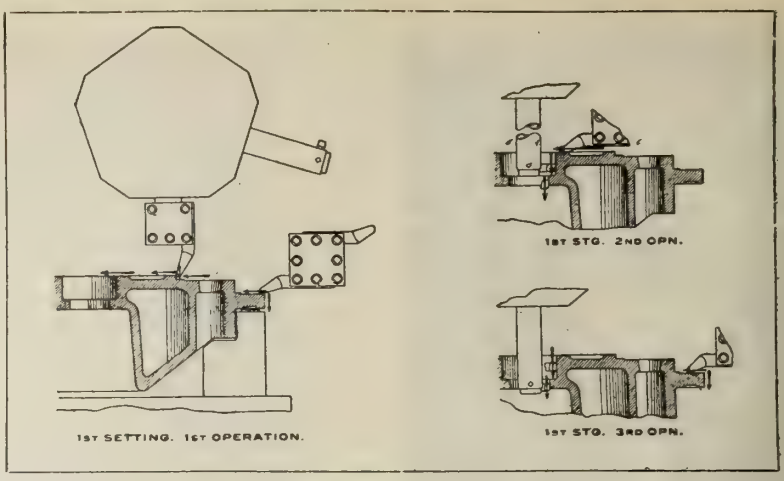
The group of line drawings in Fig. 8 show a few typical jobs performed in various railroad shops where boring mills usually are in evidence. "A" and "B" shows the tool layout for a solid head piston, and as will be noted two settings are required at which five operations and three settings are performed respectively. The various sketches show clearly the tooling necessary and the arrows indicate the direction of travel of the tools.

The remaining illustration Fig. 9, shows the machining of a cast iron cylinder head which is completed in four hours. It will be noted that the head is of complicated shape and the tooling used in the set ups can be seen clearly.

Without showing any further illustrations, we will touch upon a few of the common parts completed on boring mills in railroad shops throughout the country. This type of machine handles easily such parts as pistons, piston bands, packing rings, valve rings. piston valve bushings, piston glands, and pump cylinders, cylinder heads, crossheads, brasses of all kinds, driving boxes, eccentrics and straps, throttle boxes and knuckle pin bushings, crank pin washers, hub liners and wheel bands, engine truck centers, and any cylindrical, or suitably shaped casting or piece of a locomotive.

In the general manufacturing plant boring mills are used for such a variety of purposes that no attempt will be made to enumerate them.

Speeds and feeds cannot be tied down to any hard and fast rule for much depends on the material used, the accuracy and finish desired, and the tools selected. The Bullard Machine Tool Co., have found that the following figures work out very satisfactory, and when running under ideal conditions the speeds shown below can be considerably increased. In other words the figures represent average conditions.



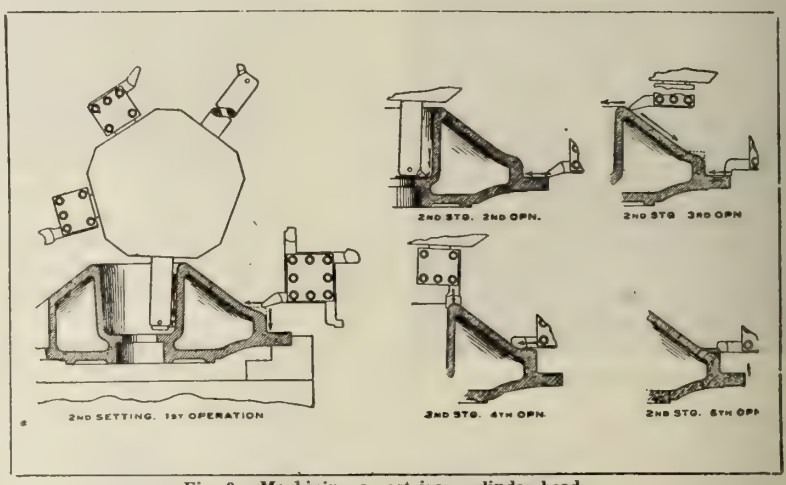


Fig. 9.—Machining a cast iron cylinder head.

Material	Turret Lathe Practice Surface Feet per Min.
Soft cast iron roughing	50 to 60
Soft cast iron finishing	60 to 80
Hard cast iron roughing	35 to 50
Hard cast iron finishing	60 to 80
Malleable cast iron	80 to 90
Steel castings	150 to 250
Brass	50 to 60
Bronze	150 to 250
Hard Bronze	80 to 100
Soft machine steel	100 to 150
Copper	150 to 200
Aluminum	250 to 400
Medium hard machine steel	60 to 80
Hard machine steel	40 to 60
Tool steel—annealed	60 to 80
Tool steel—unannealed	25 to 35
Alloy steel annealed	50 to 60
Alloy steel treated	30 to 40
Cutting threads on brass	60 to 150
Cutting threads on steel or cast iron	25 to 40

For high speed cutters For carbon cutters decrease about 50%.

CUTTING SPEED (ft. per minute.) = Dia. in inches x R. P. M. x .26

TIME TO COMPLETE CUT = Length of cut (in inches)
Feed per rev. (in thousandths) x R. P. M.

At a later date we will take up some further examples of vertical turret lathe practice.

VALVE STEEL TREATMENT

An English house organ, speaking on the heat treatment of valve steel claims that the proper heat treatment for the valves of internal combustion engines is as follows: 3½ per cent. nickel steel should be normalized at 830—850 degrees centigrade. No further treatment is necessary. 25 per cent. nickel steel should be normalized at 880—900 degrees centigrade. No further treatment is necessary. 13—18 per cent. tungsten valves should be heated to 950 degrees centigrade and cooled in still air, then reheated to 800 degrees centigrade and cooled in still air before machining. 13 per cent. chromium valves should be heated to 900 degrees centigrade and cooled in oil, then reheated to 700 degrees centigrade and cooled in still air before cooling in oil.

According to reports a new high record for production for one month was reached at the Ford Motor plant, Detroit, Mich., when 108,962 cars and trucks were produced. During April, May and June, the production of cars and trucks was 301,796, this being an increase of more than 80,000 over a year ago. The July schedule calls for 109,000 cars and trucks, and this means that a car or truck will leave the assembly line every 6½ seconds. If the schedule is maintained 4,360 cars per day will be turned out.

Micrometers as an Aid to Production Work

Their Application to Such Work Has Been The Means of Developing Special Appliances—Several Types Are Used—Details of the Most Common Styles Are Given With Explanatory Data

THE micrometer caliper, or simplified modification of the same, has become a widely used tool in machine shop practice. Their application to production work has been the means of developing special appliances for increasing efficiency. Fig. 1 illustrates several types of micrometers in general use, that shown at A, being the common one-inch size, but specially designed for heavy duty.

At B is shown a caliper designed for a wide range of work and it is particularly adapted to shops where quantity production is not a feature, but where a high degree of accuracy is required. The anvil A is so constructed as to take a number of extension posts of different lengths, the usual one-inch reading being provided on the barrel. A sheet metal micrometer is shown at C, with the graduations placed on a disc secured to the frame. The latter is so constructed as to allow measurements to be taken at a distance from the sheet edge to escape any burrs or kinks frequently resulting from punching or shearing.

For measuring the depth of holes, counterbores or shoulders, the type shown at D is used. At the rear of the depth micrometer is a set used for inside measurement of holes of varying diameters, extension rods being used in the one body.

Some application of the use of these calipers are shown in upper portion of Fig. 2. The method of finding the depth of a counterbore is shown graphically at E. The disc is placed in the recess and the distance measured; this length minus the thickness B of the disc gives the distance C. Subtracting the length C from D gives E, the depth of the counterbore.

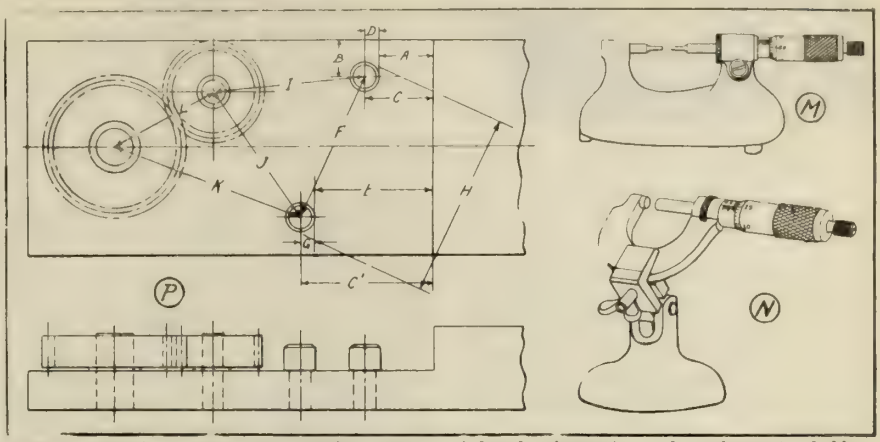


Fig. 3—Showing method of measuring centers. A bench micrometer and a micrometer holder.

The setting of boring cutters may be accomplished as shown at F. The process is similar to that just described; for the diameter I the measurement F would be (I H) 2 H. F.

At G is shown a method for finding center distances of holes or pins and the dimensions are obtained as in the other cases. In practice the tool maker would probably use buttons for determining the location of the holes and would subsequently use these buttons for locating the work in the machine prior to boring the holes. Final checking would be done as shown in the sketch.

For measuring the thickness of a hub the shallow frame micrometer shown at H is used. The tool shown at I is particularly adapted for use on soft material, the wide faces eliminating the possibility of excess compression of the material and assuring more accurate measurement.

For the laying off of work and for line measurements the design shown at J is frequently used, the scriber A being

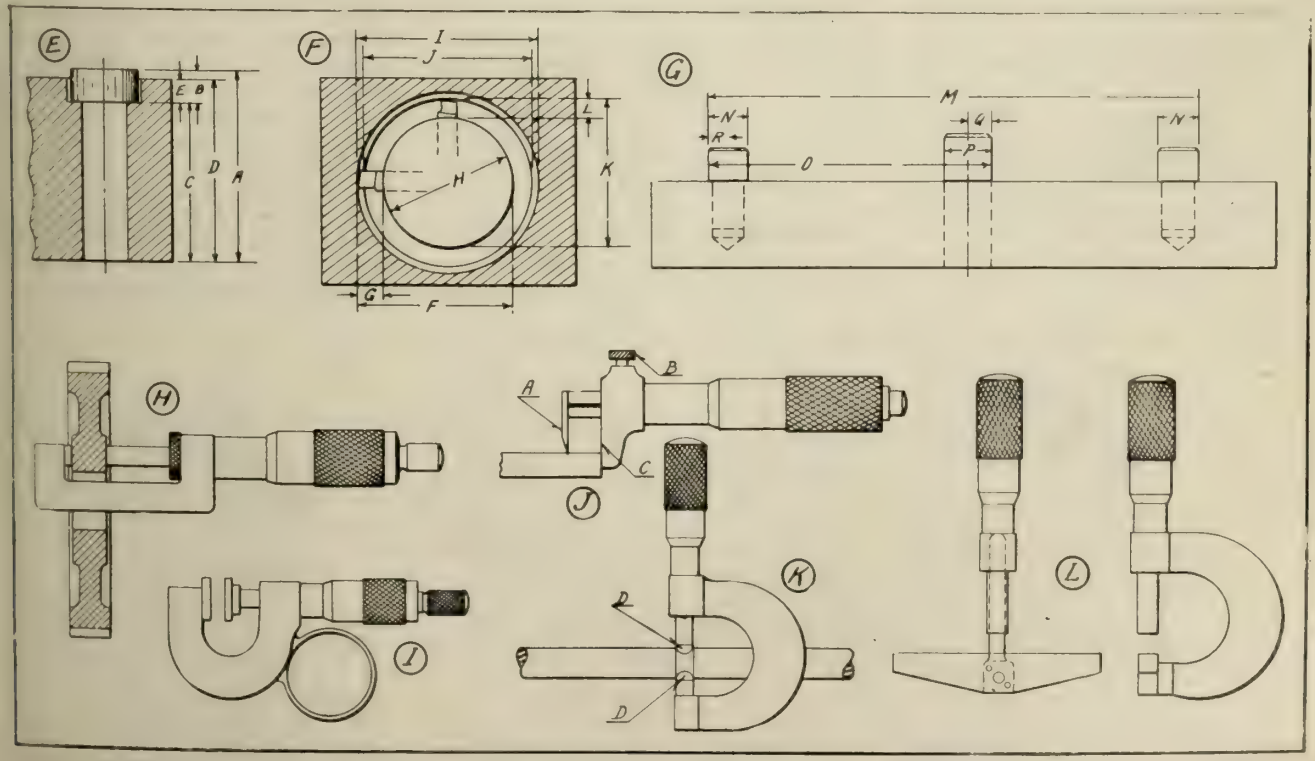


Fig. 2. The various sketches in this group are fully explained in text matter.

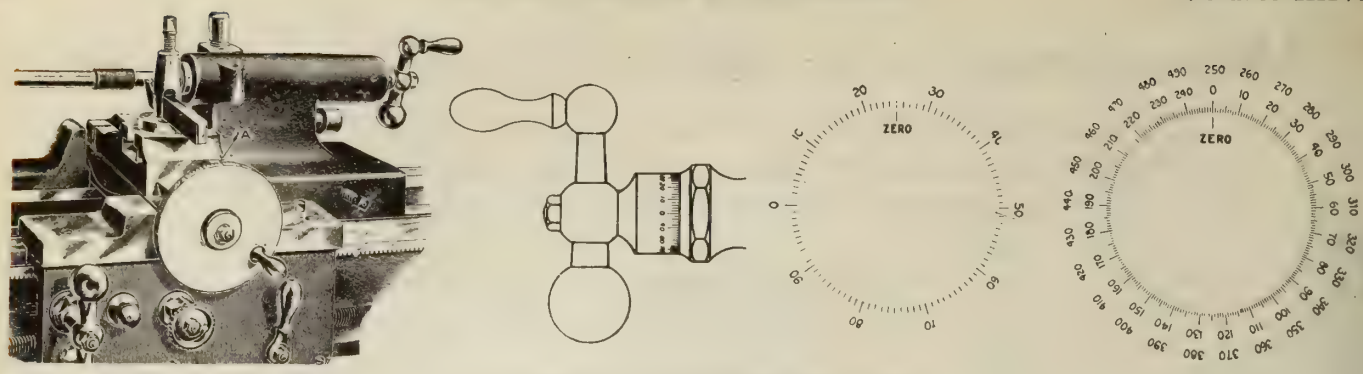


Fig. 4.—Showing the lathe dial and details of same.

secured to a special spindle, which may be clamped, if desired, by the small screw B.

For measuring grooves in shafts a micrometer with semi-spherical points D on the end of the spindle and anvil is often used; such a tool is shown at K. Another special design, shown at L, can be modified to suit varying conditions or requirements.

At M and N are special appliances for inspection purposes, where the work is brought to the measuring instrument instead of the tool to the work. M is a fixed appliance, while N shows an ordinary caliper held in a special bench stand.

In the machining of work efficiency can be increased when graduated dials are used for accurate determination of the movement of the feed screws and the advance of the cutting tools. A lathe detail and several typical dials are shown in Fig. 4.

INCREASE IN PRODUCTION

According to a statement by the United States Geological Survey, the production of fullers earth in 1920 was 128,487 short tons. This amount represents the largest output ever recorded. The output was 21 per cent. greater than in 1919; it was more than three times as great as in 1913, and nearly nineteen times as great as in 1895, the first year of production. The value in 1920 was 25 per cent. greater than that in 1919, nearly seven times as great as that in 1913, and sixty times as great as that in 1895. The average price per ton in 1920 increased only 4 per cent over that in 1919.

Fuller's earth was produced in eight States in 1920; named in the order of their rank in output they were Florida, Georgia, Texas, Alabama, Nevada, Arkansas, California, and Massachusetts. Promising deposits of fuller's earth have been discovered also in Pennsylvania and Virginia. The Southern States reported 99 per cent of the output, Florida alone reporting about 85 per cent of the total.

The imports of fuller's earth, which for many years constituted the entire source of supply, also increased in quantity and value in 1920. During the war these imports naturally decreased in quantity, and with the cessation of hostilities they just as naturally increased. The imports in 1918 were about 50 per cent. of the maximum (24,977 short tons in 1914); in 1920 they were 77 per cent of the maximum. During the war some refiners of edible oils and fats—by whom the imported fuller's earth is probably used exclusively—were unable to obtain a sufficient supply of foreign earth and were compelled to adapt domestic earth to their needs, and it may be that imports of this material will never again be so essential to the American industry.

The imports of fuller's earth in 1920 were 19,235 short tons, valued at $221,893, or $11.54 a ton. These amounts represent an increase of 39 per cent in quantity and of 17 per cent. in value. The average price at the markets of the country from which the material was imported decreased $2.13 a ton.

ANCHORING SHIFTING SANDS

An experiment will be made by the Ontario Provincial Forester to test whether the shifting sand dunes of Prince Edward county can be anchored by the planting of belts of trees in the sand areas. These sand banks, under the influence of winds from Lake Ontario have been moving inland, covering up fertile lands and rendering them useless. Tree planting has stopped shifting sands in France and other countries, and on the prairies belts of trees keep light soils from drifting. It is expected the plan will prove equally successful in this Ontario county, one of the most fertile in the whole province.

SUBSTITUTE FOR GASOLINE

According to Professor Whitford of the Yale School of Forestry alcohol could be economically manufactured from the moist vegetation of tropical forest and jungles. "The evidence is conclusive," according to him, "that the tropical sun has the power to store up more energy in the form of cellulose in a given time than has the temperate sun. If this is in a utilizable form," he says, "it remains for the ingenuity of man to overcome the difficulties of profitably applying it. With the increasing needs of the nation it is reasonable to expect that sooner or later it will be necessary to utilize more fully the plant resources of the tropics." Professor Whitford said that the annual production of alcohol from the nipa plant in the Phillipines was now nearly 3,000,000 gallons and that one distillery there had produced 93 per cent alcohol at a cost of about 20 cents a gallon, and if operated to full capacity could make it at a cost of 15 cents a gallon.

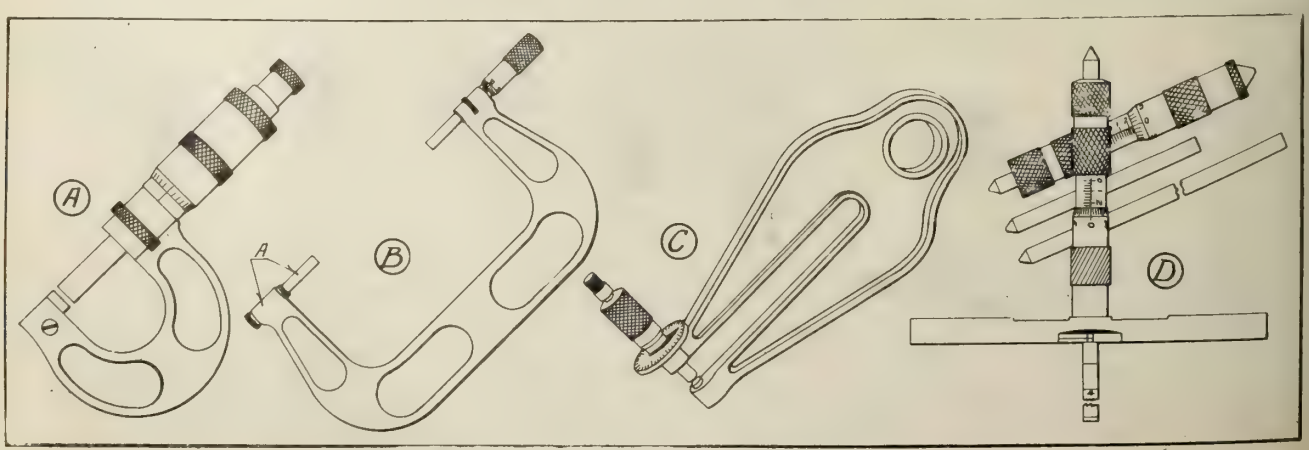


Fig. 1.—Various types of regular micrometers, including depth and inside style.

What Should Apprenticeship Mean to the Trade?

Trade Has Not Kept Pace With Educational Methods—Tendency of Modern Boy is to Avoid Work—Educational Goods Must Be Sold—A Trial Test is Advisable

*By J. E. Goss.

IN using the expression "Modernized Apprenticeships," I do so to differentiate between what, to my mind, apprenticeships would mean and what, unfortunately for the metal trades, they seem to have meant to people in general for the last ten or fifteen years. Too often do we find "old-fashioned" applied to the traditional system for training mechanics, and too often do we feel that the application is rightly made.

The causes of the transition from the old to the new estimation of apprenticeships are mainly four; the failure of the trade itself to keep pace with changes in educational methods and requirements; the false notion that learning can be accomplished intensively; the belief that vocational education in the public schools displaces training on the job, and the tendency of the boys of to-day to seek the less manual kinds of work.

As to the first cause, the trade may be largely, yet not wholly at fault. It is doubtful whether machine shop owners are giving due recognition to the fact that the high school enrollment of this country is increasing at the rate of over a hundred thousand a year, which means that each year many boys are being graduated, each boy with a supposedly better understanding as to what should constitute his trade training. To-day it is as much a matter of the boy choosing his factory as of the factory choosing its apprentice, and I believe that this is as it should be. Especially is the small shop owner at a loss to meet the changed conditions. He might not be able to afford a department, or even an individual solely responsible for the training of his few apprentices, and he may lack the facilities adequate for training apprentices as they must be trained if his apprenticeship system is to stand. Even though both finances and facilities are ample there is still the problem of their best use for the purpose. To-day public educators stand ready to co-operate with the shop, but such technique as they are able to supply will be of a minor importance to the things which the shop itself must do. More than all else is needed the interest of management. Raw stock, equipment, routing, and the rest — even vestibule training and upgrading—seem so much nearer the ultimate object that apprenticeship training is made secondary to them. There is likely to be insufficient interest in a thing seemingly so remote from profits.

The second cause should be charged as much, perhaps more, to others concerned as to shop management. The notion that there are quick and easy ways to learn has taken hold in places where it is most likely to do harm, but we must offer only constructive criticism of this and I am sure that those educators who are guilty of it will try, at least so far as our line of work is concerned, to profit by our suggestions. A short time ago I visited one of the best known technical schools in the country and was told there, by an instructor of long standing, that the institution could make a mechanic, out of raw material, in 150 shop hours. This, of course, is an extreme and ridiculous case, but it is indicative of the trend toward intensifying beyond reason the training for machine shop work. The vestibule school and the upgrading plan, so necessary to bring about certain badly needed results, have been misconstrued as an admission that industry itself had found ways to supplant apprenticeships. It seems to me that we might as well look for short cuts to experience as for short cuts to the learning of trades, for is not experience a major factor in a sound and thorough knowledge of craftmanship?

School Does Not Displace Training on the Job

As for the belief that the school displaces training on the job, there may be some shop men who have hoped that the trade school would solve their problem, but it is a question whether this has affected apprenticeships to any great extent. However, this belief on the part of educators, parents, and prospective mechanics, has had, and is having, its effect. It is not my purpose to argue against any movement tending toward a more practical curriculum in the schools. It must be said of the schools that they are making an earnest effort to turn out a more usable product, but there are still some people, at the risk of being classed as ultra-conservative, who believe that considerable effort is being scattered on various shop exercises at a time when it should be concentrated for a better understanding of the fundamentals. Even if the trade school should, in time, become a more or less satisfactory substitute for an apprenticeship system it would save no time for the apprentice. There might be some saving in time and expense for the shop, but I doubt whether the job would be as well done.

Tendency of Modern Boy

The fourth cause of the present day condition of apprenticeship—the tendency of boys to seek the less manual kinds of work—may be laid to many things. For one thing, each year more boys are completing the secondary schools and colleges, and it is quite natural that they should expect a certain prestige, allowing them to evade shop training and at once start upon the ascension of leadership. For another thing, there may appear to be—judging from some of the best national advertising copy of our day—ways in which young men may become mechanics, foremen, draftsmen, engineers, production managers, and so on, simply through part-time study. I have great regard for such study, but only as supplemental to actual experience. Then there has always been the idea that office work, physically nearer the head places, has its advantages over the shop. It seems to me that this Association is uniquely fitted to educate the people to an appreciation of the wide scope of the machinery industry and of the opportunities offered men who know shop processes through first-hand contact with them. I have faith in the stability of the boys and I believe that, with the return of normal business conditions and the "survival of the fittest" again holding good, this cause will be less marked than it has been for the past few years.

A diagnosis of our apprenticeship sickness is, of course, the first step toward the getting-well process, but it is the timely and careful administering of remedies that will count most in bringing back our apprenticeship system to a sound and healthful state. From all sides we hear that apprenticeship is dead, but those who say this either don't know what they are talking about or else they have dealt it what they thought was a death blow and left it before it began to revive. It's the doctor, not the coroner, who is needed.

The Brown & Sharpe System

Many of the shop men who visit Brown & Sharpe in the interest of apprenticeship training tell us that it would be impossible to pattern their apprenticeships after ours because of comparatively limited facilities and product, and it must be admitted that certain problems present themselves to the owners of the smaller shops. There may be some who ought not to attempt apprenticeship training at all. To my mind it is better to give it up entirely than to do it in a way that will bring little result to the shop itself and at the same time lessen the confidence of prospective mechanics and their advisers in this system of teaching a trade. But some of the most important phases of apprenticeship work are just the ones that can

*Mr. Goss, who is supervisor of apprentices for the Brown & Sharpe Co., presented this matter before the recent convention of the National Metal Trades Association.

be applied to most any shop large enough to need apprentices.

By briefly describing the Brown & Sharpe system I can, perhaps, best point out a few of the things practicable of broad application. In the first place, we recognize the fact that the propaganda of dead apprenticeships must be met with proof that apprenticeship training in some places is very much alive. Missionary work, for want of a better name, is what we might call the preliminaries to our plan. This means the publication of booklets and folders, and their distribution among people most likely to be interested in the futures of boys. All this takes time and money but eventually it shows as an asset and we have found it well worth the patience and tangible outlay. If we are to maintain a system in whi the management takes pride these things must be done—there is no choice in the matter. We would not send our own boys to a dead school, a school in which we thought educators had no more interest, in which was an untrained faculty, commissioned with something of greater importance than teaching and whose subjects might be learned in one quarter of the required time.

Educational "Goods" Must be "Sold"

Just as we meet sales competition so must we meet educational competition. We must tell people about our educational goods, more because they think that we have stopped making them. As our competitors increase in numbers and efficiency we must improve our production methods, proving by our finished product that our ways are good and that our material is the kind the management is willing to pay for. About a year ago we told the Cape Cod boys what we might do for those of them who had mechanical inclinations. It was ten months before we received an inquiry, but it will not be long before boys from the Cape will be coming to us, and what better could the grandsons of seafaring men turn to than the building of machinery? We go after good material because we want to make something out of it that we could not make out of inferior stock. If our object were to exploit a boy for four years and then put him at a job alongside another who learned the kinks in four weeks we might rely on the chance applicant from the street, but it is the backbone of our organization that we have in mind when we enter into correspondence with a farmer's boy in New Hampshire or a high school senior down on the Cape.

In line with our policy of getting good stock a dormitory for apprentices was opened nearly a year ago. It has been in existence long enough so that we know it is serving its purpose and has been successful enough, both financially and otherwise, to warrant tentative consideration of expansion. In addition to attracting boys who are used to good, wholesome homes, it is functioning as a builder of apprentice morale. Many of the associations formed at the house are sure to develop an esprit de corps which will strengthen as time goes on.

When a good product presents himself it is well to be able to show him proof of statements as to the value of apprenticeship training. Simply to tell him that nearly every executive in the organization was once an apprentice might be enough, but to walk through the engineering department and the shops and point out to him the leaders, men who once started just as he may start, means a great deal more. This is something which will take time for a shop just starting an apprenticeship system to do, but if boys are trained to hold the bigger jobs and then are consistently advanced to them it will not be long before this effective means can be used to secure the boy who shows discrimination in selecting his school. It also is well to have the prospective apprentice see with what care his records will be kept, so that he will understand that his placement as a journeyman will not depend on memory or the whim of some individual, but upon his own efforts during his apprenticeship. We like to show parents, at first hand, what we would try to do for their boy. If the home works with the shop the job is easier and better done; besides, enthusiastic fathers and mothers advertise us very effectively.

The Trial Term

Every boy comes to us on three months' trial, for, while careful selection saves time and turnover, the real test must be made on the job. It is important that this trial be given under foremen who appreciate a beginner's difficulties. Some of the best foremen on the more advanced work may be unsuited for the job of helping select the right boys, mostly because they have been used to handling apprentices well along in their courses and have lost the faculty of seeing possibilities in the face of certain shortcomings. About on quarter of the boys we take for trial are rejected during or at the end of the trial term and there have been very few boys who have disagreed with us that they were unfitted for the chosen trade. To bring about mutual satisfaction a careful report, on a printed form, is made by the foreman, shop instructor, class instructor, timekeepers' office, works superintendent and supervisor of apprentices. This is not red tape; it is what is due both the company and the boy if both are to act intelligently about entering upon further obligations.

Apprenticeship Served in Production Dept.

All the apprenticeship time is spent right in our production departments. There are some good things to be said of the segregation plan, but an experience of more than seventy years is the foundation of our judgement as to which method is the better, at least for our own purpose. To be workable the plan calls for sympathetic foremen, trained shop instructors and co-operative spirit, and without any one of these it is likely to fail. It is the feasibility of this method that is most questioned by people who visit us in the interests of apprenticeship training, perhaps because it seems like holding too closely to the old fashioned way. Time does not permit going into the reasons for our doing this, but a summation might be that we find the basic principles of the old fashioned system still sound and worthy of modernizing. This method calls for the service of shop instructors of a high order; men not only competent in their respective trades but men with tact, judgment, patience and ability to handle men as well as boys. Such men can seldom be found, even in a high grade labor market. Usually they must be selected for their workmanship and experience and for any other desirable qualities that may be apparent and then trained to do the instructing as best suits the requirements of the system.

Regular Schedule of Operations Followed

A regular schedule of operations is followed by every boy. From the lathes to the drilling machines, to the milling machines and so on throughout the course each machinist's apprentice is routed by the apprentice department. From helping to floor work, to bench work and so on thoughout his course each moulder's apprentice is likewise routed. With the boy there goes to the foreman a job analysis card, to be checked off as the steps of the work are taught, and to be returned to the apprentice department when the boy leaves, for comparison with a duplicate card checked by a shop instructor. With this is returned a printed form bearing the foreman's estimate of the boy's industry, department, workmanship and mechanical judgement, marks which are transferred to the boy's history card for a permanent record.

You may have noted that the boys are routed by the apprentice department. To my mind, the first and most important step to be taken in organizing effective apprenticeship work is to completely centralize authority and responsibility for results. There can be found today but two places in which foremen must get the permission of the apprentice department before doing anything more than teach their part of the trade. It should not be expected of a foreman primarily commissioned with the making of goods, that he will give equal attention to both production and instruction If time, or any other factor, necessitate the sacrifice of one of these responsibilities, even temporarily, instruction wil be given a second place. Occasionally w find a foreman who might carry on bot jobs fairly well, but in a shop larg enough to need apprentices it is likel that comparatively few such men wi be found. Where the work is not cer tralized it is often the case that the be ter boy gets the poorer chance to lear the trade. The foreman soon know whether or not an apprentice is going t be a real help to him in turning out

good job on time. Especially if a large rush order is in process and the boy has become familiar with the work there is reason to believe that he will become solely a producer, even though we may seek to ease our consciences by the claim that there is always something to be learned. Assuming that a foreman is a hundred per cent efficient, insofar as the apprentice while in his own department is concerned, when he thinks it time for the boy to go on the next man may be short of work to think otherwise. We all have our shop standards for production, for fire prevention, for safety, for cost keeping, then why have special departmental standards for apprenticeships? It should be understood, of course, that the foreman cannot be left out of the reckoning. He is important to the extent that he, as a group, can either make or break the system. In the shop where he and his predecessors have had full authority over the boy it is going to take a little time and considerable tactful handling to bring about a centralized plan, but it has been done in the matter of employment, the taking away of whose additional authorities must have hit harder than would those connected with apprenticeship work.

Executives Must be Educated

No matter what the organization, the management and department executives must be educated before a start is made on the boys. Some times management has a notion that a school, to teach shop mathematics and drawing, largely fulfils its obligation to the apprentice. In other words, all the thought is put into four hours out of the forty-eight or fifty that the boy spends in the plant each week. No doubt the shop school is a significant institution. Its establishment by many concerns, heretofore expecting their apprentices to continue their schooling in public night classes, has been a marked advance toward what seems to me should be our aim. As for Brown & Sharpe school work only shop mathematics and drawing are included in the regular program. Such subjects as chemistry and metallurgy are not included because we have found that the others, so essential to the shop man, take all the school time, if taught thoroughly. In addition to our regular school work, however, we have a lively library—fiction for the boy who must cultivate the reading habit and the best technical books that we can find for the others. Just now, out of 201 apprentices, there are 85 regular users of the library. A feature of the library is the training to the boys of literature pertaining to the different jobs on which they work. For example, as an apprentice is scheduled for assembling and erecting grinding machines he receives several booklets on the use and construction of these machines. As he goes to the grinding job he keeps these pamphlets and receives in addition pamphlets on the selection and safety of wheels. Questions put to him by one of the shop instructors show whether or not the pamphlets are being studied. In our lecture room the boys listen to and discuss illustrated talks on gear cutting, grinding, lubrication, purchasing, routing and the like, most of which are prepared and given by our own foremen.

A few weeks ago a committee on education, visiting our apprentice department, were surprised to learn how few of our indentured apprentices break their agreements. The only reason I can think of is, that we are giving them something that is worth while staying for. Certainly it is not because of any fear of prosecution under the apprenticeship law. If we find that a boy is the kind that honors the contract only long enough to suit his own requirements we prefer to get rid of him, the sooner the better, not only for the company, but for other boys who might be unduly influenced. Problem of keeping apprentices to their agreement works out something like this. We want a boy with a mind capable of grasping a big and important trade. Such a mind can discriminate between exploitation and a good course. If a good course is not given the mind will so discriminate and will then consider and act upon opportunities elsewhere, and another broken contract will result. We have found that boys who pass muster on the trial term are quite certain to like their work and to want to stick to it.

Placing the Man After Apprenticeship is Served

One of the most important phases of apprenticeship work, from both a practical and a physiological point of view, is the placement of a man at the finish of his apprenticeship. If we keep in mind the reason why we took the apprentice in the beginning we will take pains to see that our aim is accomplished. All that is done in connection with apprenticeship work will help to do this, but it may be well to note some of the phases of our system which directly aid in a fairly intelligent disposition of the new journeyman. Records as to industry, deportment, workmanship, mechanical judgment, attendance, class work, piece work, use of books and outside study, enable us to do more than generalize to the foreman with whom we think the graduate would be best placed. Especially at a time when new men are not being hired unless they are able to qualify under a high standard we must not expect a foreman to register a graduate unless we can show exactly what kind of a man we are asking him to take. Almost always, when an apprentice is being considered for work at a journeyman's wage, the foreman analyzes the history card. To know what twenty or more other men have thought of the boy will help to form a judgment of him. In addition to the records the course is planned so that any senior apprentice who has a definite idea as to what he wants to do may be given a three months trial at the work. This enables the foreman either to rate his new journeyman fairly or to advise us as to why the man should not be kept at his choice of jobs. Our interview system is also a factor in placement. Periodically during his course each apprentice is called to the office of an executive for an exchange of views. The interviewers make a typewritten report to the apprentice department, each executive reading the accumulative reports before calling for the boy. At first glance this may look like a cumbersome arrangement, but a little card file and a group of men with a real interest in apprentices do the job smoothly and effectively. A mutual acquaintance and the boy's knowledge of our particular work, as well as a general machine shop practice, should make careful placement a prominent feature of the whole program.

In connection with the subject of placement it might be well to express a belief which I hold regarding the number of boys accepted for training. It has always seemed to me that a shop should not take more boys than it can properly absorb upon graduation, adding, of course, a certain percentage which will go elsewhere anyway. True, boys come to us to learn a trade and not necessarily to remain in our organization, but they ought to want to stay with us and it is well to be able to keep the men who feel this way about it, and who have been tried and found valuable.

The smaller shop can do many of these things perhaps better than a larger shop can do them. For example, any manager employing only a few apprentices could call a boy to his office, even once every six months, and have the boy go out feeling that he was a real partner in a scheme to build up the business. In most cases the talk would not be one-sided; there would be something for the manager, as well as the boy, to learn.

The Brown & Sharpe system does not set itself up as an example to be universally followed. There has been found no one best way to do the training job. What some one else is doing might be copied to much better advantage. I hope, though, that I have made it clear that we find much beside instruction technique that must be put into an apprenticeship system to bring it on a plane with our other system for doing business.

SWEEPING THE SEAS

It is certain that the world at large does not realize what an enormous and difficult task it was to clear the seas of mines after the conclusion of the war. Round th British coasts 73,000 mines had been laid as a submarine barrier; and that area represented no more than a fraction of the total where mines had been sown freely. The British forces engaged in this work of clearance have swept an area about equal to the whole of England and Wales; the work was done thoroughly, but with so much scientific care for the men employed that the loss of life has been less than one per cent of the number of hands engaged.



WHAT OUR READERS THINK AND DO



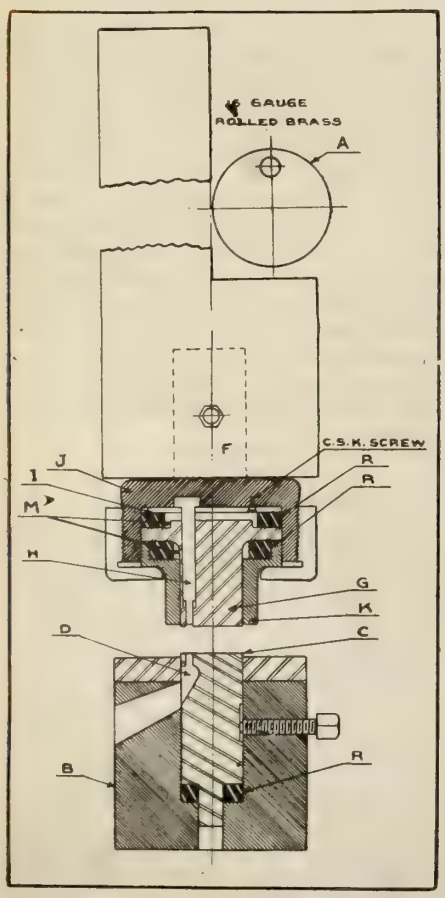
EMERGENCY JOB IN MACHINE SHOP

By T. WILLIAMS

Having a call for a number of pieces as shown in Fig. A, to be used as tool checks, I decided to make them although we were not equipped for press work. The sketch shows the part full size. The large slotter being idle, was to be used as the press, and the following description will prove interesting as the piece was to be blanked and punched in one operation.

No special castings or forgings were required, all the material being around the shop. The die holder B is a piece of cast iron machined top and bottom and dovetailed for the die, a piece of tool steel. Two side holes were drilled for clamping purposes. The block was next put in the lathe and the die and block bored to the outside diameter of the blank to the depth of shoulder shown in the section which holds the combined inner die and stripper C. The small hole was then bored for emergency use. R shows hard rubber compression rings. Die C, is a piece of tool steel turned to fit the die B, then bored and end milled as shown at D, for the small punch, and for slugs to pass out through slot end milled in front of block as shown at B. On the opposite side of C, a slot is cut for setscrew point to prevent the die from turning, but free to move vertically.

The blanking and piercing punch is shown in section Fig. F. G is the blanking punch, H the punch for the hole in the blank which is held in place in holder J, with plate I, which is secured in position with three countersunk screws, K is the stripper and also holds the stock flat while blanking. Large punch G, is stripper for small punch H, M is space for compression. The assembled punch is held in the upper punch holder shown at O, by a set screw, and in turn is secured to the slotter in the usual way with the projection underneath the ram to transmit the pressure.



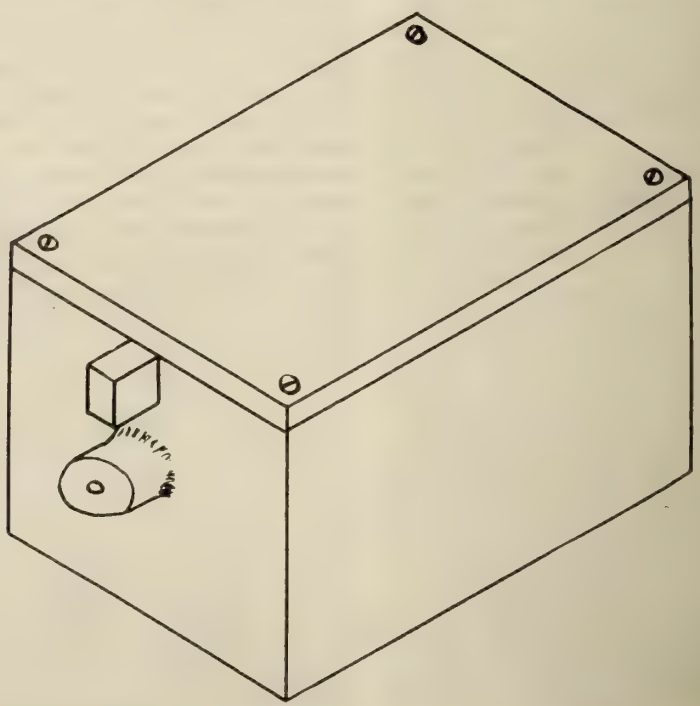
Showing the tool check die.

TUMBLING BARREL FOR LATHE

By D. A. H.

The drawing shows a tumbling barrel for the lathe—a piece of equipment not usually found in the machine shop but one that is extremely useful in general manufacturing. The "barrel" is nothing more than a cast iron box, 8 ins. square by 12 ins. long, with walls ⅜ inch thick. The simplest kind of pattern answers for the foundry and, if the sides are given a little flare, it lifts out of the sand very easily in spite of its depth. Short hubs are cast on each end and on one end there is located a rectangular lug at a proper distance to engage the face plate slot and thus drive the box. Centers are countersunk in each hub and on these the box revolves. A cover of the same thickness completes the box.

Tumbling is associated in most minds with the foundry—a rough process for rough work, accompanied by lots of noise and dust. Then there is the refinement in the ball burnishing tumbling process used for very nice work in some manufacturing lines. Between these two extremes, there are the occasional jobs which every shop has that could best be done in this way if they had equipment for them—a few delicate castings that would be broken if put in the foundry barrel but which can be cleaned as well in no other way—a batch of stampings which need tumbling to remove the sharpness of the corners; a thousand round nuts from the automatic which require just a suspicion of burring; a bunch of small milled parts to be tumbled in sawdust to dry and brighten them thoroughly all over.



A rough sketch of the Tumbling barrel.



Heating The Storeroom

A PECULIAR case of improvement in heating is told by a writer in the Dodge Idea. He states that the workmen of a certain firm were complaining about the storeroom not being warm enough. Investigation showed ample radiating surface and that the heating system was working as well as could be expected of it. However, the men kept complaining about it being cold in the passage ways between the shelves, which extended up to the ceiling. In the open places it was comfortable.

It was decided that the fault lay in the solid partitions. As a remedy it was suggested that they remove the solid partition and substitute expanded sheet metal which would allow a freer circulation of air. After the change was made there were no more complaints about a cold store room.

* * * * *

Putting Waste Vapor to Work

THE method employed to increase the capacity of a heating plant for a paper mill was described recently by W. H. Howell, Jr., before the technical association of the pulp and paper industry. The capacity in this particular case was increased by the proper utilization of waste vapor and Mr. Howell stated the usual practice has been to heat fresh air from outdoors by carrying it over steam coils, blowing it into the room and taking out the moisture from the driers, either by having openings in the roof or with exhaust fans. This system has been quite highly developed and gives satisfaction provided it is properly installed.

At the mill referred to, this old system was in use, but as the production was increased about 100 per cent. it was found to be inadequate. It was then arranged to ventilate the machine room with two fans. One exhaust fan is used for pulling moist air out of the machine hood to the economizer and a supply fan distributes the warm air to various points in the room. The hot outgoing air and the fresh cold air crisscross each other in the economizer without actual contact except through corrugated plates. The object of the corrugated plates is to enable the closest possible contact for transmission of heat from hot moist air to the cold fresh air, at the same time separating the moist air from the dry air. Both fans are belt-connected to a single 20-horsepower constant-speed electric motor.

In average winter weather (34° Fahr.) the economizer is able to raise the outdoor air to 107° Fahr. for distribution in the machine room in quantity sufficient for all ventilating purposes and without the use of any steam whatsoever. This result is accomplished solely by utilizing the waste vapor going out of the machine hood and still leaving a large quantity of vapor available for other heating purposes.

It was found that 107° was too warm for the comfort of the operators, and a certain amount of moist air was consequently allowed to escape into the atmosphere without passing through the economizer, so as to bring the air temperature supplied to the room down to 98° or 100°.

Mr. Howell stated that, so far as he knows, this is the first practical use of the idea on a large scale for heating and ventilating a machine room without the use of steam from the boiler plant. By its means first-class ventilation conditions are assured in a place that formerly presented a very difficult and expensive operating condition. Of course the intention is also to use such waste heat in some cases to assist drying operation in the summer.

Selecting Proper Lubricant

"IN deciding upon the proper lubricant many factors enter in of which the average engineer has but very meagre knowledge. Oil for one purpose must have certain qualities and must undergo a certain test. This same test for an oil of different character may be absolutely useless as far as proving anything goes. It does, then, become especially desirous to arrive at some standard way of testing oil.

"The governing feature in choosing the proper lubricant," continues W. J. Bitterlich in a recent issue of Factory, "is its film-forming properties under different load conditions. In general, the lighter the oil that forms the proper film for the load pressure, the lower the friction will be.

"The simplest test of all is with the thermometer. The higher temperature of the oil in the bearing shows the greater friction loss. This, of course, necessitates experimenting with at least 1,000 or more different oils in every bearing in the plant, which is rather out of the question for many concerns. However, in this particular plant, where the oil bill amounts to $10,000 or more a year, this method shows substantial saving in power consumption and maintenance.

"The question of light and heavy oils may be settled by noting the amount of waste through stuffing boxes and felt washers. Too light an oil will leak excessively. If an oil is exceedingly heavy, however, too much power will be required to start the machinery when the oil is cold."

These two simple tests will prove good guides for the layman in the selecting of proper oils.

* * * * *

Managing An Inspection Department

"IN at least two ways the management of an inspection department differs from the management of a production department. The working force is widely scattered and the work usually varied" continues a writer in a recent technical journal, "so that coordination is difficult; the pay of inspectors is nearly always low in proportion to their responsibility, which means that it is difficult to attract and keep the right kind of workers for inspectors."

Conferences between the chief inspector and his superintendents and foremen, binders for each member of the inspection department in which to keep the proper bulletins and instructions, and the development of the spirit among the members of the department to make their work most effective, are, without any question, three important ways of getting better coordination from the inspection department.

The nature of the work of inspectors makes it difficult to pay on any except day rates, and it frequently occurs that machinists on piece rates earn more than the men who inspect their work, and this naturally causes discontent. A definite rate of promotion with grade rates of pay based upon length of service, in combination with efficient work, is one of the best ways of avoiding continual requests for wage increases and general discontent among inspectors.

Foremen inspectors often request insistently that more and better inspectors be supplied, under the impression that the larger the number of men working the larger and better will be the output. This argument can be successfully met by showing that while this is true up to a certain point, beyond that point the more men present the more congested conditions will be and the less total work that can be accomplished. Rather than more men, it is a matter of increasing the efficiency of the allowable force.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Three contestants had correct lists for the August 25th contest, these being John M. Campbell, Thessalon, Ont.; Ernest V. Bell Fredericton, N.S.; and George Land, Peterboro, Ont. They were drawn in order mentioned so that Mr. Campbell gets the scale this week. Better luck next time Mr. Bell and Mr. Land, but the rule is the first drawn gets the prize. The winning lists are laid face down, and a total stranger, who knows nothing about the names on the papers, draws them out in rotation. We thus eliminate distances and make it fair to all.

CONTEST FOR SEPTEMBER 15TH ISSUE.

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something to keep a watch on.
2—A machine that will work faster and better per minute.
3—Can be used in both war and peace times.
4—The difference between two arts.
5—Something adopted in America and Europe.
6—A field where things are cheerfully furnished.
7—Something where the body, glands and even a bonnet are made of brass.
8—Has an eccentric relief but does not chatter.
9—An advantage for unskilled help.
10—A product with an open hearth.
11—His bread and butter depend upon it.
12—A chamber for refining.

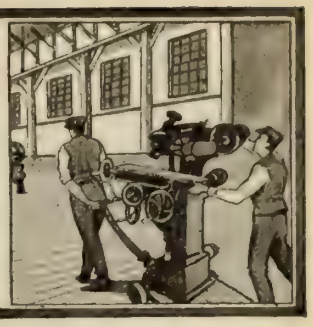
These are Correct Answers for List from August 25th Issue.

1—John Bertram & Sons.
2—Nicholson File Co.
3—Gisholt Machine Co.
4—Dalton Mfg. Co.
5—American Pulley Co.
6—J. T. Hepburn, Ltd.
7—Carlyle Johnson Machine Co.
8—Cleveland Pneumatic Tool Co. of Canada.
9—H. H. Robertson Co.
10—L. S. Starret Co.
11—Roelofson Machine & Tool Co.
12—The Shore Instrument Co.

Closing Date for This Contest is October 6th



DEVELOPMENTS IN SHOP EQUIPMENT



HEAVY DUTY GRINDER

The Van Dorn Electric Tool Co. Cleveland, Ohio, have perfected and put on the market an improved heavy duty ball bearing electric grinder driven by a 4 horse power motor. Two 14 inch diameter by 2½ inch face grinding wheels, slip direct on the ends of the motor shaft, so that the full power of the motor is used for work. The wheels are quickly changed by removing four bolts and the end flanges from the heavy non-movable wheel housings, these in turn furnishing ample protection from bursting wheels. Provision is made on the wheel guards for connecting to the exhaust ducts when desired; besides a lug with a hole permits the attaching of an eye shield on each guard.

The tool rest is conveniently located with both horizontal and vertical adjustments; and the aluminum water pot, which is easily lifted out of place, sets in the proper position to be reached by a short movement of the arm. A Van Dorn built polyphase induction motor, designed especially for this grinder, embodying all the features necessary for heavy duty grinding operations, furnishes ample power for both wheels. It is insulated, tested and rated by A. I. E. E. standards. The rating is 4 Horse Power for normal continuous operation and 7 Horse Power for a momentary overload capacity. The standard motors operate on 3 phase, 60 cycle alternating current, with either 220 or 440 volts. Special windings such as 2 phase, 60 cycles, or 3 phase, 50 cycles, with either of the given voltages, are only made on special order. The speed of the 60 cycle motor is 1,200 R. P. M. and for the 50 cycles it is increased to 1,500 R. P. M.

Another feature is the completely enclosed, dust proof, motor housing, smaller in diameter than the grinding wheels, so that ample movement of the operators hands are possible without touching the machine and also preventing interference when grinding long pieces. A fan within the motor furnishes positive ventilation under all normal conditions; but where excessive dust is encountered, provision is made for piping a supply of fresh air to the intake end of the housing. To insure accurate operation, a minimum amount of friction, and decreased power consumption; the motor shaft is set in extra large ball bearings that are rigidly supported directly beneath by the housings which are continued down to the pedestal top where they are bolted. Lubrication is accomplished by inserting the grease-gun nozzle in the grease ports located directly above the bearings.

The pedestal is built heavy and rigid to prevent vibration; at the same time it serves as a safe and easily accessible enclosure for the switch, fuses, and connections. The cable conduit enters through a hole in the back, so that no wires or electrical appliances are exposed at any point on the machine. This grinder is started or stopped by a pedal switch located at the base of the pedestal. The center of the spindle is 39 inches from the floor. Grinding wheels are set 25 inches apart thereby permitting two operators to work without interference. A floor space of 22¼ inches by 24 inches is covered by the base. The net weight of the grinder is 696 pounds.

DRAW-IN CHUCK ADAPTER

The Phoenix Tool Company of Bridgeport, Conn., are now manufacturing a self-contained adapter that can be applied to any engine lathe or milling machine for the use of draw-in collet chucks without the use of a draw-in bar or the need of a hollow spindle. The operation is by means of a knurled nut on a piece at the forward end of the adapter. These adapters may be furnished to take any standard spring collet. The shanks are made to fit any taper or adapters may be secured unturned so that purchaser can adapt it to any machine desired.

ROTARY WIRE BRUSH

The Independent Pneumatic Tool Company, of Chicago, Ill., has developed a rotary wire brush that can be used on either their electric or pneumatic portable tools. The brush for the former is smaller than that used on the electric machine, owing to the greater speed of the latter. The brush is so constructed that the wire may be replaced when worn out without destroying the holder. The device is particularly adapted to the removal of paint, rust, scale, etc., from the bodies of steel cars, automobiles, castings and sheet metal.

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AND MANUFACTURING NEWS

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A Step In The Right Direction

THE most important step which has been made by the Toronto Fair directors within the last ten years occurred last week. This was the calling together of the various representatives of the machine and tool engineering trades, to discuss the advisability of erecting a new machinery hall. The result of this meeting, which will be the first of many, is reported elsewhere in the present issue.

It has been recognized for some years past that the machinery building at present in use is obsolete. Apart from the fact that it is out of the beaten path, the building itself is far from suited for the exhibition of machinery, especially of the heavier variety. There are no lifting facilities whatever, so that anyone showing heavy machinery has to lug it by brute force to the desired position, providing it does not go through the floor in the meantime. It has been in this condition for some time past, but in view of the earnest effort which the directors of the fair are making to erect a suitable building let us look forward rather than backward.

The machinery show this year is far superior to any other previous year. Mr. Murray, who has had charge of this building for many years says so himself, and he ought to know, for he is a keen judge of merit. If this holds true with an old building, what can we not accomplish with a new modern structure. Canadian machine tool builders, and makers of other engineering and electrical lines have nothing to be ashamed of in the design and workmanship of their products. Rather, there is real cause for pride, and it is up to every manufacturer to get behind this movement. Let us show the directors we mean business, so that they will erect a hall large enough to house not only machine tools but all lines of the engineering trade. Electrical, Steam, Mining, Moulding, Printing, Pulp and Paper, in fact all lines of machinery should be represented. We cannot make the scope too wide. Let us do away with the term "Machinery Hall," calling the new edifice "General Engineering Building" or something of that nature.

Each manufacturer should decide what space he desires, submit this to the chairman of the investigation committee appointed, when they in turn can have a tentative plan drawn up, submitting this both to the directors and manufacurers. Even in the event of such a plan being prepared, provision should be made for extension, so that those concerns who may be timid about coming in at present, can do so at a later date. Not that there is anything to cause the slightest hesitation, for Canada has a wonderful future, but there is always an element existent that wants the other fellow to take a chance. There is no chance in a venture of this kind. The manufacturer who stays out of the new hall is simply losing a wonderful opportunity to show people what he is accomplishing.

Next in importance to the building itself comes the question of location. This point should be watched carefully for to get the greatest benefit of such a structure, it should be convenient to the public, yet handy to the railroad tracks. It is quite posible that suitable tracks can be laid from the main line. which can run directly through the new building. If this is done, so much the better.

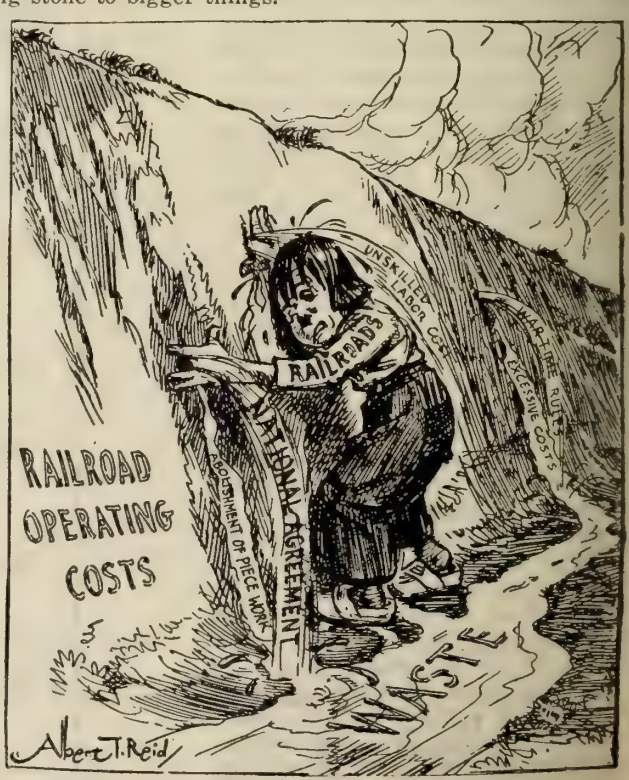
The gentlemen who asembled last week to discuss the erecting of this building are to be congratulated upon their choice of a committee. It is a well balanced one, and the moral support of both the Electrical and Mechanical Engineering societies will doubtless be felt before final arangements are completed.

* * * * *

An Opportunity for Young Men

"TELL the young men of your journal that there is a wonderful opportunity at their very hand." Thus spoke a well known business man to Canadian Machinery a few days ago. On investigation we found he was referring to the possibilities of stenography for young men. Personally, he said, he was sick and tired of girls whose chief aim and object was dress, not business. "Show me the young man who really wishes to be something; let him start as a good stenographer, working up gradually," he continued, "and I'll make a success of him."

Come to think of it, and what do we find? That many men occupying president's chairs at the present time were formerly humble pounders of the typewriter keys. This thought would be well to bear in mind for provided a young man is serious in his intentions, the art of stenography is actually a stepping stone to bigger things.



Trying to save the dyke, as Reid of New York World, sees it.



MARKET DEVELOPMENTS



Steel Production Shows Considerable Increase

In Six Weeks the Production of Steel Has Increased Over One-Half—Price Increases Are Announced in Wire Nails—Machine Tools Are Moving Slowly—Scrap Market is Very Dull

THE market shows a few increases this week, these coming into effect September 12th. Wire, and wire nails are the products which have been boosted in price. The advance came as a surprise to those who had not realized that steel prices in general were very near rock bottom.

Steel production shows considerable improvement, having increased by a little more than half, during the past six weeks. The stiffening in pig iron prices is regarded as representing a movement up towards actual cost, as some furnaces have been selling stocks at below cost, in anticipation of lower freight rates coming into effect. The freight reductions have not come, while on the other hand, the stocks of many furnaces are gone.

The railways seem to be hanging off as long as possible. They are purchasing only what they actually require.

The small tool market marks time. We cannot report an increase, nor can we say the situation is poor, for it's not. The various dealers say they cannot complain considering the circumstances.

Machine tools are rather easy this week. Last months big business was really the closing up of various deals which had been hanging in the balance for some time. Dealers however are not discouraged. They say that the confidence existent, speaks well for the future. The scrap market refuses to wake up. Nobody seems to want to buy, and the dealers themselves do not care to stock up further even at prevailing prices.

STEEL PRODUCTON SHOWS INCREASE PRICES ARE BOOSTED IN SOME LINES

Special to CANADIAN MACHINERY.

PITTSBURGH, September 15.—Computations based on the monthly report of the American Iron and Steel Institute show that production of steel ingots in August by all the producers was at the rate of about 15,800,0000 gross tons per annum, or 30 per cent. of capacity, against a rate of about 11,100,000 tons in July, or 21 per cent. of capacity. As production at the middle of July was slightly below the average rate for the month, and production was increasing during August, being at the end of the month above the 30 per cent. shown as the average of the month, the rate of steel production increased by more than one-half in a month and a half. The official statistics furnish ample confirmation of our recent reports of continued improvement in demand upon the steel mills.

Of course the rate of steel production cannot be expected to increase by one-half every six weeks, but it is quite likely to increase some more in the next few weeks, and a rate of about 40 per cent. will probably be attained before the end of the year. More than this can hardly be expected for this year, but in early spring there can easily be a further increase, and in all probability there will be. There is not the slightest ground for thinking the rate of production will ever again go below 20 per cent. as it did in the fore part of July.

The Steel Corporation's unfilled obligations at the end of August are reported at 4,531,926 tons, showing a decrease during August of 268,368 tons, this comparing with decreases of 287,544 tons in July and 364,619 tons in June. The August decrease was equal to 21 per cent. of the month's capacity, there being 27 working days while capacity is taken at about 52,500 tons per working day. Shipments in August may be estimated at 30 per cent. of capacity, and with 21 per cent. decrease in unfilled obligations the new bookings in the month seem to have been 9 per cent. of capacity. For six months past the bookings have been very light, the business filled by the corporation being chiefly by shipments against old contracts. This has caused misunderstanding in some quarters, where a decrease in the "unfilled obligations" is considered a bad thing.

From that viewpoint July would have to be considered a "better" month than March, because in July the unfilled tonnage decreased only 287,544 tons, while in March it decreased 649,102 tons, but the fact is that the shipments in March were correspondingly greater than the shipments in July, and thus March was a much better month. It is the shipments that bring in the money, not the contracts that customers fail to specify against. Some people in Wall Street, however, seem to think otherwise. In these same Wall Street circles there has been complaint lately that "there is no forward buying" as if the mills would like to fill up for a full operation Christmas week no matter how nearly idle they are at present.

A Steel Price Advance

Effective Monday, September 12, the American Steel & Wire Company has advanced its price $2 a net ton on plain wire and $3 on nails and barb wire. The advance has come as a surprise to those who had not realized that steel prices in general were necessarily very near bottom and in some lines were ripe for an advance. The new prices are: Plain wire, 2.60c; galvanized wire, 3.10c; painted barb wire, 3.05c; galvanized barb wire, 3.55c; wire nails, $2.90; cement coated nails, $2.50. The independents are making corresponding advances but as the policy in the wire trade has always been to book customers ahead a little distance before requiring them to pay advances it may be a few days before all the independents have put the advances actually into effect. The reductions to 2.50c on plain wire and $2.75 on nails occurred early in July, and from that time to the advance this week there was practically no shading, the prices being very low indeed by relation to the cost of production.

Outside of wire products, the stiffest line in finished steel products is sheets, which for three weeks past have been at 2.25c for blue annealed, 2.75c for black and 3.75c for galvanized, with no

shading except slight concessions in the southwest, where there is competition between production districts. These sheet prices when made were regarded as altogether too low in relation to cost of production and there is a possibility that there will be a slight advance in the near future.

Bars, shapes and plates, on the other hand, have continued to exhibit a slight sagging tendency in the open market. This is not a decline in the extreme prices, possible on the most desirable business, but is rather a relaxation in the restrictions that make an order particularly desirable. Large orders are no lower than early in August, but small orders are lower, and are nearer the price of large orders. Bars, shapes, and plates may now all be quoted at $1.70. Some business has been going at a little higher, but not a great deal of business, while concessions below this level are small, and are given only on very desirable orders. Late in July the open market, on single carloads, became established at $1.75 for bars and $1.85 for shapes and plates.

Current demand is heaviest from jobbers, particularly in the south and southwest, and is moderate from manufacturing consumers, the smaller manufacturers apparently doing better than the larger, presumably because the latter had the larger stocks. Demand for construction purposes, and from railroads, is very light. By products, sheets show the best demand, and the scale runs down through tubular goods, wire products, tin plate, bars, plates, shapes and rails, the last named showing the lightest demand.

Pig Iron and Coke

The stiffening tendency in pig iron prices, more or less in evidence since the middle of August, is still seen, but price advances are regarded as representing simply a movement up towards cost, furnaces having been willing to sell stocks at below present cost, in anticipation of reduced costs in future by reason of freight rate reductions. The freight reductions, however, do not come while the stocks at many furnaces are gone. Foundry iron at valley furnaces is up 50 cents to $21, furnace, this being the third 50-cent advance.

There have been curious and interesting developments in the Connellsville coke trade. By a series of wage reductions the independents, which means all producers expect the H. C. Frick Coke Company (Steel Corporation) got down to the scale dated July 1. The Frick Company reduced twice, but the second reduction, August 1, left its wages between 10 and 15 per cent. above the independent scale. Then, late in August, W. J. Rainey, Inc., one of the largest independent operators, attempted another reduction, producing strikes and threatening trouble elsewhere. In the past week most of the independents have advanced wages to the Frick level. The coke market has stiffened at least 25 cents. The market for spot is not under $3 25 for furnace and $4.25 for foundry and it is a question whether much can be bought even at those advanced figures.

POINTS IN WEEK'S MARKETING NOTES

Pig iron is up a dollar in Montreal. A fair business only in this line is reported. Scrap metal still remains the black sheep. There is nothing being done and little hope of improvement in the near future.

The railways seem to be hanging off as long as possible, purchasing only what they actually require. Used tools are selling in Montreal, one dealer claiming that he has about three enquiries for re-manufactured tools, against one for new tools.

In Montreal the quotation on bars, rails, and structural shapes are down to about production costs. Structural steel is moving in small quantities, while sheets and tank plates show a little additional activity.

Steel production shows a good increase in the Pittsburgh district. In a month and a half the production has increased a little better than one half.

Plain wire has gone up $2.00 a ton; nails and barbed wire have increased $3.00, and the new prices which came into effect Sept. 12th are as follows:—Plain wire 2.60c.; galvanized wire, 3.10c; painted barb wire, 3.05c.; galvanized barb wire, 3.55c.; wire nails, $2.90; and cement coated nails, $2.50.

Pig iron prices are very much the same as last week, and the recent stiffening in prices is regarded simply as a movement up towards cost, as many had been selling stocks at below cost, in anticipation of reduced freight rates.

The Toronto machine tool market is rather quiet this week, although some good prospects are being brought to the point where business is expected. It looks as if the various firms do not wish to spend their money just at the moment, for in many cases the equipment is badly needed.

The small tool market moves along in steady fashion. Business keeps coming in, but only in small lots, for manufacturers are still hanging on to the buy as you need it policy. The scrap metal market refuses to come to life. Things are very dull, and a quick unveil is not looked for.

TORONTO MARKET REMAINS STEADY

TORONTO, September 15.—While there is nothing startling to report this week, the growing feeling of confidence is, in itself, worth while. Speaking to one machine dealer Canadian Machinery enquired if the present lull in buying could be attributed to firms waiting for still lower prices. "Lower Prices" exclaimed the dealer "what do you mean lower prices."

He then went on to say that in his opinion the lowest possible price had been reached, so far as his particular line was concerned. He pointed out that reductions had already been made which fully covered the drop in the other commodities. "To my mind" he continued "there is not another thing sold on the market which gives back such quick returns as machine tools. When you purchase a machine, you do so in order to increase production. The added work you turn out soon pays for the equipment, and any maintenance you may have in later years is very small in comparison with the profits you make. That is," he concluded "if you purchase high quality tools, and take care of them."

He then quoted two examples to prove his former remarks regarding maintenance. He said that no later than a few days ago he ran across two machines which had been in use over ten years, turning out accurate and heavy work, yet the maintenance on both tools had only been around $25.00.

As far as selling machine tools is concerned, the various dealers interviewed state that while business is being secured it is not quite as large as last month. Several good prospects are being lined up however, and when they decide to spend their money, the size of the orders should be worth while.

The small tool market remains very much the same as last week. We are getting about the same quantity of orders, remarked one dealer, and we expect to do likewise next week. We cannot complain under the circumstances, and while no sudden improvement is looked for, we expect the business to be steady. There is no change in prices, and like last week, our customers are only buying what they actually require.

Scrap Market

Everybody seems to be up in the air regarding the scrap market. How some dealers continue to remain in the business is a mystery to many, for there is absolutely nothing doing. Nobody seems to be anxious to buy, and of course dealers refuse to stock up further. In many cases these stocks are very heavy and any further buying movement would only make a bad situation, worse. Evidently the scrap dealers have a side line which nets them some profit, while they wait until the regular market shows signs of life.

The Steel Market

Structural material is still selling fairly well. The other lines are moving

at a fair rate of speed, in fact the market is passing through a regular seasonable improvement. There has been no change in prices, nor is there likely to be any for some time. As one dealer puts it, prices are pretty near the bottom anyhow, so any changes that will occur will likely be in an upward direction. Such changes will be gradual however, so that the buyer can enter this market with a good feeling of safety.

SHEFFIELD MEN VISIT MONTREAL SECOND HAND TOOLS ARE OFFERED

Special to CANADIAN MACHINERY.

MONTREAL, Sept. 9, 1921—Little change in business circle has been noted in the past week. The slightly better tone in some lines that has been noticed for the past two weeks has been sustained, but still business is far from being normal in most lines of the detail working industries. This week Montreal has entertained some very prominent steel magnates from Sheffield. These men have been in Washington voicing their objections to the new Fordney tariff. They do not make any very startling prophesies of an immediate improvement in the steel industry of Britain. They state that the natural resources of Britain are such that she ought to be able to produce steel cheaper than Germany or the United States owing primarily to the fact that coal and ore are found within a few miles of each other.

In the case of Germany and the United States, a long rail haul is usually inevitable in bring coal to the ore, and then a further rail haul to the seaboard for export. In Britain the coal and iron mines and the seaport are all within a circle of thirty miles. Of course the old problem of labor comes up and if labor is unreasonable why the natural advantages will be offset. At present little or no British steel is being imported into Canada. It is understood that at present the British mills are trying to re-establish their old conditions.

Structural steel is moving a little in small quantities while sheets and tank plates are showing a little additional activity. Pig iron has again stiffened in price but the consumption is very small. Little or nothing is being done in the non-ferrous metals, while the scrap metal market has shown no signs of recovering.

Steel Market

Very little improvement over last week can be reported. The mills are taking a number of small orders and are trying to keep their plants in operation as it would be a very costly matter to allow their various furnaces to stop active operations, then later to blow them in again. Thus the quotations on bars, rails and structural shapes are down to about production costs. A few odd orders for medium heavy plates have been placed in the last week or ten days for tank work. There is also the usual increase in sales of sheets for stove pipe work and for range boilers. This is only a seasonable improvement and in a few weeks the demand will have fallen off again. Bars are very quiet, in fact, no sales of any moment have been reported. In Montreal vicinity there is more or less building in progress and a small demand for structural steel is noted, but the season for building is nearing a close and the business will drop off in the near future.

Machine Tools

The manufacturers of machine tools are still asking war time prices for their product which keeps prospective purchasers out of the market. It would appear that many of these tools have been produced from high priced labor and materials and the manufacturers are hesitating about taking their loss. The purchaser feels that in the near future he can purchase the same machines at a lower price and naturally postpones his purchasing. Then, too, many United States manufacturers of machine tools are using this opportunity to clean house, as it were, and are removing from their factory all surplus equipment and advertising same for sale. In some cases the tools thus placed on the market are in excellent condition and are very modern. A vast amount of machine tools of this variety is being offered, and compared with the prices of new machines they represent excellent value. Machine tool dealers report that they have about three calls for remanufactured and second hand tools, to one inquiry for new tools.

Small Tools and Supplies

Similar conditions to those reported last week exist in this line. All buying is of the small lot variety. The railways are deferring old work that is not absolutely necessary, and in this way have been able to reduce their purchases to a minimum. Other shops are following the same policy. The price lists are not very stable as yet owing to the liquidation of the many large firms that have found themselves to be overstocked.

Prices in non-ferrous metals have remained practically unchanged for the last week with very little business moving. The large cable companies manufacturing electrical cables are operating on short time and only parts of their plants, thus their purchases have decreased to a very small portion of their normal volume. The brass foundries, which in ordinary times, consume a large volume of scrap are practically idle and their demands are for small quantities only.

Pig Iron

The price of pig iron is up one dollar more this week. Orders from the Province of Quebec have been reasonably satisfactory, one firm alone having booked in the last week orders in excess of 600 tons. This is of course, only a nominal amount in the ordinary event, but goes to show that the small and medium sized foundries are operating and doing a fair business. No large orders have been reported as all the large foundries have not been operating for some time past. There is absolutely no call for scrap iron or steel and all the dealers have been forced to look elsewhere for a method of earning a livelihood. No doubt these men will reappear in the business as soon as business in this line improves.

PIG IRON SHOWS DECIDED INCREASE

Same Number of Blast Furnaces That Were in Operation During Month of June

The total output of pig iron and ferro - alloys in Canada during July showed an increase of more than two thousand tons over the production reported by the dominion bureau of statistics for June. Pig iron output remained steady at slightly over fifty-four thousand tons, but the production of the several grades varied considerably from the amounts reported for the preceding month. Of the entire output of pig iron over 90 per cent. was reported as having been made for the further use of the companies producing.

There were no changes during the month in the number of blast furnaces active, the six furnaces reported in blast at the end of June being kept in operation throughout the month. At the close of the month, therefore, six furnaces were active, namely, three at Sault Ste. Marie, one at Hamilton, and two at Sydney.

The output of direct steel castings of all kinds amounted to a total of 1,337 tons during July, a decline of more than 400 tons from the 1764 tons produced in June. Of the 1,337 tons reported, 865 tons were made for sale and 472 tons were used by the producers. The average monthly production for the seven months ending July of the current year was 50,000 tons. Output for the past three months, it will be noted, has been in excess of the average monthly production for this year to date.

J. C. Wilson & Co., Picton, Ont., have moved to Belleville, Ont., and are now to be known as the J. C. Wilson Mfg. Co. They have both a pattern shop and a machine shop. They make grey iron castings and brass castings, and in addition job steel castings. Machine work is often required on steel castings or they are included in order for iron castings or they are maintained a close connection with the steel foundry. The foundry is equipped for heavy floor work rather than for light bench and snap flask work.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago.	30 00
Standard low phos., Philadelphia.	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	2 10
Tank plates, Pittsburgh	2 20
Structural shapes, Pittsburgh	2 20
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 00	17 50
Castings, copper	16 75	18 00
Tin	34 00	39 00
Spelter	7 00	7 50
Lead	6 50	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 88	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 50	$ 9 00
Copper, crucible	11 00	11 00
Copper, heavy	10 50	11 00
Copper wire	11 00	11 00
No. 1 machine composition	9 50	9 75
New brass cuttings	6 00	8 00
Red brass turnings	8 00	8 00
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less.	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	45
Can. carbon cutters, plus	10
Standard drills, all sizes	45
3-fluted drills, plus	10
Jobbers' and letter sizes	45
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	10 to 15 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$6.00	$5.25
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 50	7 00
Can. plates, all bright	7.75	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	8.00	....
Fleur-de-Lis, 28 B. W. G.	7.50	....
Orbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	....
Premier, No. 28. U. S.	8.25	6 75
Premier, 10¾-oz.	7 25	7 15
Ine sheets	11 50	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for E.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	27 00
1¾ in.	29 75	24 00
2 in.	29 25	22 00
2¼ in.	33 00	25 50
2½ in.	44 75	28 00
3 in.	49 25	34 00
3¼ in.	.....	42 50
3½ in.	63 50	37 50
4 in.	85 00	48 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21	Atlas	.19
Peerless	.22	X Empire	.15
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.13½
X L C R	.16½		

Colored

Lion	.13½	Popular	.10½
Standard	.12	Keen	9
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.17	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ....10% Best grades..15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

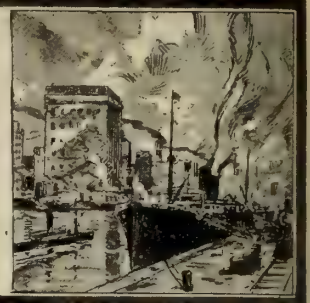
Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



NEW RE-HEATING FURNACE IS NOW IN OPERATION AT SYDNEY STEEL PLANT

THE new reheating furnace at the steel plant in Sydney, N.S. is now in operation. This installation, which cost $125,000 was completed in twelve weeks. Double shifts were used in the construction work, for the furnace was required quickly in order to complete a large rail order.

Before the new furnace was installed blooms from the blooming mill were carried direct on runways to the rolls of the rail mill, and put through while still hot from the open hearth. If anything happened to the rail mill rolls, the supply of blooms had to be stopped. If the stoppage of the rail mill was lengthy, the blooms naturally cooled and had to be laid aside. Moreover, the blooms got through the rail mill rolls at an uneven temperature owing to temporary delays en route.

This condition is now remedied. In between the blooming mill and the rail mill, comes the reheating furnace. Direct connection between the two mills is cut off. Instead of blooms coming straight to the rail mill and going through to the rolls on the heat retained from the open hearth, they are shot into the new furnace, reheated and delivered to the rail mill rolls as needed—every bloom at exactly the same temperature as every other, insuring an absolutely even grade of temper in the finished rails.

The Travels of the Bloom

The glowing red hot bloom is deposited on a steel carriage at the blooming mill and comes rattling down a minature railway line to the reheating furnace.

The furnace leads directly on to the conveyors leading to the rail mill rolls, and the bloom which comes down the track to the front of the furnace has to be deposited inside at the rear.

To effect this a twin set of rails, spaced widely apart, run along the side of the furnace from front to back. The bloom carried up from the blooming mill, is caught by rolls and dragged off the carriage. It is then seized by a pair of automatic clutches and dragged up the rails by the side of the furnace to the rear, where it is again caught by revolving rolls and run across the end of the furnace to a position directly in front of the door. The door is now

(Continued on page 56)

raised and the bloom is pushed inside by means of a mechanical pusher.

Delivering the Bloom

The interior of the furnace is heated by gas supplied directly from the coke ovens and is kept at an even temperature. When a bloom is pushed in at one end, it must traverse the whole length of the furnace before it comes out to the rail mill rolls at the other consequently it is thoroughly heated to the temperature of the furnace.

When the signal is given for the delivery of a bloom to the rail mill conveyor, the bloom rolls out through a heavy fireproof curtain at the lower end of the furnace, is caught by an endless chain conveyor and delivered to the rail mill rolls.

This new furnace will not only speed up the work at the Sydney plant, but will be a more economical proposition.

HUGE SHEAR

Many Features of Interest—Has Blades 30-in. Long, and has Cutting Capacity up to 6½ in. Square

Canada is going to be able to boast about the owning of another huge alligator shear. The new shear, which has been purchased by a well-known Canadian Co. will weigh 221,500 lb. when complete. It will be driven by a 120 h.p. motor, and the knifes in the shear will be 30-in. long with a capacity to cut 6½ inch square, or 4-in. x 24-in. cold soft steel.

The machine will have a cast iron bed, pitman, flywheel, motor base, etc., and cast steel lever, shafts, gears, etc., and all other subject to strain. The flywheel will be 11-ft. in diameter, and will weigh approximately 17,600 lb. The main gearing will have 15-in. face, and a ratio of 1 to 7½. When the flywheel shaft runs at 90 r. p. m. the speed of the shear will be 12 cuts per minute.

This machine contains various features, and it is equipped with a breakable pitman in the rear end of the lever which is so arranged that an overload will break the pin and probably do no further damage. The knifes are supported on cast steel knife seats, this distributing the load and preventing the crushing of the bed and lever. This arrangement also provides removable seats so that the bearing of the knife can be kept in better condition. The Garlock Walker Machinery Co. were instrumental in arranging for this machine to come to Canada, as they sold it on a special order.

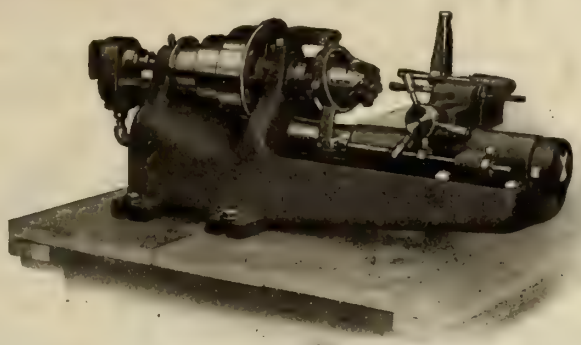
COMMERCE COURSES WILL START SOON

The Queens University, Kingston, Ont., is starting a series of commerce courses for graduate engineers. According to those responsible for this special course, the need for such instruction has been widely felt and frequently expressed. The engineer is more and more called upon to undertake administrative and financial tasks. Native aptitude and painfully acquired experience have enabled many engineers to rise to these opportunities, but even for the exceptional man the way would have been much shorter had the alphabet of business been acquired in advance. For every Engineer some knowledge of business methods and business principles is becoming requisite. For the engineer whose interests and aptitudes fit him for the administrative rather than the technical branches of the profession, such training is particularly essential.

They feel that there is real remand and important field of usefulness for engineering graduates who have received, in addition to a fundamental training in science and engineering, instruction in business methods, business economies and business law. Business has gradually ceased to be a trade and is becoming a science. Employees, while having little difficulty in obtaining the services of men trained along specialized engineering lines, find it hard to secure assistants able to aid them effectively on the administrative side of their business. There is a growing demand for men familiar with the fundamentals of engineering and yet trained in the art and science of business.

The new courses will be open to engineering graduates of any Canadian University. Men with academic training in other fields, or with practical engineering experience, who may desire to take the work, should apply to the Registrar for special consideration of their cases. The University year begins on September 28th, 1921. Advanced students must register on that date. The Christmas vacation extends from December 17 to January 2. Classes close on April 19; examinations begin on Apri

(Continued on page 56)



Geometric Bench Threading Machine

GEO MET RIC

Right in the Lead

With Another World Leader

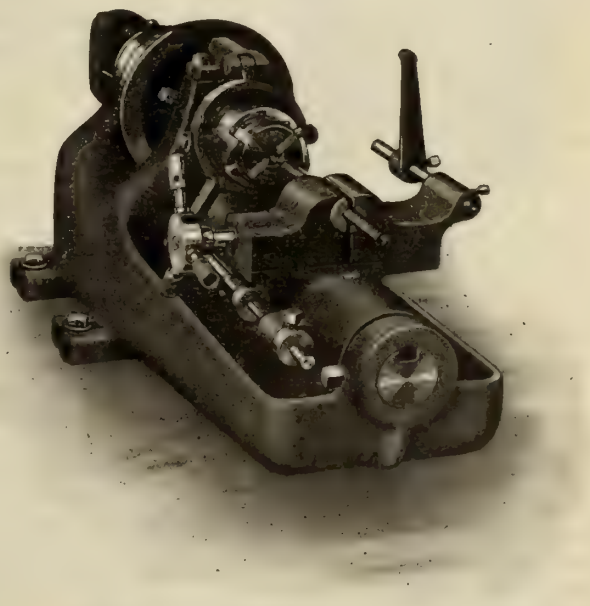
This time it is---

The LITTLE BENCH THREADING MACHINE

The Geometric Bench Threading Machine is a wonder on small threaded work.

It weighs but 90 pounds and takes bench space of only 9½ x 29 inches.

The 5|16″ Geometric Rotary Die Head with which the machine is fitted cuts threads of standard and finer pitch on diameters 1|16″ to 5|16″ inclusive. The machine is arranged for bolting to a bench, or it may be mounted on a separate pedestal for floor use.



Geometric Bench Threading Machine, Front View

Send for Circular giving Complete Description

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal.

The A. R. Williams Machinery Co., Toronto, St. John, N. B., Halifax, N. S., Vancouver, B. C.

New Machinery Hall for the Toronto Exhibition

Should Present Plans Go Through Canadian Manufacturers Will Have a Modern Building In Which To Show Their Products—Such A Structure is Badly Needed

"A NEW Machinery Hall is needed badly at the Toronto Exhibition." Anyone who doubted this fact would have been instantly won over had they attended the meeting held in the board room at the Fair grounds on the evening of Sept. 9th, when several of the directors listened, and spoke to a delegation of machine tool manufacturers, dealers, and firm representatives.

The directors showed themselves in favor of the scheme. In fact they would have encouraged immediate action we feel sure, had that been necessary. Seldom has Canadian Machinery attended a meeting of so many branches of the machine trade that was in such complete harmony. The uppermost thought in everyone's mind was "We want a new Machinery Hall". It must be larger; be located in a better position than the present building, and above all it must be modern in every respect."

Mr. Irving, the director in charge of the meeting started the discussion by presenting briefly what the directors were prepared to do for the various exhibitors. He stated that he had long realised the present edifice was inadequate and he felt sure there would be little difficulty in passing the resolution for a new building through the board. Speaking on the financing of such a new building he said that exhibitors would be asked to sign a ten years lease guaranteeing the officials to occupy, or arrange for sub-letting their booths for that length of time.

Using the new "Pure Food" building as an example Mr. Irving explained that the exhibitors in this building would only pay a sufficient amount to cover the sinking fund and maintenance charges The same condition would hold good in the new machinery hall. Without entering into the figures he quoted, sufficient to say that he expected a charge of about 60 cents per square foot for space would be about right.

He mentioned that the directors were anxious to give exhibitors more value for their money. "I keenly realise" he said "that the present building is out of the beaten path. We even sent a band up the other day to play in front of the hall to attract attention in that direction. As far as I am concerned you cannot proceed too quickly."

At this point he brought in a rather novel and unlooked suggestion. He stated that if possible, the cost of such a new building could be considerably reduced by purchasing a factory building somewhere which was out of use. One of the Polson Iron Works buildings was mentioned, also some others throughout the country. The saving which could be effected was pointed out, not to speak of the speed in erection. The steel and brick work in such a building could be bought at the tonnage rate, torn down and re-erected in short order. Apart from the roof and floor, all other portions could be used.

One point which was brought out very forcibly during the meeting was the need of suitable lifting apparatus. The Polson building under discusion was said to contain one 10 ton, and one 25 ton crane. One member at the meeting suggested that he would like to see a 50 ton crane in place so that the various locomotive concerns could bring several of their engines for exhibition purposes.

The electrical branch of the trade also showed a great willingness to be among those present. It looks as if the term "Machinery Hall" will not be broad enough when the new building is completed for if the present plans go through the following trades, with possible additions will be represented:- Machine Tools of all kinds.

Wood working machinery.
Electrical machinery.
Machine tool supplies.
Electrical accessories.
Printing machinery.
Welding apparatus.
Boiler equipment.
Steam engineering equipment.
Mining machinery.
Mill supplies.

Molding machinery, and in fact every possible branch of the machinery industry.

After considerable planning, a committee was elected to look into the cost of building a new hall, the proper location, etc. Mr. T. A. Hollinrake of the A. R. Williams Co. will be president; Mr. McIntosh of the Canadian Manufacturers Association will be secretary, and the following gentlemen will also act on this very important committee:-W. Inglis of the John Inglis Co., General Engineers, Toronto; Mr. Ferguson of the John Bertram & Sons, Dundas; Mr. Blair of the Alfred Herbert Ltd.; Mr. Robinson of the P.B. Yates Machinery Co. Hamilton; Mr. Hamilton of the D.K. McLaren Co. Montreal and Toronto; Mr. Gaskell of Lancashire Dynamo and Motor Co. Toronto; Mr. Braden of the Canadian Westinghouse Co. Hamilton; Mr. Crowley of Davis Bournonville Co. Toronto; Mr. Waterous of Waterous Engine Works, Brantford; Mr. Alex Goldie of Goldie & McCullough Co. Galt; Mr. Bawden of Bawden Machine Co. Toronto; Mr. Patterson of the printing industry, Mr. Dobson chairman of the American Society of Electrical Engineers, also Mr. Hamilton, chairman of the American Society of Mechanical Engineers. Thus we have practically every branch of the engineering industry represented.

Faith in Canada

What the meeting lacked in the matter of faith was supplied by Mr. Murray who has had charge of the "Machinery Hall" for many years. "We have as good mechanics in this country as any other," he commenced, "and what is more I thoroughly believe that when we have anything to exhibit we should show it to the very best possible advantage." He also pointed out that without "Machinery" we would still be back in the dark ages. "Even the Fair would be impossible without the aid of machinery" he concluded. Mr. Murray struck just the right cord, for when the meeting dispersed to leave the committee alone to discuss their plans, groups of interested men could be seen outside discussing this, the most important move, that has been made for the good of the machinery trade in many moons. Among those present at the meeting were:—A. H. McQueen, Supt. Machinery hall; P. E. Thring, Bond Engineering Works; E. Kinrade, Dominion Belting Co.; J. Kaibs, Pullman Wiper and Waste Co.; W. S. Watson, Wayne Forge and Machine Co.; J. T. Donnolly, P. B. Yates Co.; J. S. Stewart, Canadian Link Belt Co.; C. W. Garner, Cleveland Pneumatic Tool Co.; P. H. Bradley, Elliott Machinery Co.; Mr. Ferguson for Pratt and Whitney and John Bertram Co.; E. F. Roberts, Dominion Steel Products Co.; P. A. Borden, Secretary of A.I.E.E.; Fredrick N. Moody of Powley and Townsley; W. J. Murray of Chapman Ball Bearing Co.; S. L. Montgomery and Mr. Smuck of the Prest-O-Lite Co.; C. W. Leslie, Toronto Battery Service Co.; G. L. Patterson of Miller and Richard; Ed. Logan, Clipper Belt Lacer Co.; W. F. McLaren, and W. S. Hamilton both of the D. K. McLaren Co.; Mr Hathwood, Prest-O-Lite Co.; E. E Clarke of the Clarke Electric Co., and J. M. Leslie of the Canadian Westinghouse Co.

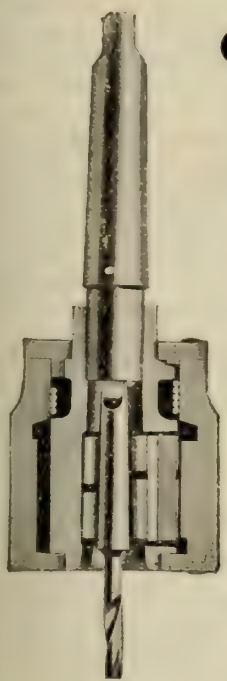
Wm. G. Harris, Canada Metal Co. C. B. Hamilton Jnr., Hamilton Gear and Machine Co.; J. M. Bawden of Bawden Machine Co.; Wm. Ingles, John Ingles Co.; C. H. Wheaton, Dodge Co.; E. C Roelofson, Roelofson Machine Co.; J. M McIntosh, C.M.A.; Thos. Roden, of Robert Roden Ltd.; William Garlock, Garlock Walker Co.; J. C. Blair, Alfred Herbert Ltd.; A. Powell, Lancashire Dynamo and Motor Co.; D. B. McWilliams, and J. Firstbrook of Westco Pump Co.; Mr. Dobson, Chairman A. E.E.; W. Cavern, Cavern and Co.; I L. Cole, Geo. W. Cole, Ltd.; Mr. Blanford and Mr. Graham, Brown and Boggs Co. Hamilton; also many others which Canadian Machinery did not get a chance to list as they came in late for the start of the meeting.

Everything in Fine Tools

Aikenhead's

The House that Sells You Quality

Wahlstrom Automatic Drill Chucks



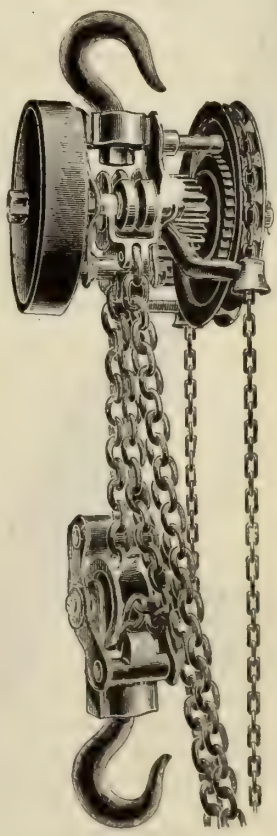
Get the most work from your tools

Why? Because if you break the tangs on your tools you don't have to discard them or spend a lot of time in repairing. You can get just as much work—tangs or no tangs—if you use **Wahlstrom Automatic Drill Chucks.**

The instant-acting jaws of the **Wahlstrom** close on the entire shank and the grip becomes firmer and firmer as the resistance to the tool increases. Tools can be inserted and released in exactly **two seconds.** All tools are centered automatically.

Wahlstrom Chucks are mechanically perfect, true and strong with interchangeable parts. They are not limited to regular drill press work but may be used on boring or milling machines to spot, drill and ream without stopping the spindle.

Made in two styles—one for straight shank tools, the other for Morse taper shank tools.



Simplex 2-Speed Hoist

A Big Saver of "Man Power"

The too free use of "man power" for lifting and moving heavy machines can mean but one thing. Profits are slowly but surely slipping away! They can be guarded with a quick-acting, reliable Hoist—a hoist with capacities like the "Simplex."

The "Simplex" operates at two speeds. Small loads are lifted at twice the speed of large loads. The chains are properly guided so as to eliminate any tendency to jump the sprocket or stick in the guides.

Made in twelve sizes. Blocks with capacities up to 1,600 lbs. handled by one man. With blocks of capacities up to 40,000 lbs., two men can lift full load.

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

Non Breaking

Simonds are the Best Hack Saw Blades on the market. They are fast cutting and non-breaking, made for machine or hand use.



Hardened and tempered by Simonds Own Method these blades have the backbone to withstand hard service. If you require hack saws YOU'LL WANT SIMONDS.

Simonds Canada Saw CO., Ltd.

"The Saw Makers"

Montreal, Que.

St. John, N. B. Vancouver, B. C.

Trade Gossip

The Palmer Steel Works at Jarron, England, have been reopened. Business generally in this district seems to be picking up rapidly.

* * *

The W. C. Hunt Brass Mfg. Co., Toronto had a fire recently which caused about $30,000 worth of damage. The fire was first found in the lacquering room, but efforts to stop the fire at this dept. failed.

* * *

The Russell Construction Co., Peterboro, have been awarded the contract for the erection of foundations, decks and hand rails for bridges numbers four and five at the entrance of the Toronto-Hamilton Highway. The contract was let after considerable discussion owing to the fact that the Blackwell Construction Company had tendered at $4,072 less. The successful company's figures were $43,375 and the Blackwell Company $39,303. The reason advanced for not giving the work to the lowest tenderer was that the controllers were not satisfied that they could do the job in the twenty-one days mentioned.

* * *

Arrangements for the opening and operation of the Government briquetting plant at Bienfait, Sask., are expected to be completed during the visit to Ottawa of Premier W. M. Martin and Hon. C. Dunning of Saskatchewan, who reached Ottawa recently. Premier T. C. Norris of Manitoba, is expected tomorrow to represent his Province. This plant was built at a cost of $680,000, for the purpose of manufacturing the low grade lignite coals of Southern Manitoba and Saskatchewan into briquettes for household use, the cost being shared by the two Provincial Governments and the Federal Government. Work at the plant will commence as soon as operating plans are arranged.

* * *

According to Reports the Canadian Pacific Railway Co. has placed a rather large order with the Algoma Steel Corporation. It is said that the order is for about 25,000 standard steel rails, and no contract price has been mentioned. This order together with those already on hand, will keep the corporations rail plant busy until November 1st.

* * *

Work has been commenced on the taking down and re-building of the trestle work for the Port Arthur blast furnace owned by the Palatine Mining and Development Co. Hancock & Co. are handling the construction work, and the same firm are rebuilding the bridges and culverts on the Pee Dee railway between North Lake and Gunflint to give access to the Polson mine.

* * *

The Preston Car & Coach Co. Preston, Ont., is going to be taken over by the Canadian Brill Co. Ltd. The new company intends starting operations immediately and has behind it the financial engineering and manufacturing resources of the J. G. Brill Company of Philadelphia of which the new company is a subsidiary. Operations will be started with a substantial volume of business, having orders on hand from Toronto and Winnipeg and the Timiskaming & Northern Ontario Railway, and the reorganization of the Preston Car & Coach Company will mean the bringing of considerable American money to Canada at once, and an increasing amount before long. All the work will be done in Canada, and it will mean an increase in the purchasing in this country, orders already having been placed with some Toronto firms.

* * *

The J. G. Brill Company of Philadelphia, the owners of the new company, is the largest company of the electric street railway car business in the world, and it also manufactures automobile bus bodies. The parent plant is operated in Philadelphia and there are other big plants at St. Louis, Springfield and Cleveland, and one in Paris, France.

The President of the new company is Samuel M. Curwen of Philadelphia, President of the Brill Company and all subdiaries; First Vice-President; H. K. Hauck, General Manager of the G. C. Pullam Car Company of Cleveland; Second Vice-President, A. N. W. Clare of Preston. H. D. Scully is a director and General Manager. Another Canadian director is yet to be appointed, as wel as two more American directors.

* * *

The new contract embraces the con struction of one thousand feet of new trestle, with 150,000 feet of timber, and the driving of 500 new piles as the in tention of the Palatine company is t have the entire work rebuilt with new timbers and new foundations.

* * *

One of the trestles, leading to the ele vator at the furnace, by which the lime stone and flux is delivered to the blas furnace, will be thirty feet in heigh and the other which leads to the roaste will be only twelve feet high.

COMMERCE COURSES

(Continued from page 52)

21st, anl last week or ten days. Co vocation for conferring degrees is he on May 10.

Instruction, after the elementary sta es have been passed, will be carried c as far as possible, by the problem met od. The aim is not merely to provi the student with the knowledge of bu iness methods and procedure, but to t him in thinking systematically on bu ness subjects and to develop his powe of investigation and analysis. Ea student is required to undertake a stu of some definite field of industry. limited amount of field-work will prescribed. Special lectures by bu ness men dealing with problems in th experience are being arranged. Fur er information can be secured by w ing the Registrar at the University.

Personals

. Home Smith has been elected chirman of the Toronto Harbor Commsion. Some consideration was given at he meeting, for the rebuilding of the os bition seawall, but a counter plan w presented which is now under consideration. Preliminary plans for the development of the eastern waterfront w approved, but detailed work can-nc be completed until the water lots at h Beaches have been acquired. It reported the dredge "Cyclone," wh has been in use on the Chippawa al, would be back in the harbor h tly.

dvice comes from the Montreal field o e effect that F. W. Gray, editor of h Canadian Mining Journal, and asso-ied otherwise with the Editorial De-ament of The Garden City Press, St. e de Bellevue, Que., has been ap-oted assistant to D. H. McDougall, Vi-President of the British Empire l Corporation. Mr. Gray, who came Canada from England in 1904, was connected with the Dominion Coal o as confidential assistant to various e ral managers. In 1918 he became ant to the President of the Nova cia Steel & Coal Co., until his ap-o tment to The Mining Journal in the following year. Mr. Gray who is a well nformed and attractive writer on Can-d economics, is a member of the a dian Mining Institute.

* * *

Engineering

. W. McLimont, Vice President of the Winnipeg Electric Railway Co., has announced that arrangements have been concluded for the financing of a $10,000-000 power development project at Great on the Winnipeg River. Mr. Mc-t recently returned from a trip where he consulted with officials financial corporations.

When completed the plant to be de-ed will have a capacity of 168,000 power. Work on the project has begun and about 200 men now are ed. Later from 1,000 to 2,500 will be employed on the construction of the plant, which will be one of the world's largest systems for the development of electrical power. It is ex-ed that the project will be complet-1927.

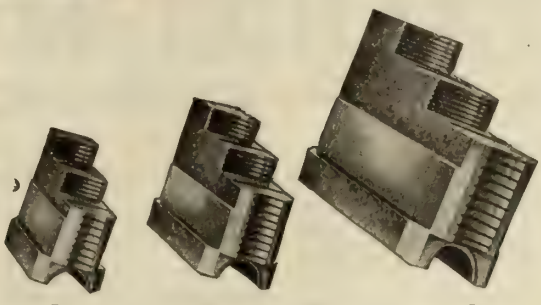
The undertaking will be carried out the charter of the Manitoba Pow-mpany Ltd., which company is tak-the plant and assets of the Winnipeg River Power Company, Ltd. Manitoba Power Company, Ltd., Augustus Nanton, as President, will be surrounded by a strong directorate. A. McLimont will be Vice-President, the active management of construction operation will be in his hands.

Nesbitt, Thompson & Co., Ltd., investment bankers, of Montreal who will have associated with them several eastern banking houses, will finance the development. A. J. Nesbitt, who is head of the above firm, is also a director of the Winnipeg Electric Railway Company.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



The Jaws Are Extra Strong

THEY are drop forgings, made of best quality steel, heat-treated and hardened. The threaded portion of jaws form a half nut for the setting-up screws. Have stood the test of heavy duty work in our own shops where accuracy was the only accepted standard.

DOMINION STEEL PRODUCTS CO.
LIMITED
Engineers • Manufacturers
BRANTFORD, CANADA

3

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators. Bakers' Ovens, trucks, casters, etc. Write for Booklet.
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The production of pig iron and ferro-alloys shows improvement, according to the latest report from the Dominion Bureau of Statistics. During July there was an increase in production to more than two thousand tons, as compared with the month previous. There was a marked increase in the production of malleable iron during the month, the output rising from 661 tons made in June for sale to 2,922 tons made during July for use of the producing firms. Electric iron castings showed an advance over the previous month's record. The figures for the two months being 67 tons in June and 105 tons in July. Of the entire output of pig iron over 90 per cent was reported as having been made for the use of the companies producing.

Production of steel ingots dropped from 62,339 tons in June to 52,641 tons in July. Electric steel production declined from 1,276 tons in June to 608 tons in July.

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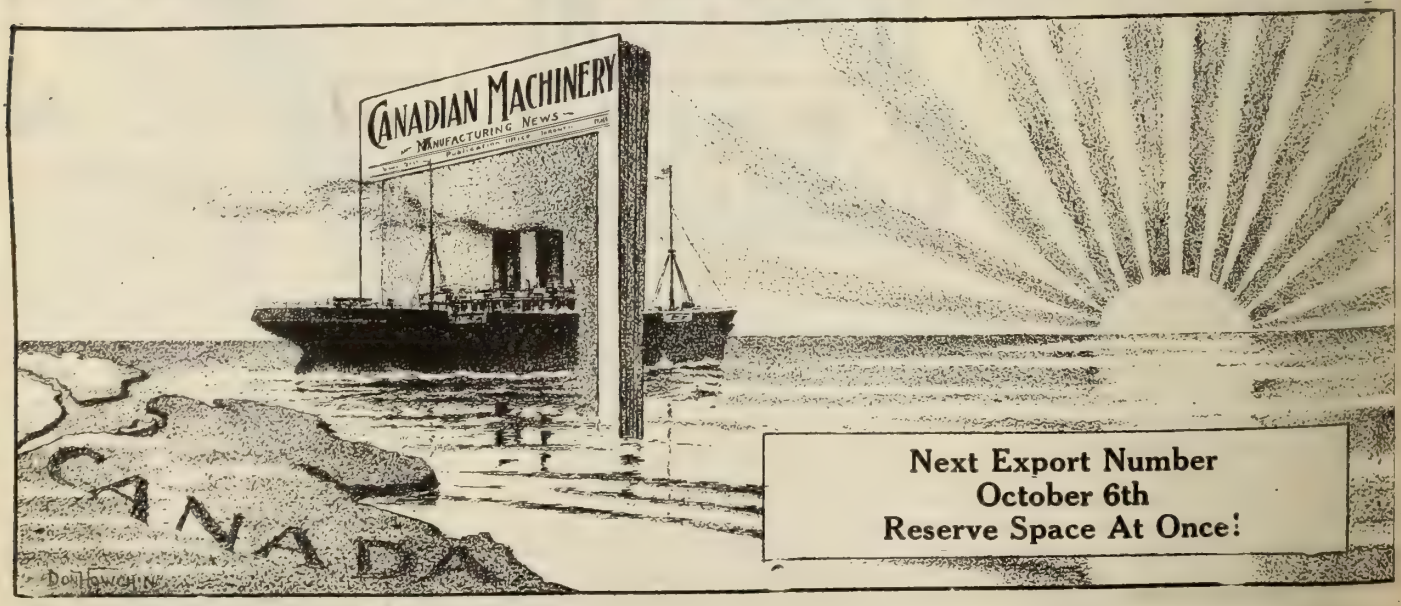
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Classified Advertising Section
143 University Ave., Toronto



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INCREASE THE CAPACITY OF YOUR MERCHANT

There are two kinds of business policies of the merchandising field to-day.

The first believes the goods are sold when they have been sold to the merchant. Having bought the goods it is up to him to sell them and to get rid of them the best way he can.

The other thinks of merchants in terms of their capacity to sell his goods to the ultimate consumer, and having sold them to keep them sold and keep them coming back for more. The former very often finds new competitors coming into the field, and taking away a great deal of the business he has come to expect should be his.
The second approaches his merchant on a man to man basis. He encourages him to build. He shows him clearly and carefully what he is doing to help him create a market for the products he is distributing. Through the business newspapers the merchant reads, he shows him the turnover possibilities in his line. In fact, he shows him how to make more money for himself, and incidentally make more for the wholesaler or manufacturer.

The second and most successful type of business realizes that training does not stop when he has trained and sold his own selling forceon the goods he is merchandising. He realizes that this is only a beginning, that the great force of retail merchants who finally dispose of his goods to the ultimate consumer must be trained, must have knowledge, must have information, so they in turn can prove and sell the ultimate consumer.

The one great way to reach the merchants who are selling your goods is through the MacLean Trade newspapers, which merchants are reading every day and every week of the business year. They are reading them for new ideas, methods, for merchandising plans, for schemes to make more money. Now as never before they are studying the market pages and price quotations of every issue. Firms who are taking advantage of this avenue to better business are finding results far in advance of their expectations.

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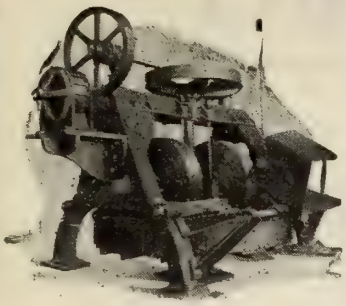
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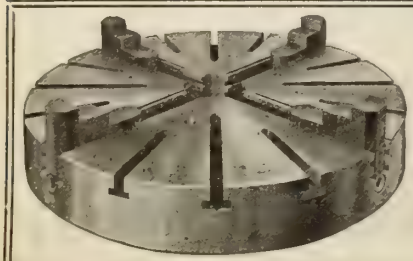


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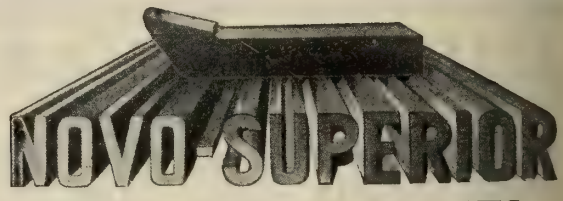
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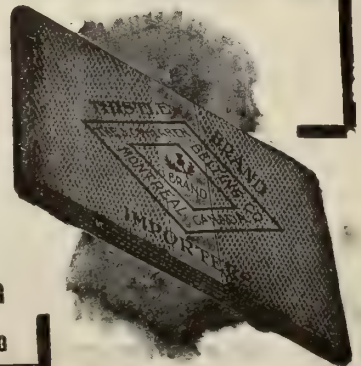
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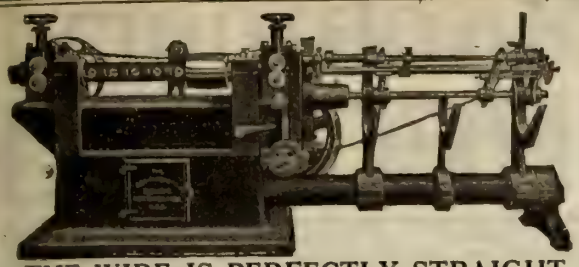


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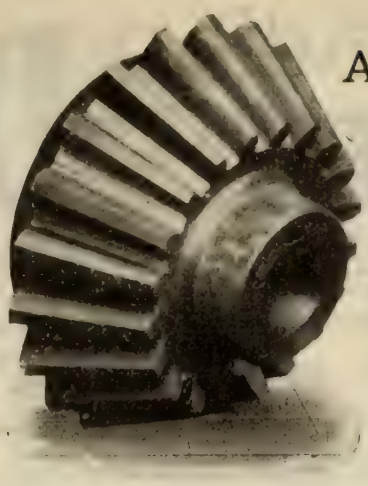
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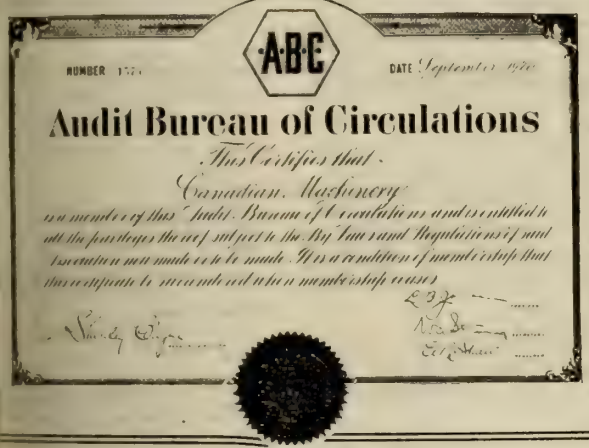


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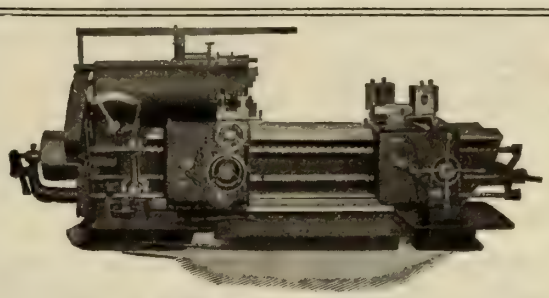
NUMBER 1577 DATE September 1921

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National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Machine and Carriage Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach. Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

Bronze
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd. Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O

Bulldozers
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont

Bushings
Fisher Motor Co., Ltd., Orillia, Ont

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R
Starrett Co., L. S., Athol, Mass.

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Castings, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can Driver-Harris Co., Walkerville, Ont.

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal. Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

BUYERS' DIRECTORY

Geld, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press

(See Tool Work)
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada
Banfield & Sons, Ltd, W. H., Toronto.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont

Dies, Forging

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable

Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening

Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads

Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine

Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables

Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials

American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel

Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders

Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads

Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic

National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand

Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable

Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive

Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret

Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist

Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings

Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments

Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices

Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical

Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube

Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)

Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Files and Rasps

Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines

Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)

Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe

International Malleable Iron Co., Guelph, Ont.

Flexible Shafts

Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing

British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding

L'Air Liquide Society, Toronto, Ont.

Forging Machinery

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop

Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid

Can. Steel Foundries, Montreal, Que.

Furnaces, Electric

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal

Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric

Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing

Brown & Sharpe Mfg. Co., Providence, R.I.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop

Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator

Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

ages, Measuring (See Tool Work)
anfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

ages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ages, Standard
Armstrong Whitworth Co. of Can., Lt. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
hannson Inc., C. E., Ploughkeepsie, N. Y.

ages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
anfield & Sons, Ltd, W. H.,Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

as, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

as, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

askets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

auges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

ear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

ear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

ear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

ear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

ears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

ears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Renold (Hans) of Canada, Ltd., Montreal, Que
Dominion Engineering Works, Limited, Montreal, Que.

ears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

ears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

ears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

ears, Machine Moulded

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis,
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation

Diamond State Fibre Co. of Can., Ltd. Toronto, Ont.

Iron Bars

Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves

Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic

Norton, A. O., Boston, Mass.

Jacks, Planer

Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd. Montreal, Q.

Japanning and Varnishing Ovens

[illegible] Rack Co., Brantford, Ont.

Jigs and Fixtures (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines

Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine

Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine

Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments

Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ort.

Lathe Tools

Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench

Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)

Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine

Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret

Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)

Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving

Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand

Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting

Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand

Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading

Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning

Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe

Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery

Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants

L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes

Dennis Wire & Iron Works, London, Ont.

Lubricants

Oakley Chemical Co., New York, N.Y.

Lubricating Systems

Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists

Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel

Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid

Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy

British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers

Parker Co., Charles, Meriden, Conn.

Micrometer Calipers

Alkenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments

Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic

Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench

Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand

Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain

Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Thread

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical

Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal

International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric

Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery

Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples

Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.

International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits

Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Nipples

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen

L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw

Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners

Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems

Bowser, S. F., & Co., Ltd., Toronto, Ca

Oil Storage Engineers

Bowser, S. F., & Co., Ltd., Toronto, Ca

Oils

Canadian Oil Companies, Ltd., Toront Ont.

Oil Hole Covers

Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble

Imperial Oil Ltd., Toronto, Ont
Brantford Oven & Rack Co., Brantford, O

Oxygen

Carter Welding Co., Toronto, Ont
Dominion Oxygen Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont

Oxy-Acetylene Apparatus

L'Air Liquide Society, Toronto, Ont

Packing, Hydraulic

Can Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam

Can. Consolidated Rubber Co., Ltd. Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montre

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Qu.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Hardenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal, Q

Screens
Can. Wire & Iron Goods Co., Hamilton.

BUYERS' DIRECTORY

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stuart & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton Engineering Service, Ltd., Hamilton.
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal. Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont.

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Wheel Trueing Tool Co. .....
Whiton Co., D. E. .....
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Emblem of Integrity

LIQUID AIR Co

Standard of Excellence

OXYGEN
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BLOWPIPES-REGULATORS
FILLING RODS - FLUXES
ACCESSORIES

THE LIQUID AIR Co

SOCIÉTÉ L'AIR LIQUIDE

FACTORIES FOR SERVICE

HALIFAX, THREE RIVERS, MONTREAL, TORONTO,
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OPERATED IN CONJUNCTION WITH A CONTINENT WIDE NET-WORK OF DISTRIBUTION STATIONS



"Liquid Air" Oxygen Means a Saving in Transportation

With a network of Factories, not only planned but in actual operation, and a number of Distribution Stations situated at all large centres all over Canada, Purchasers of Oxygen can obtain their supplies at a point very near to the point of consumption. This completely obviates heavy freight charges on cylinders and assures an immediate supply at any time within a few hours and even minutes after the orders are placed.

All cylinders conform to the specifications of the Canadian Railroad Board and are made to ensure safety without unnecessary weight. When purchasing "Liquid Air" Oxygen you not only save on freight, but in very many cases this expense is almost eliminated.





HENRY BERRY

& Company Limited.

LEEDS, England

Codes: A. I., A. B. C. (5th Edition), Engineering, Everybody's Pocket Code, Marconi International.

CANADIAN AGENTS:

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***Head Office*—Montreal**

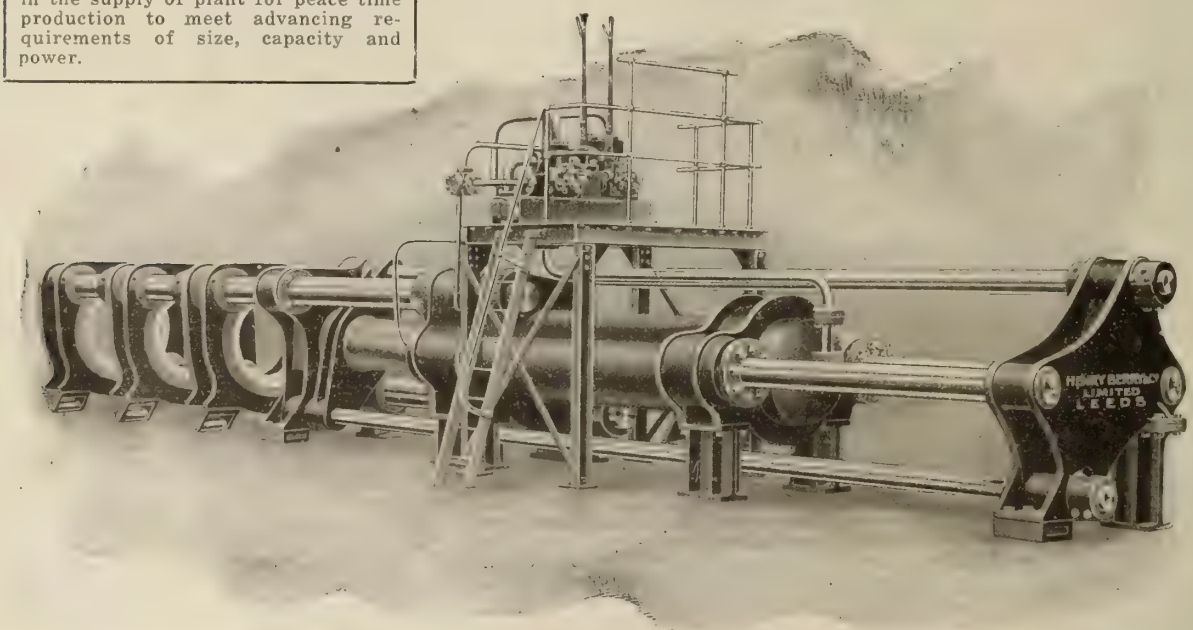
A Cradle of Imperial Industry

Concerned for many years with the design and the manufacture of some of the largest types of machinery for the British Government, the Colonies and the Indian Empire, the firm of Henry Berry & Co. possesses some of the most extensive resources in the country for the production of the biggest, most powerful and most practical types of hydraulic machinery for Shipyards and Industrial Enterprises. These include all kinds of Shipyard Tools, Plates and Armour Bending Rolls, Rivetters, and Punching and Shearing Machines, Presses and Cranes.

Designs and estimates will be submitted to all requirements without charge. Prompt deliveries with full guarantee of Quality and Power.

750 TON PUNCHING & DRAWING PRESS

Pioneer manufacturers of hydraulic shell forging presses for the largest shells in use during the Great War, we are likewise always to the fore in the supply of plant for peace time production to meet advancing requirements of size, capacity and power.





CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVI., No. 12 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Sept. 22, 1921 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM
MACHINE TOOLS

18-inch
Crank Slotting
Machine

A. C. Motor Drive Through Speed Box

10 H.P. Motor—1,000 R.P.M.

The John Bertram & Sons Co., Limited
DUNDAS, ONTARIO

MONTREAL
723 Drummond Bldg.
VANCOUVER
609 Bank of Ottawa Bldg.
WALKERVILLE
103½ Sandwich St.
TORONTO
1002 C.P.R. Building
WINNIPEG
1205 McArthur Bldg.
HALIFAX
Roy Building



All the Fine Qualities That Good Work Demands

Pratt & Whitney Small Tools enjoy an enviable reputation for excellence that has been well earned in the high production shops of the country. Where stamina as well as exceptional accuracy and precision are required P & W Tools have more than held their own. Our line is complete. It includes taps, dies, milling cutters, reamers, punches, drills, etc., both of standard and special design and in sizes to suit every requirement.

Prompt service is assured at our nearest store, where P & W Small Tools are carried in stock for immediate delivery.

PRATT & WHITNEY CO.

OF CANADA

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723 Drummond Bldg.

TORONTO
1002 C.P.R. Bldg.

WINNIPEG
1205 McArthur Bldg.

WALKERVILLE
103½ Sandwich St.

VANCOUVER
B. C. Equipment Co.

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Roy Building

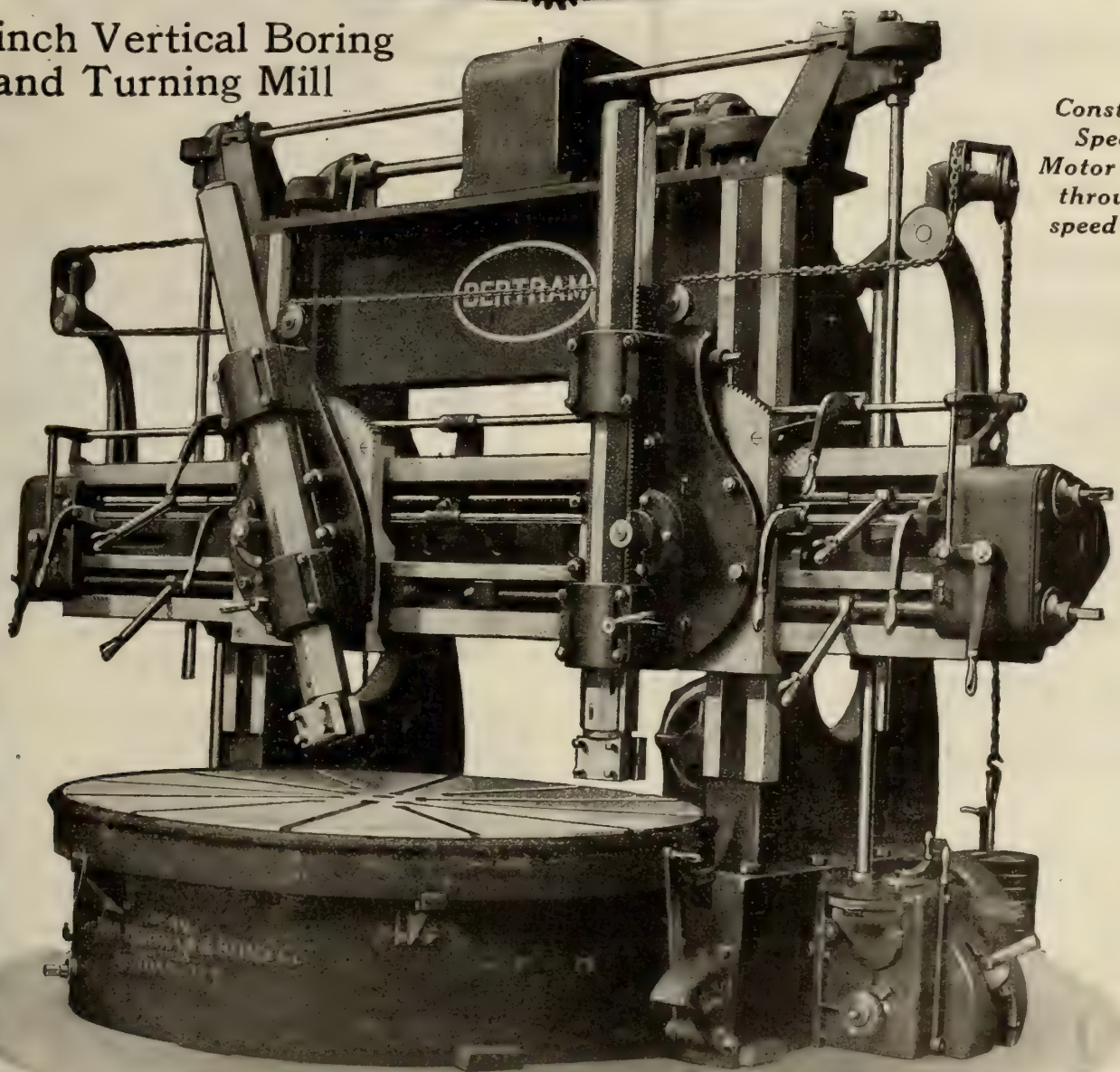


The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box



P 1330

The John Bertram & Sons Co., Limited

DUNDAS, ONTARIO, CANADA

MONTREAL 723 Drummond Bldg. TORONTO 1002 C. P. R. Bldg. VANCOUVER 609 Bank of Ottawa Bldg. WALKERVILLE 103½ Sandwich St. WINNIPEG 1205 McArthur Bldg. HALIFAX Roy Bldg.

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A file that has lost its keenness wastes a workman's effort and time, and so costs more than a new file.

Keep a new file handy to replace the worn one, and for long-lasting efficiency specify one of these brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by:

Nicholson File Company

Port Hope - Ontario



STRENGTH

Strength is a very essential quality in a wrench, but it does not depend entirely upon bulk or weight of metal. The strength and long-lasting qualities of Armstrong Wrenches are the result of skilled combination of the Best Steel, Expert Design, Accurate Machining, and Heat Treatment. All kinds and sizes.

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Armstrong Bros. Tool Co.
"The Tool Holder People"
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GISHOLT
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work

AUTOMATIC TURRET LATHES
For Chucking Work

VERTICAL BORING and TURNING MILLS

UNIVERSAL TOOL GRINDERS

HORIZONTAL BORING AND DRILLING MACHINES

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REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking

BORING BARS
With Adjustable Cutters

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For Time Recording in Factories

Separate Catalogs on each Product

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Large Tanks, Small Tanks, any shape, any thickness for any purpose made to specification. Every tank absolutely guaranteed.

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STORAGE TANKS for—
Oil Refineries
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HEAVY AND LIGHT STEEL PLATE CONSTRUCTION ERECTED ANYWHERE

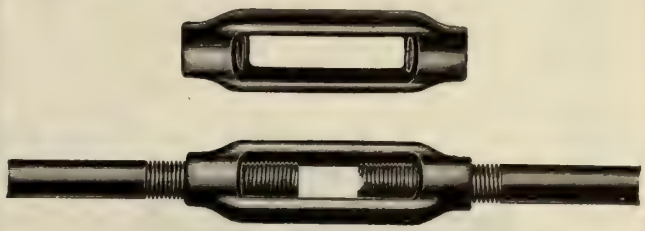
Consult us before placing your next order.

THE **TORONTO IRON WORKS** LIMITED

HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

CANADA FOUNDRIES & FORGINGS LIMITED

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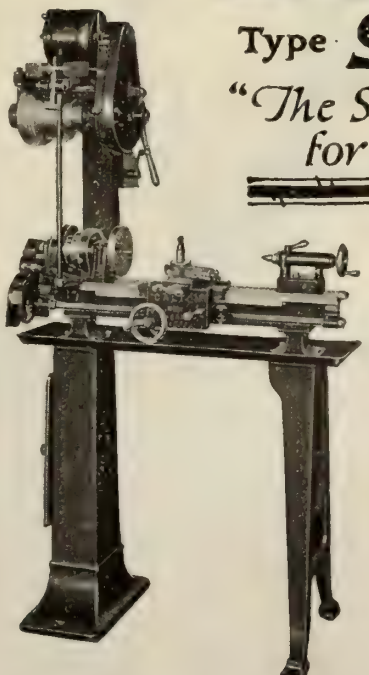
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16 Sizes with / without } Stubs

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Welland, Ont.

"DALTON Type SIX" B-4

"The Small Lathe for the Big Job"



Actual Swing 7¼ inches

Motor Driven Lathe for AC or DC

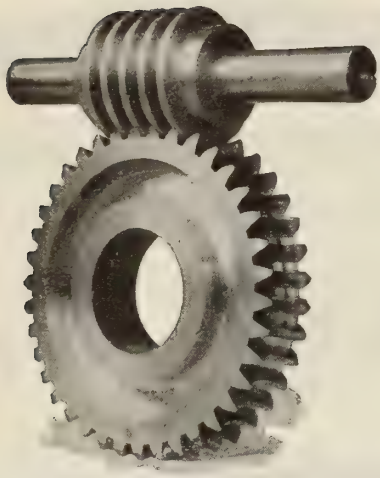
Made with 30" and 36" Length of Bed

Write for Bulletin BC-652

Dalton Manufacturing Corporation
Sound Beach, Connecticut, U. S. A.
Cable Address "ALEDAL Stamford"
Also Manufacturers of Type B-6 Lathes

Quality Gears

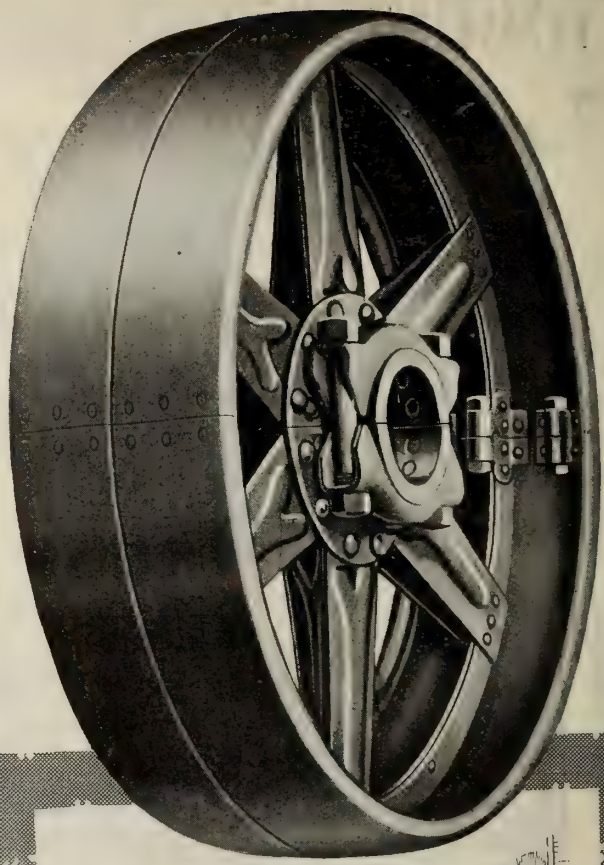




Good Gears pay in the long run

Hamilton Gear & Machine Co.

Van Horne St. - Toronto



The Waste You Can See is Least to be Feared



A HOLE in a dam or a leaky steam pipe is not to be feared; it cries aloud for attention.

It's the hidden leaks—such as excessive weight of pulleys on the bearings—air fanning and belt slippage that steal your power and add to its cost.

How to overcome these losses is explained in our book, "Getting Maximum Pulley Efficiency." Yours for the asking.

The American Pulley Co.
Philadelphia, Pa.

AMERICAN
STEEL SPLIT
PULLEYS



OXYGEN AND HYDROGEN
(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER

We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders OXYGEN PUROX HYDROGEN Who Want the Best!

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STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.



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by the
HARMET
Liquid Process

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL

Canadian Machinery's Used Equipment Service

IF you are in the market for used machine tools, electrical equipment, shafting, power equipment, etc., consult the "Used Equipment Section" of CANADIAN MACHINERY. It offers many opportunities in good used equipment and surplus stocks.

If what you want is not listed write us about your requirements and we will endeavor to put you in touch with possible sources of supply. Be sure to give details of what you want.

If you have anything to sell, the logical thing to do is to advertise it in our Used Equipment Section.

Our rates are reasonable and with white space goes service. If you want to test our service without advertising and without cost tell us what you have to sell.

CANADIAN MACHINERY & MANUFACTURING NEWS

"Used Equipment Department"

143 University Avenue,

Toronto, Ontario.



The illustration above shows the three protective coatings which provide an impregnable shield for the specially annealed steel which forms the core. An actual sample will be sent to you upon request.



Permanent Repairs

Now is the Time to Make Them

Manufacturing plants now need repairs. With winter snow, wind and storms approaching the need for renewing old roofs and siding becomes more urgent every day. Delays cost money.

This time make your repairs permanent. Why put on roofs that deteriorate quickly? The short life of unprotected metal shows that it is an unprofitable investment. To its short life add the cost of frequent painting and repairs and the evidence is even more conclusive.

This time use Robertson Process Metal. Rust and corrosion will be stopped. You end frequent repair work and painting. Your upkeep and maintenance costs will be cut to the bone and you will practice true economy.

Robertson Process Metal is a sturdy building material made in corrugated and flat sheets for roofing and siding. It is also made in building trim, gutters and other building details. It is protected by three impervious coatings (1) Asphalt, (2) Asbestos, (3) Waterproofing, which completely encase the steel sheet within. "Long life" is assured when your buildings are covered with Robertson Process Metal. Send for illustration and sample.

This partial list of users is significant because of the prominence of the various corporations and because all of them have used *Robertson Process Metal* repeatedly. Surely experience covering many year's usage is evidence of true value in the Robertson Product.

Abitibi Power & Paper Co., Ltd.
W. D. Beath & Son, Ltd.
Brown Boggs Company, Ltd.
Canadian Electro Products
Canada Furnace Company, Ltd.
Coke Oven Co., of Canada, Ltd.
Dept. of Railways & Canals—Ottawa, Ont.
Dominion Glass Company, Ltd.
Dominion Iron & Steel Corp., Ltd.
Dominion Sugar Company, Ltd.
Grasselli Chemical Co., Ltd.
Imperial Oil, Ltd.
Montreal Harbour Commissioners
Moirs, Ltd.
Montreal Locomotive Works, Ltd.
Nova Scotia Tramways & Power Co., Ltd.
Oneida Community Co., Ltd.
Page Hersey Tubes, Ltd.
Sarnia Bridge Company, Ltd.
Dept. of Works, City of Toronto

H. H. ROBERTSON COMPANY, Limited, Sarnia, Ontario

Sales Offices; Drummond Building, Montreal, and Kent Building, Toronto

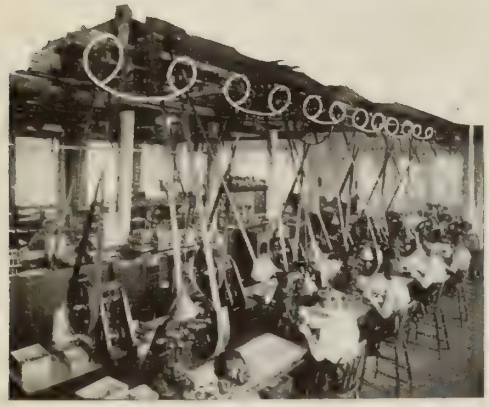
Agencies; Canadian Asbestos Co., Montreal and Toronto; Jamieson Engineering Co., Ltd., London Building, Vancouver; R. Y. Kilvert & Co., Builders Exchange Building, Winnipeg; Gandy & Allison, No. 3 North Wharf. St. John, N. B.; General Sales & Engineering Co., Metropole Building, Halifax, N. S.; James E. Crawford, St. John's, Newfoundland

ROBERTSON PROCESS METAL

TRADE MARK REG. U.S. PAT OFF.

FOR PERMANENT ROOFS, SIDING AND TRIM

THE JOHNSON FRICTION CLUTCH



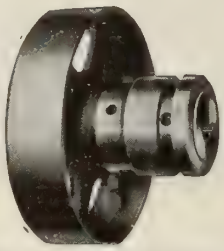
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

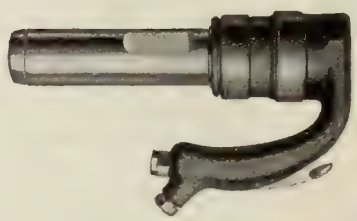
THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



Cleveland "Pocket-in-Head" Riveting Hammers

For Locomotive and Car Shops, Boiler and Tank Shops, Ship Yards, Etc.

THE "POCKET" IN-HEAD INCREASES PISTON SPEED

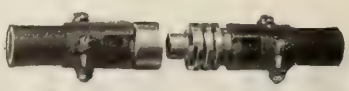


THE "POCKET" IN-HEAD INCREASES POWER of BLOW

The Inverted Handle Riveter is 4-in. shorter than regular styles.
CLEVELAND RIVETERS are Shorter, Lighter, Hit Harder, Run Faster and use less Air in Operation than any Riveter on the market.
IN STOCK:—RIVETERS, CHIPPERS, CALKERS, AIR DRILLS, CORNER DRILLS, COMPOUND DRILLS, RAMMERS, PORTABLE GRINDERS, ETC.
BOWES AIR HOSE COUPLINGS AND CLECO PRESSURE-SEATED AIR VALVES
Are Standard Equipment Everywhere



The Valve That Never Leaks



The Coupling That Never Leaks



Cut Shows Never Slip Clamp Attached to Bowes

Write For Illustrated Bulletin No. 46 and 48.

CLEVELAND PNEUMATIC TOOL COMPANY OF CANADA, LIMITED

84 Chestnut St., Toronto, Ont. **337 Craig St. W., Montreal, Que.**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

Keep Your Shop Clean



Remove your sawdust, shavings, or other loose material with a

Canadian Standard Reversible Mill Exhauster



A clean shop with machines free from shavings, chips, or sawdust makes for greater efficiency.

Let our engineering department help you plan your refuse exhauster system.

Write for Catalogue 16

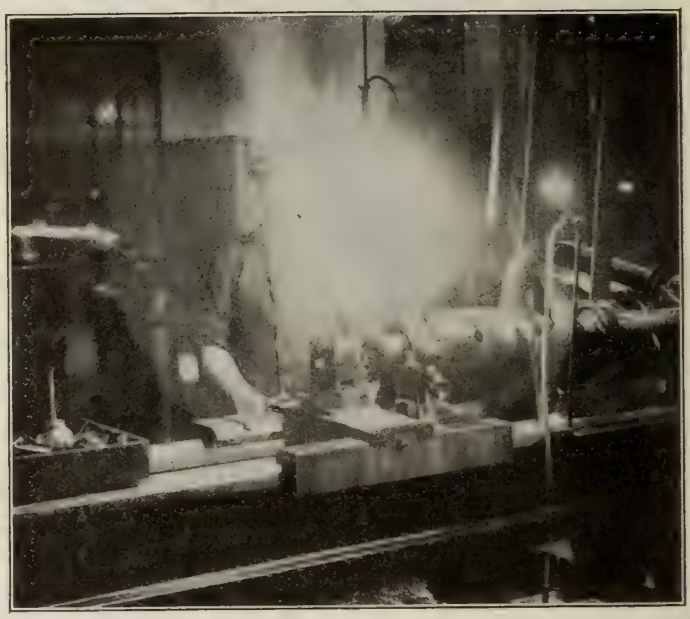
Canadian Blower and Forge Co., Limited

KITCHENER, ONT.

Toronto Montreal Calgary Vancouver St. John

Correct Lighting in your Plant means More Work and Better Work





Let Us Ease the Eye Strain

Good lighting is a factor of first consideration in any effort to improve workmanship, increase production, reduce spoilage and safeguard employees.

A poorly lighted plant breeds weariness and discontent, resulting in uneven production and waste. Ease the strain and get more and better work from a happier staff by installing a correct Industrial Lighting System in your plant.

Our illumination Engineers will gladly help in solving your particular lighting problem by planning the system that will most efficiently and economically meet your need. Such well-known names as Benjamin, Adams & Bagnall and Overbaugh and Ayres are included in our stocks of Illumination Equipment.

Northern Electric Company
LIMITED

Montreal Quebec Hamilton Toronto Winnipeg Regina Vancouver
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Where Good Machinery Originates



Canada's Dependable Machinery and Supply House

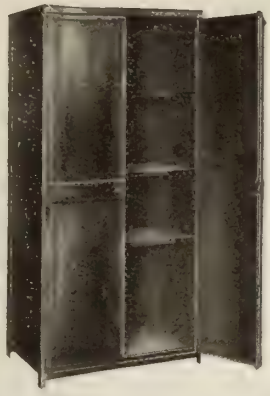
Of course the machines we sell are not actually built in our building shown above. Yet as a supply base that promptly meets demand from all parts of Canada many of our customers speak of our establishment as the place where "good machinery originates." And they are right. We handle and give prompt service in supplying Metalworking and Woodworking tools by the best makers. See us if you need—

Lathes, Planers, Millers, Grinders, Shapers, Drills, Boring Mills, Punches, Shears, Etc.

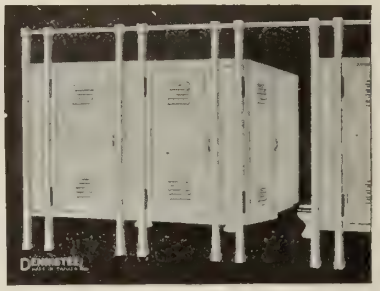
H. W. PETRIE, Limited

TORONTO and HAMILTON

DENNISTEEL



Material Cabinets



Lavatory Compartments



Lockers

EVERY Dennis product is produced by experts. We have many lines, but in each and every line we are specialists.

We are the largest makers in Canada of our principal lines—a position of leadership that has been attained, not by throw-together methods, but by long years of applied effort and improvement.



WE MAKE

Steel Lockers, Steel Cabinets, Steel Shelving,

Steel Bins, Steel Chairs and Stools, etc.

Steel Lavatory Compartments, etc.

Commercial Wirework of all kinds.

Ornamental Iron and Bronze

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THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON
CANADA

Halifax Montreal Ottawa Toronto
Hamilton Winnipeg Calgary Vancouver
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Quick Service

After Ordering—

—you don't expect the supply house to "go to sleep." You may need those Taps in a hurry and you want them "rushed." We understand that. That's why we try to ship the same day if possible.

After Receiving—

—take a good look at those **Murchey Solid Adjustable Taps.** You'll agree that Murchey quick service hasn't stopped with the ordering. Murchey Taps are built for fast, accurate work. Try them on your work at our expense.

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75 Porter St., Detroit, Mich.

Coats Machine Tool Co., London, Glasgow, Newcastle, Eng.
Fenwick Freres & Co., Paris, France

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



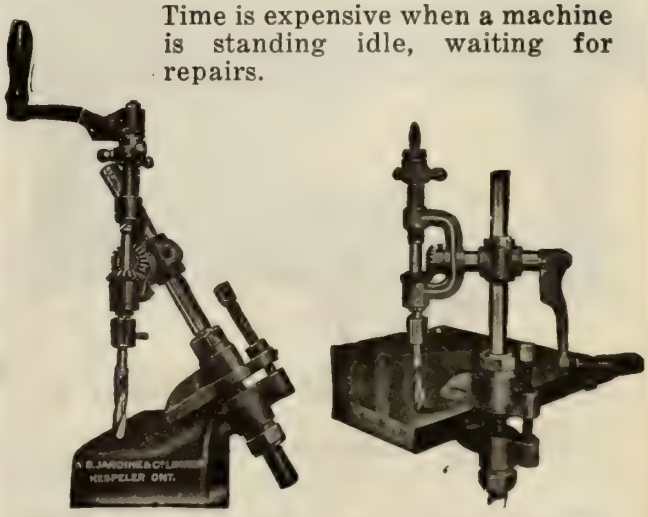
American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.
La Salle, Illinois, U.S.A.

Represented in Canada by
A. R. Williams Machinery Co., Ltd.
64-66 Front Street W., Toronto
Halifax St. John, N.B. Montreal Winnipeg Vancouver

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

HEPBURN
CRANES



Double I Beam Hand Overhead Crane

Building Stability into Business

For better conditions all round, manufacturing and selling costs must be put on a lower and sounder basis.
Only by everyone pulling together—by reducing manufacturing time, and consequently costs, can this be accomplished.
HEPBURN CRANES are proving big factors in this industrial renaissance. Built to last, backed by a reputation and sold with a guarantee, they are the worthy choice for any shop. From ¼ to 20 ton capacity.

Let us send full particulars. Also on Vertical Engines, Derricks, Steam Pumps, Planers, Presses, Forgings and Castings.

John T. Hepburn Limited
Engineers and Iron Founders
18-60 Van Horne St., Toronto

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

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Emery Glass Flint Garnet Corundum Carborundum	Paper and Cloth	In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

JOHN OAKEY & SONS
LIMITED
WELLINGTON MILLS
LONDON, S.E. 1, ENGLAND

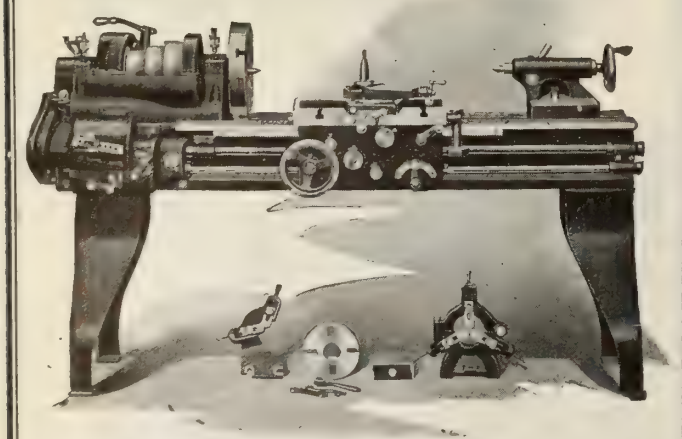
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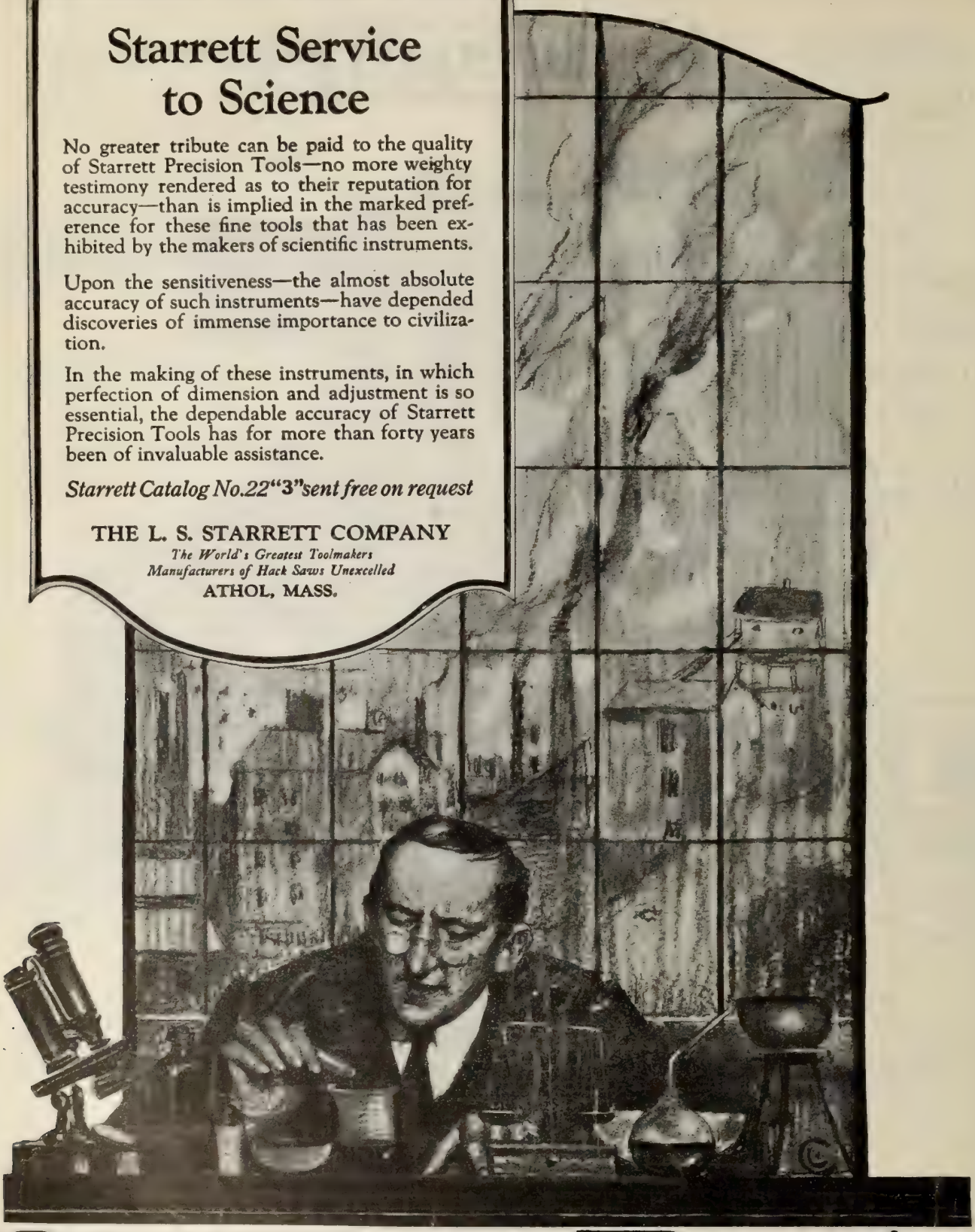
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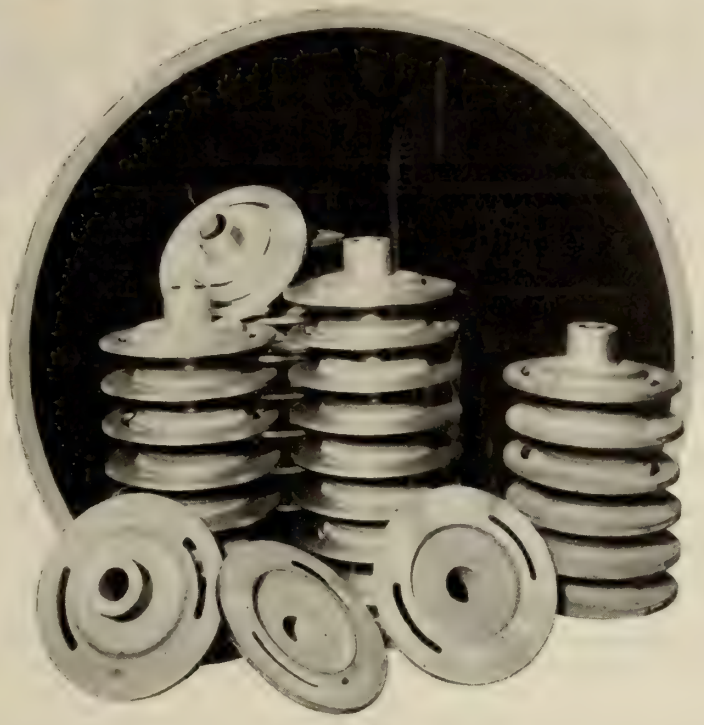


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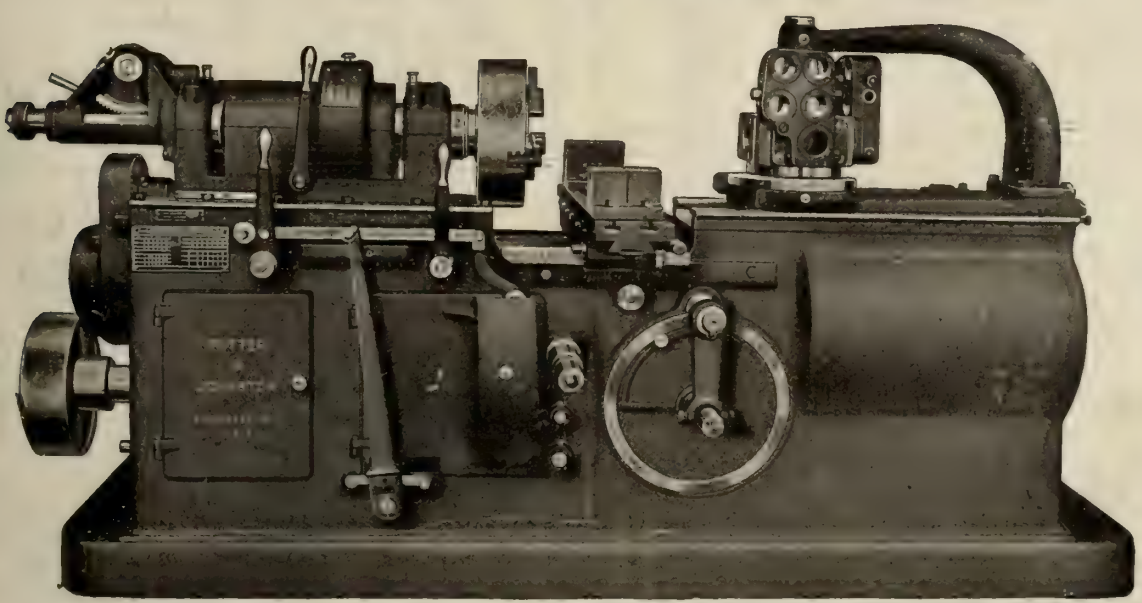
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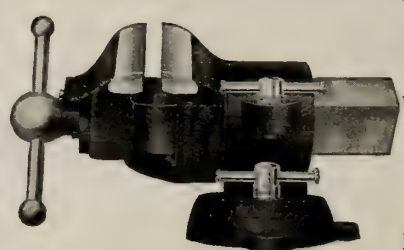
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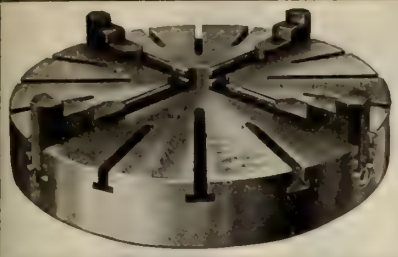
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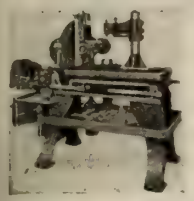
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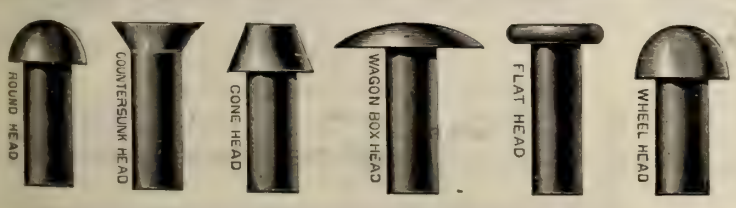
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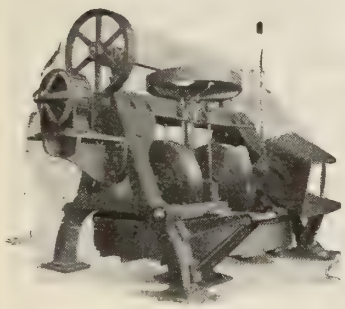
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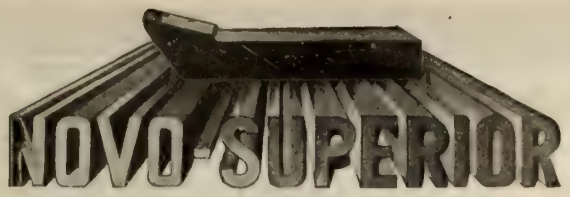
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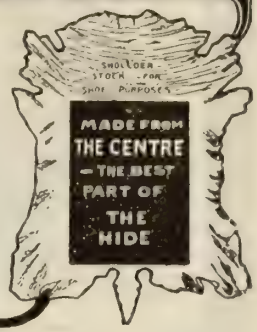
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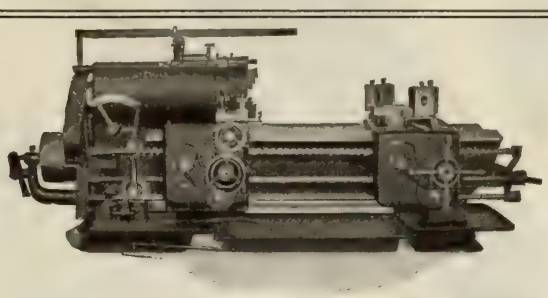
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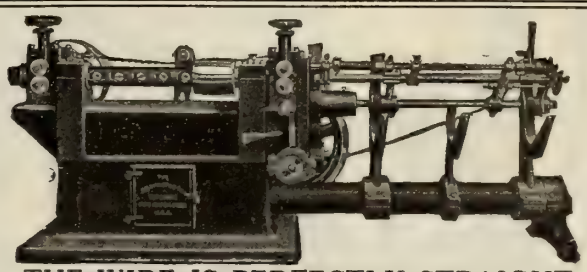
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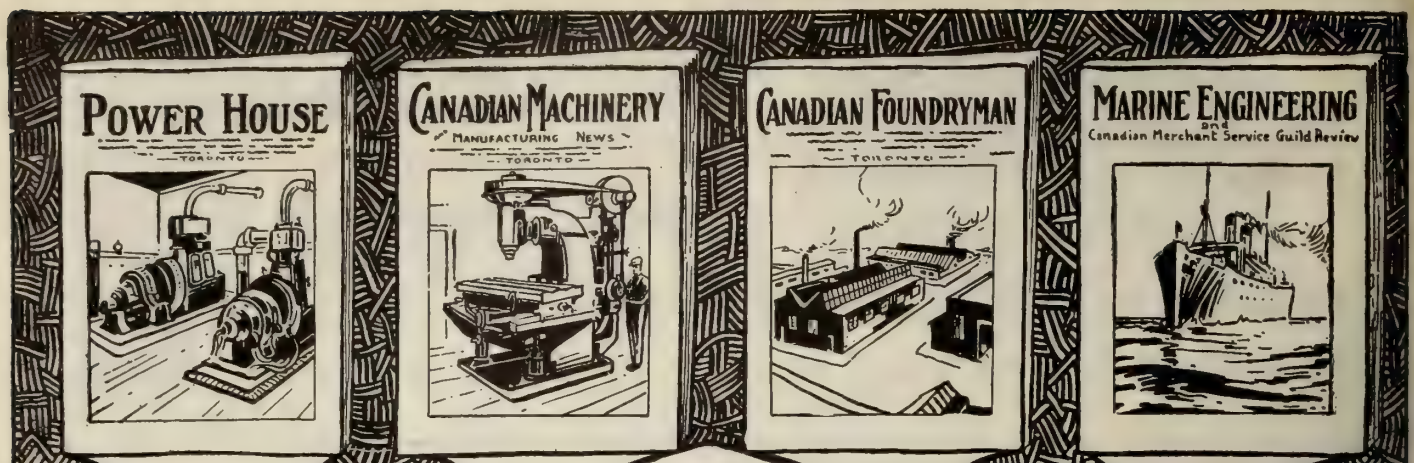
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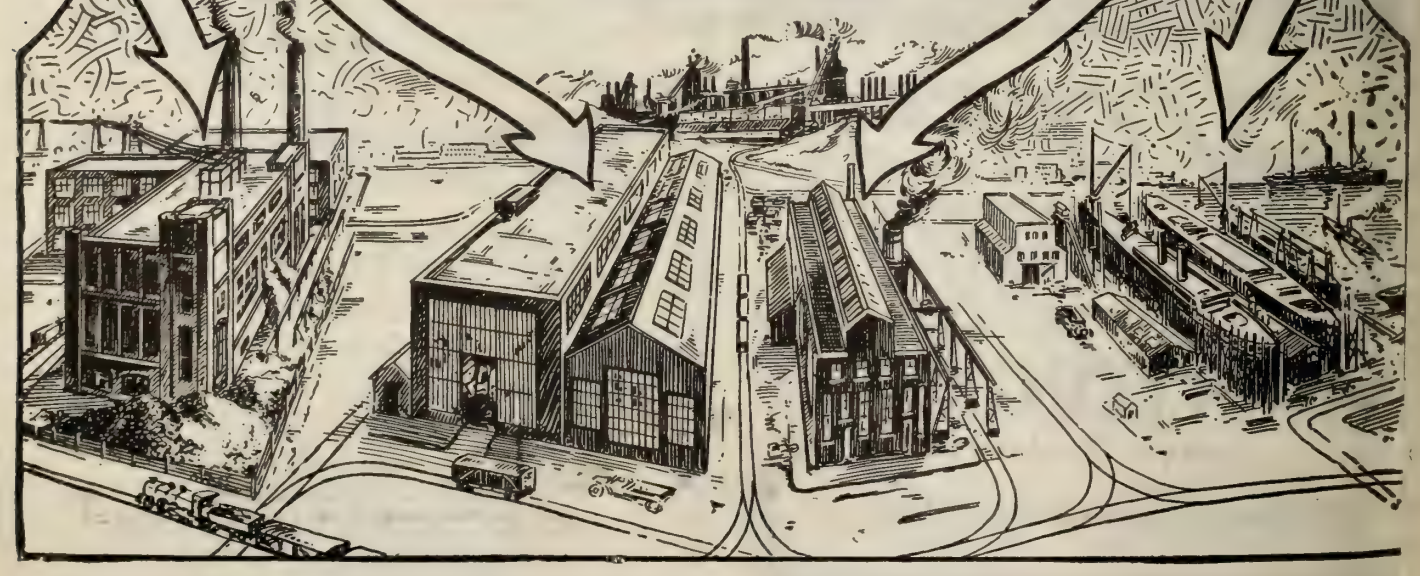
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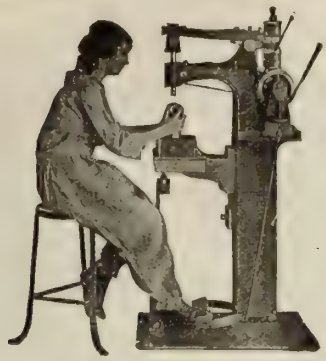
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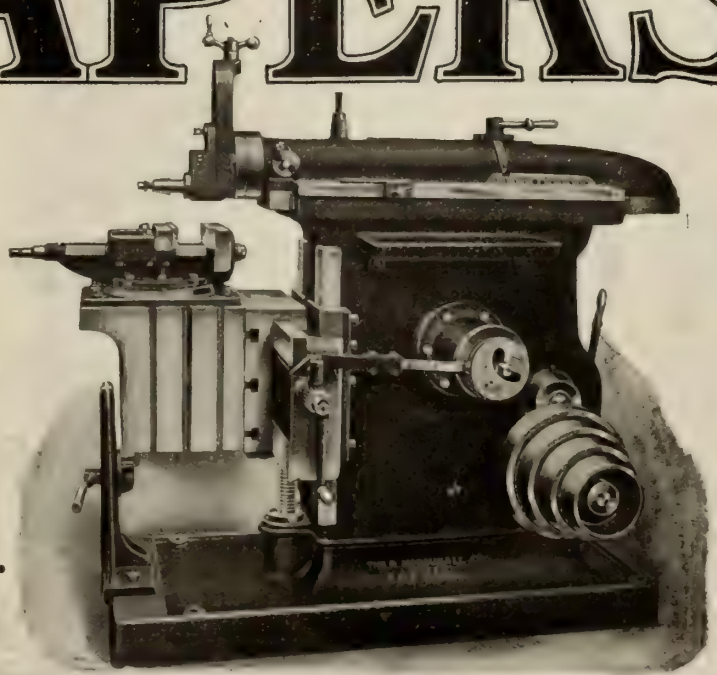
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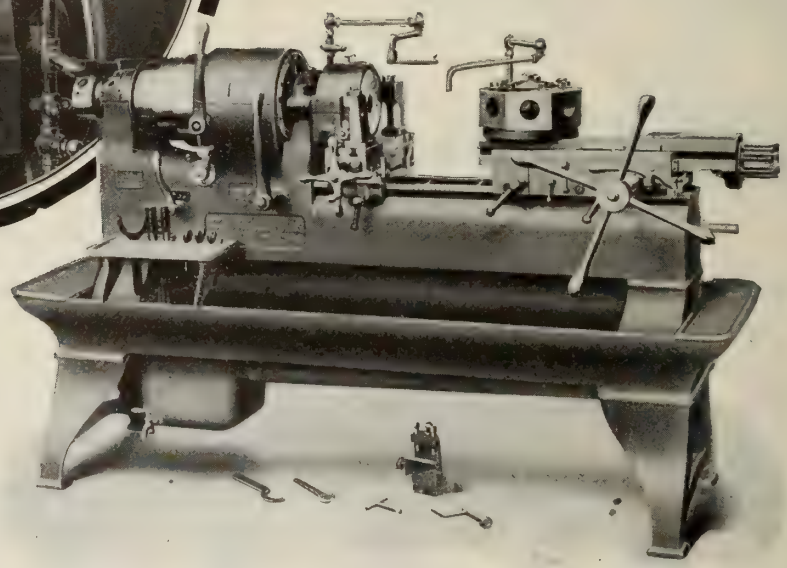
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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVI, No. 12. September 22, 1921.

The Art of Drop Forging with Examples of Work

Blacksmithing And Drop Forging Are Widely Different—The Proper Design of Parts—The Question of Draft—Limits Usually Allowed—Producing of Intricate Shapes

CONTRARY to a popular impression, the art of drop forging is not merely a sort of glorified blacksmith's job. There is a vast difference between blacksmithing and drop forging. Each has its own field of usefulness therefore the two trades should not be confused.

The art of drop forging goes back about 70 or 80 years, although at that time the possibilities of the business were only being discovered. The bicycle really deserves the credit for bringing the art to a greater and better life, for when they were in vogue, small drop forgings were required for their manufacture. This condition induced the installation of small drop hammers running up to 1,500 lbs., with 2,000 lbs. as the maximum.

Next came the automobile, which in turn required large hammers, dies, etc., to speed up the necessary drop forgings for the different makes of cars.

The development of the art when bicycles became popular was nothing in comparision to that caused by the automotive industry, and it is due to the automobile that alloy steel has been developed to its high point of perfection.

Previous to the late nineties, little had been accomplished in the manufacture and heat treatment of alloy steels. With but few exceptions, Bessemer, open hearth, and crucible carbon steels were employed, and heat treating was a closed book to most people.

There is no difficulty in forging Bessmer, open hearth, and crucible carbon steels. Generally, these straight carbon steels flow much better in the dies, filling the impressions more readily than the alloy steels, and the daily product from them would therefore be higher—usually, very much higher. This difference in the rate of production is not always understood, although it is a very important factor in determining cost. Most of alloy steels are denser, more sensitive in character, require far more care in heating and forging and in addition to curtailing the output, necessitate special and accurate heat treatments, sometimes quite complicated, for which many drop-forgers are not properly equipped. Under these conditions the use of such materials has been discouraged to a certain extent. However, the meeting of these very difficulties by those who had the courage and determination to face them, has developed the drop-forging art far beyond its status of 10 or 12 years ago. Indeed the regulation of the various heats in forging, quenching and drawing induced by these alloy steels, made possible by the great advance in metallurgy, has placed the production of drop-forgings on a scientific basis.

Given proper equipment, there would now seem to be no reason, in connection with difficulty of production, why an experienced forging concern should hesitate to accept this business. So far as we are individually concerned, we have been successful in forging practically every alloy steel that has been offered including Nickel, Chrome-Nickel, Chrome-Vanadium and high Tungsten mixtures.

Copper and some of the bronzes, such as Tobin, Naval, Managanese, etc., can be forged but others, like Phosphor Bronze, cannot. Neither can Brass. Aluminum can be worked to some extent, if handled very carefully.

The Design of Parts

In designing parts for drop-forging it should always be borne in mind that the movement of the dies in the hammer is strictly limited to but one direction—the vertical. Undercuts and transverse-holes such as can be secured very readily in castings by means of cores, are practically out of the question in forgings. Attempts have been made in



Drop Forging an automobile crankshaft.

*Data and photographs by courtesy of J. H. Williams & Co., Brooklyn. N Y.

some cases to produce such openings by the use of mandrels so as to avoid finishing operations, but this method has never been commercially successful.

At one time, it was the practice to form the opening in the Lathe Dogs by use of mandrels. This system naturally required the use of at least two sets of dies and as many hammers. Before starting the job a stock of mandrels, which deteriorated rapidly in use—particularly the smaller sizes—was made up. This was an item of considerable expense in itself. The Dog was forged out flat without bend in the tail and with the opening formed, in the "break-down" dies; it was then trimmed, the opening punched and the tail bent. After the forging had been reheated, the mandrel was inserted and the Dog was turned at right angles to the previous forging plans and struck the necessary number of blows in the finishing dies. This operation removed the draft from the opening but at the same time threw out some surplus metal all around the edge of the hole. This was removed by a subsequent operation. Altogether it was a very slow and costly method of production and has since been abandoned.

Another instance of the attempted use of mandrels to form a hole, was the forging of wire rope sockets. It was thought that the tapered hole in the so called "basket" or hollow section of the socket in which the end of the rope is fastened, could be obtained by this method. The socket was first forged with the basket solid, but shorter and larger as its small end than its proposed final form. A straight hole about the largest diameter of the desired tapered cavity, was then drilled through the rudimentary basket; a tapered mandrel was inserted, and the attempt made to draw down the basket over this mandrel in a supplementary forging operation. After many trials the idea was abandoned. The basket is now forged solid and the tapered hole obtained by drilling and reaming. Much time, labor and money have been expended in other similar attempts to do by forging what should properly be accomplished by some other process.

Securing Additional Strength

Many pieces originally designed for castings are now made by drop-forging in order to secure increased strength without additional weight. In some cases the parts are not properly designed for the latter process and modifications in form are necessary before they can be produced. As the working of the metal during the forging operation automatically assures the absence of "blow holes," the increased cost of forging is considered of small moment in comparison to the certain removal of such possible defects.

In designing a part for drop-forging the necessity for "draft," or taper on its edges perpendicular to the parting line of dies, is not always fully realized by those not closely connected with the industry. It is a fact, however, that draft is absolutely essential to a commercial product if clean, smooth forgings are to be made. This taper is usually seven degrees. In deep, or narrow die impressions, or on odd shapes having a projection which must be "shot up" as it is termed, or forced into the impression in the upper die; the metal will not fill such a cavity so readily in the lower die, and in such cases 10 to 15 degrees of draft may be required. This increase in taper is often necessary also, at least to some extent, in holes or openings in forgings. These are formed by projecting "plugs" in the dies which generally require more draft than do the outside walls of the forging. This is so because the heated steel gradually cools during the process of forging and the metal in the forging itself contracts; consequently, it has a tendency, in shrinking, to stick on the die plug.

While it is possible to produce forgings with less draft than just cited, unless proper clearance is provided the dies deteriorate very rapidly indeed. Small cracks, technically termed "checks" which quickly grow larger and more pronounced, appear on the walls of the impression in the dies, forming corresponding projecting "fins" or thin slivers on the forging. These fins not only give the piece a very rough appearance but are often a positive detriment to holding the part properly in jigs and fixtures. There is no economy in attempting to decrease finishing expense by the reduction of draft only to create annoyance, delay and inaccuracy in machining, consequently increased cost.

Of course the regular daily product from such dies cannot be expected as the checks cause the forgings to stick in the impression, making it difficult for the operator to release the part readily from the dies while working. Furthermore, should less draft be taken than the best practice dictates, the very real danger of breakage, particularly where the impressions are deep, is intensified The expense of maintenance may be borne by the drop forging concern, yet if the dies fail, the customer is subjected to the annoyance and possible loss caused by the delay in replacement.

All these points are necessarily taken into consideration in estimating and pricing a job. In fact, so important is the question of draft considered, that it was one of the main reasons that led us to establish as our standard practice, the making of forging size drawings showing the exact degree and location of the taper for the customer's information before proceeding with the work. This matter of forging size drawing will be referred to later.

Another consideration that affects sometimes materially the question of design is the allowance or addition of stock to be removed by the customer in the finishing operations. We always recommend at 1/32 inch, even on small pieces where a machining cut is to be taken On larger parts this should be increased to 1/16 inch and on forgings like crank shafts 3/32 to 1/8 or more, depending on the character of the piece, should be added. These allowances for finishing are all in addition to such draft as may be necessary.

The Question of Limits

Regarding the question of "limits size." This expression can be taken two ways—(i. e.,) what is the minimum and maximun bulk or weight possible



A typical scene in a drop forging plant

a drop-forging, and, what is the closest to a given size to which it is possible to work. With equipment including hammers of the board-operated type from 300 lbs. to 3000 lbs. weight of ram and steam drops from 2500 to 3000 lbs. to 12000 lbs., we are producing a wide variety of parts both in our standard stock lines and in forgings made to the customer's order and design. The latter we call "Special Forgings." As might be inferred from the size of the smallest hammers just mentioned viz. 300 lbs.,—some of product is very delicate, quite a number of the pieces made in this equipment running 10, 12, or possibly more to the ounce. That is, 10 or 12 forgings would weigh one ounce.

Of course such parts can be made very fast as these light hammers operate rapidly and two or three forgings can be made at one heat. This is accomplished by working from the end of the bar steel, or other metal, instead of cutting it up into pieces suitable for the individual forging. The bars are cut to lengths convenient for handling—say about 3 feet—and the end is heated and forged. The forging is then severed from the bar by means of a "cut-off" attached to the hammer and another forging is made without reheating. This process can be repeated as long as sufficient heat is retained in the bar, but as the metal cools rapidly, two or three forgings are about all that it is safe to work before replacing the stock in the furnace. It is always more convenient to work from the bar, instead of using tongs, but in making heavy or larger parts this is not practicable and consequently the stock for such pieces is cut to length suitable for each individual forging.

Usually small parts require only one forging operation, and can be made fairly close to size—say a variation in thickness of 1/64 or 1/32 inch, depending on the shape and the size of the piece and the kind of material used. If greater accuracy is required they are sometimes restruck cold after they have been trimmed. This operation may be performed in the forging dies, or in separate striking dies made especially for this purpose. Type bars for typewriting machines are usually put through this process, so that the variation in thickness will not amount to more than a few thousandths of an inch. As the forgings increase in size they usually vary more both in thickness and in length. Connecting rods for gas engines are a good example of this tendency. Their typical design includes a large boss on either end connected by a thin shank of I beam section, the larger boss usually having a hole formed in it. On parts of this class, with a centre to centre distance of say 10 inches, a variation in the thickness of about .14" should be expected. In length the variation will run plus or minus 1/32 inch. Crankshafts being larger will show greater difference. For instance, on a four throw shaft about 43 inches long for an 8 cylinder motor of about 150 h. p. 3/32 inch variation in thickness, and plus or minus 1/16 inch in length would be required. Many larger parts are now being produced in the drop-hammer that would have been absolutely impossible only a few years ago, with the smaller machines then in use.



Showing a set of dies for automobile work.

With this increase in the size of forging equipment has come the possibility of enlarging the dies also, particularly in length, so that the manufacture of long pieces like automobile axles and six-throw crankshafts is now taken as a matter of course. In the old days, even a four-throw shaft was a very serious proposition and an axle was a fearsome undertaking. At this point, although the matter is not directly connected with the question of size, it may be of interest to refer to a great advantage possessed by drop-forgings as compared with hand work. By this is meant the preservation of the direction of the natural grain of the steel. Because of the bending provided by the preliminary operations in the drop-hammer, the fibrous structure of the bar stock in crankshafts, is continuous throughout the entire length of the forging-bearings, arms and wrist pins. In hand work under the steam-hammer, however, such continuous grain is impossible as the parts are made by drawing out the end bearings or shaft-ends, leaving a slab or chunk of solid stock from which to form the arms and wrist pins by machining. The metal between the arms is then removed, leaving the arms themselves with the grain of the steel running transversely to their length. The strength and stability of the entire crankshaft are undoubtedly adversely affected by these short-cross grains in the arms, although of course test pieces taken from the shaft ends, in which the original structure of the steel has been preserved, would not indicate the lower physical properties of the arms. The continuous grain of steel in a drop-forged crankshaft is shown very clearly if the part is pickled excessively.

The largest drop-forging of which I have heard was a traction engine, two



Producing crank shafts at high speed

cylinder crankshaft about 6 1/2 feet long with wrist pins and main bearings about 5 inches diameter, and rectangular arm sections about 4 by 6 inches. The weight of the forging was approximately 570 lbs.

Axle forgings will vary similarly to crankshafts, both in thickness and in length, so that proper allowance to care for this matter must be made in sinking the dies so as to enable the customer to secure a clean, finished surface by his machining operations. In considering the matter of variations, it must always be remembered that drop-forgings are not machine work, i. e. they are not produced by cutting tools such as millers, planers, boring-mills, etc., from which extremely accurate work can be obtained. The process in its final analysis, is really "machine blacksmithing" and consequently variations such as have been referred to, are absolutely necessary and must be expected. Although the die impressions are sunk very accurately to size, they will naturally wear in use, so that after they have made a few hundred or a few thousand pieces, as the case may be, they will have become enlarged to a greater or less extent. The amount of this enlargement denends upon the hardness of the die blocks, the difficulty of forging, the particular piece involved, and the material used. For instance, carbon tool steel must be worked at a lower forging heat than is permissible with so-called "machine steel" of either Bessemer or open hearth grade. In addition to being naturally "harder" than the two latter because of its higher carbon content, the lower temperature at which tool steel is necessarily worked in the drop causes an appreciable increase in the rate at which the dies deteriorate: consequently, other things being equal, forgings of this or other material that, for one reason or another, is difficult to handle, will tend to a greater variation in size than will parts made of the softer steels.

Producing of Intricate Shapes

Considering the restrictions imposed upon the production of drop-forgings by the application of only vertical blows with the part in a fixed, predetermined position established by the lay-out of the dies, it is surprising what can be accomplished in the manufacture of really intricate pieces. In producing many such parts the entire striking surfaces of the dies do not meet on a flat, horizontal plane, although there must always be a sufficient area of flat surface to absorb some of the force and shock of the hammer blows. Tools with such irregular meeting faces are technically called "locked dies" irrespective of the amount of this irregularity which naturally varies considerably, some dies showing merely a slight bend or inflection from the horizontal, while in others the "lock" may be several inches deep. Two instances familiar to all of us may be given to illustrate the use of such tools.

One of the steering arms attached to the steering-knuckle of an automobile is usually made somewhat in the shape of a letter Y with arms curved for clearness and the ends seldom if ever, on the same plane. Sometimes the difference in the height of these various ends is considerable. Of course, the part could be forged flat and then bent to shape, but so long as the quantity warrants, as it usually does, nowadays, it is better practice and cheaper in the end to make the more expensive locked dies to produce the desired angles and offsets, thus, avoiding the supplementary operation of bending. This is true also of many pieces that were previously forged flat and then bent to final form either by hand or by special tools in a press or hammer.

The second instance of the use of locked dies is that of lathe dogs to which reference has already been made. In order to produce the bent tail typical of the pattern in use in this country, the piece was tilted up and the dies so constructed that the bend in the tail comes in the bottom of the lock which resembles the letter Y with its arms opened or spread apart at the top. The introduction of this method of manufacture also made it possible to eliminate draft on the walls of the opening in which the work to be turned is held when the "dog" is operated on the lathe.

An interesting way of securing the seemingly impossible in a drop-forging is to forge and trim the piece complete, then with the part turned at an angle to the first plane of production, put it through a second and distinct forging and trimming operation. An example of this method of working is that of Eye Hooks with the eye at a right angle to the hook portion. To produce this result, the hook is forged with the hook portion in its final form but with a solid lump of stock for the eye. The latter is completed in a second forging operation. When parts are made as just described they have a tendency to vary more in length than is usual in forgings of their size which are produced in a single set of finishing dies.

Lamp brackets for automobile headlights require more than one operation to produce, and considerable ingenuity has been displayed in their manufacture. The problem, of course, is to distribute the metal properly and economically in the preliminary operations. One method is to forge the entire piece with the two arms straightened so as to come fairly close together—say a couple of inches apart. After trimming, the arms are spread and bent roughly to the final shape; the bracket is then completed in the finishing forging operation. Another way of producing these pieces, is to form the arms roughly from a piece of flat steel in a cold operation, then bend approximately to shape after which the entire bracket is forged as in the final operation of the first method.

The various illustrations throughout the article will give readers an idea, not only of how crank shafts are forged, but also the dies necessary in the making of an automobile drop-forging.

Before closing we believe a word should be said regarding the person responsible for the management of a drop forging dept. He should be, to our mind, a trained engineer, one who understands the capacities and capabilities of the plant under his control, and he should possess a practical knowledge of metallurgy. He should understand steel and its heat treatment, and he should be gifted with a live imagination as he will need such an asset to cope with the many and varied problems he will meet from time to time. We could go on indefinitely speaking of an ideal drop-forging plant manager, but we have already proved our point, viz, that a drop-forging is not a glorified blacksmith's job, but is indeed an art.

PREVENTING AMMMONIA LEAKAGE

The advantage of permanence, lower cost, and ammonia saving, gained by eliminating joints in ammonia pipe coils by Thermit welding as compared with installing ammonia flanged connections is being appreciated according to reports by the Linde Canadian Refrigeration Company, Montreal, Que., which handles refrigeration machinery for industrial plants and ships.

Since adopting this pipe welding process in 1918, the company has ordered material for welding in the neighborhood of fifteen miles of 1¼ inch extra heavy steel and wrought iron pipe for refrigeration units installed in a large number of industrial plants. The length of coil used varies from 500 to 5,000 feet. The whole coil is made up in sections of endless pipe. These sections are flanged and bolted together on the job. The sizes of the sections vary from 6 feet to 36 feet in length, and from 3 pipes high to 20 pipes high. There is one weld for every 20 feet of pipe used. No screwed fittings are used on any of these installations, but instead the pipe is bent to suit, and male and female flanges are connected together using a lead gasket. The coils are flanged before being shipped and tested to at least 150 pounds hydrostatic pressure test. In very few cases has it been found necessary to cut out a weld.

NEW PAPER MACHINES

The Laurentide Co., at Grand Mere, Que., have recently installed two new 166-in. news machines. This means that they will be able to produce marketable paper at the rate of at least 1,000 feet per minute. The machines have a daily capacity of 75 tons each, and were made in Canada. The Dominion Bridge Co., built these machines.

Making Back Gear Parts for Milling Machine

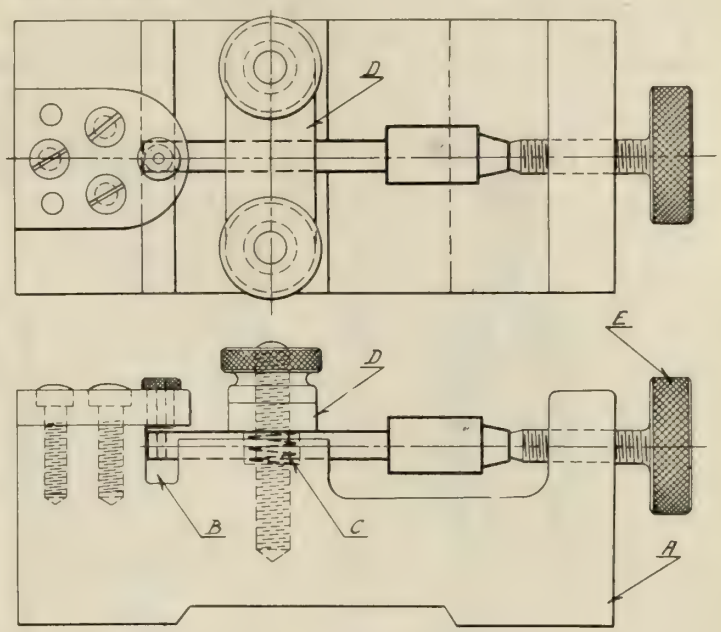
Operations on Back Gear Handle Quadrant—Three Are Required—Machinery of Spindle Bush—Back Gear Levers—Locking Pin—Retaining Bush and Knurled Grip—Rate of Production Given In Each Case

By G. BLAKE

FOLLOWING up the article on the making of back gear parts which appeared in the Nov. 25th, 1920, issue of Canadian Machinery, here are my views on the subject, taking the parts one by one. First, we shall consider the back gear handle quadrant.

Back Gear Handle Quadrant.

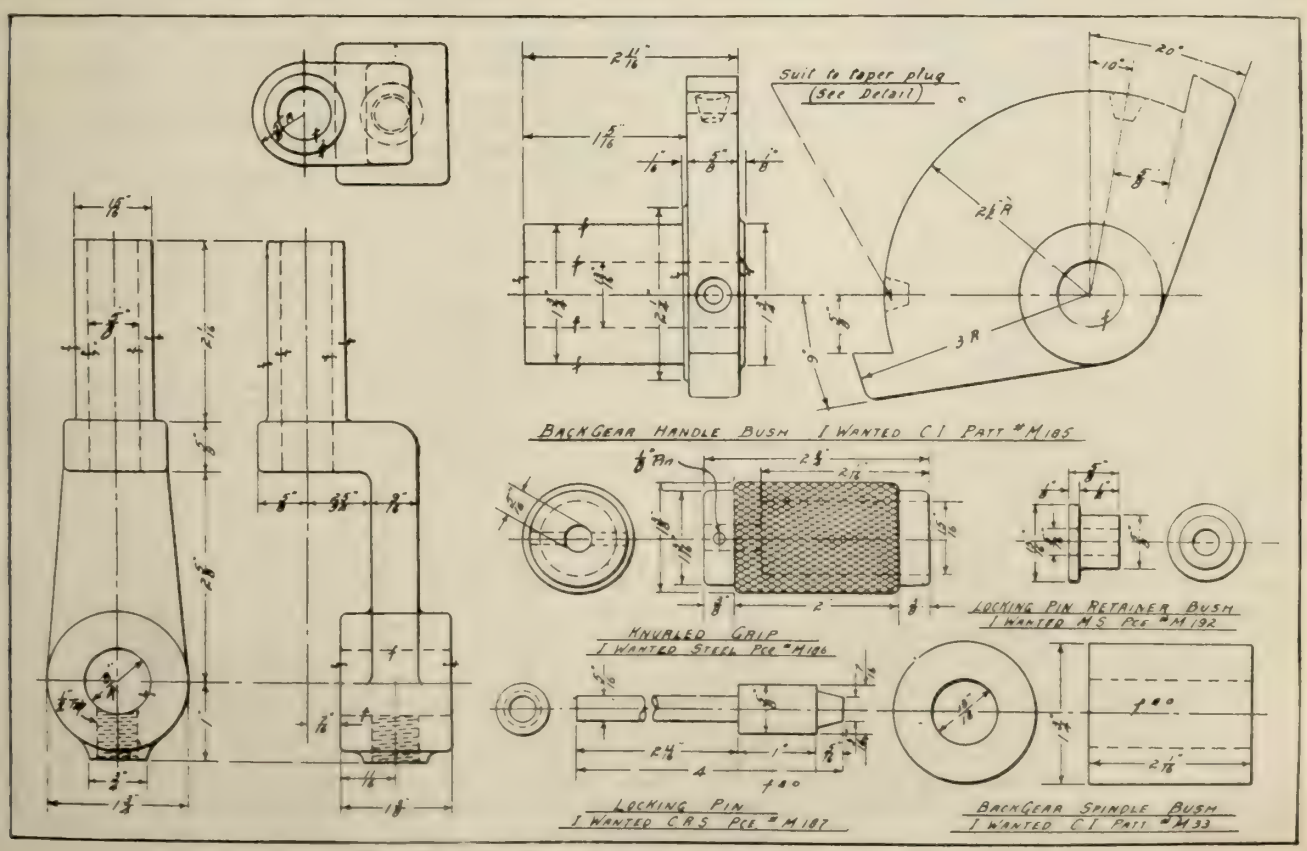
Three operations are necessary on this part. First, grip the piece in a three-jaw chuck, drill, bore and ream to 13-16 inch diameter, and face the boss. The quadrant is then placed on an arbor for the turning of the outside diameter and facing the opposite end. For the third operation a drill jig is used. The body A, is of cast iron, and the work is held in position by the two pins C, and locked on the supporting pin by means of a knob screw. A 5-16 inch drill is first entered to the required depth, after which the slip bushing is removed and a taper reamer used to complete the hole; a stop collar being fastened on the spindle to obtain the proper depth. When the first hole is reamed, a special stop pin is inserted while the second hole is being drilled and reamed. The production on this particular piece is six, eight to ten pieces per hour respectively, for each operation. The approximate cost of the drill jig will be $110.



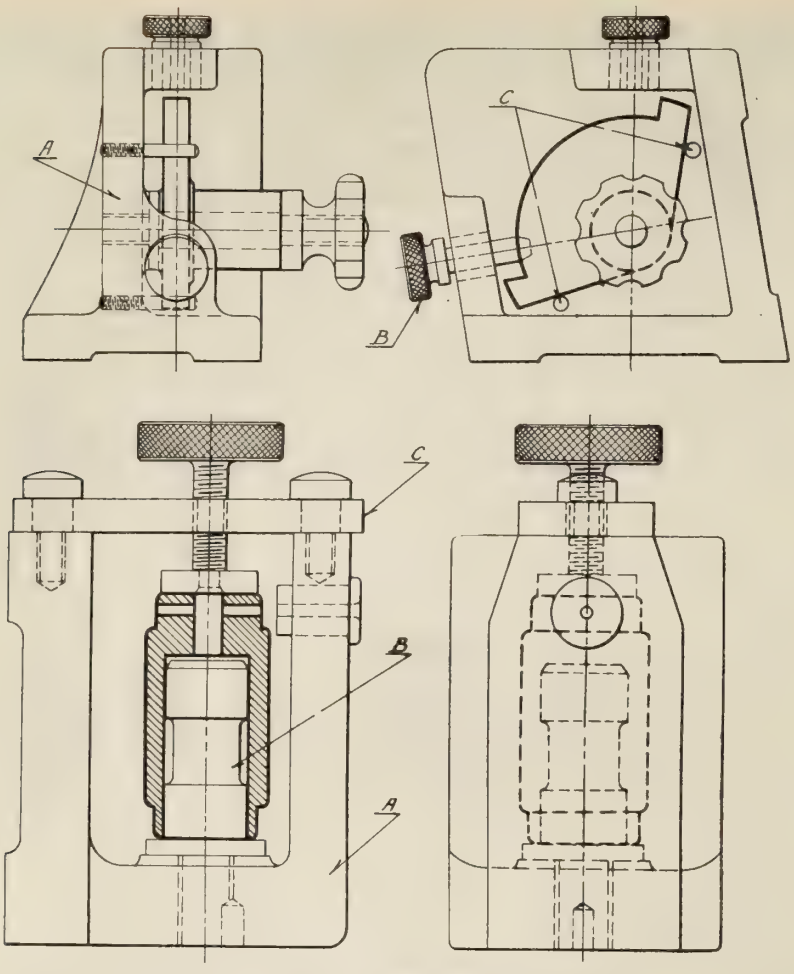
Jig used for drilling locking pin.

Spindle Bush

Next we come to the spindle bush. The machining of this piece does not



The group shows the parts which are under discussion.

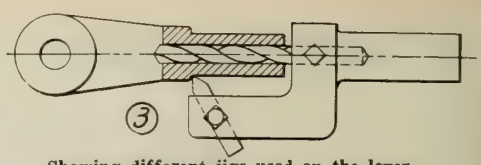


Showing the jigs used for back gear handle bush and knurled grip.

call for any special equipment. Use the knee tool for rough drilling and turning (the same as is used on the back gear lever). The making of this bushing is a simple capstan job, machining to the dimensions given. The capstan operations give a production of 5 pieces per hour, while the removal of the burrs after cutting off is done at the rate of 40 per hour. Specialized labor is used.

Back Gear Lever

The machining of back gear lever is performed as follows: The rough casting is gripped in the capstan and the hole in the boss drilled, bored and reamed to a diameter of three quarters of an inch, with the allowable tolerance. The inside face of the boss is faced off at this setting. The piece is then placed on an arbor, and the opposite side faced off so that the boss has an overall thickness of 1 3-8 inches. The lever is next located in a special fixture secured to the face plate of the machine, as shown at (3) and so arranged that the inside face of the boss is 7-16 of an inch below the axial center of the cylindrical portion. The outer end of the lever is supported by the adjusting screw A, after the lever has been securely fastened to the angle plate.



Showing different jigs used on the lever.

In addition to this support below the lever, it is held in proper alignment by two small pins C. The cross strap is bolted down on the work after all the other clamping has been performed. The angle plate is held to the face plate by means of four cap screws and two dowel pins. The outside diameter of the cylindrical portion is turned at the same time as the hole is being drilled, by means of the tools shown in the small sketch (3a).

The hole for the half-inch set screw is drilled and tapped in the fixture shown at (4). The two pins B, align the lever in a vertical position and prevent it from moving while in the fixture. The slip bushing is removed after drilling, so that the tap has a free entrance. The small pin hole in the turned portion is drilled in the jig shown at (5). The machining for the lever are as follows:

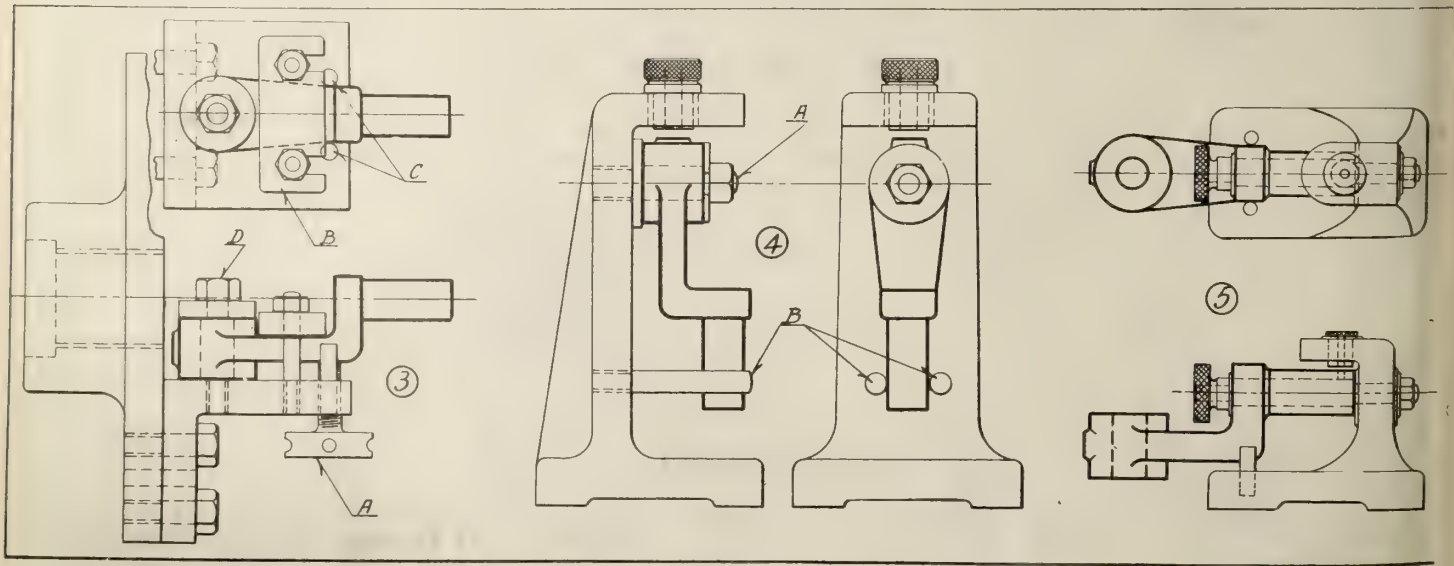
1st operation 12 pieces per hour, on capstan.

2nd operation, 15 pieces per hour on central lathe.

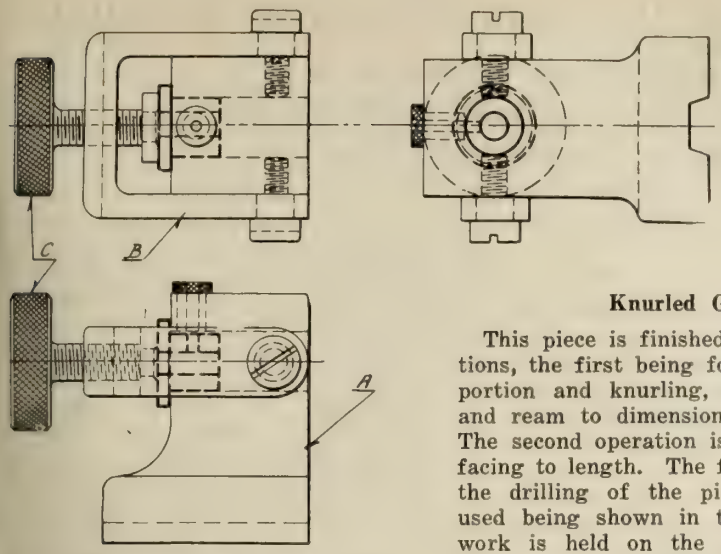
3rd operation, 4 pieces per hour, on capstan.

4th operation, 15 pieces per hour, on drill.

5th operation, 35 pieces per hour, on drill.



Showing turning of outside lever.



Drilling jig for locking pin retainer bush.

Using specialized labor on all operations, the cost of the fixture for the third operation would be from $90 to $125, and the knee tool $45 to $60. The cost of the jig for the fourth operation would be from $65 to $85, and the cost of the jig for the fifth operation from $55 to $70.

Locking Pin.

The first operation on this piece is accomplished on the capstan lathe, the details being, rough and finish turn 5-16 inch diameter, form taper and part off. The piece is then rechucked and the tapered end faced off. The last operation is the drilling of the small hole in the end of the straight portion. The jig used on this operation consists of a body A, made of cast iron, with a V-groove for supporting the work. The slot B, at the end is for the cuttings to get away. The clamping plate D is held by two knurled thumb nuts. The springs C, are for supporting the clamping plate when the nuts are released. The relative production times for the three operations are six, forty, and thirty pieces per hour. Specialized labor on all operations. Cost of the drill jig will be about $60.

Locking Pin Retaining Bush

This is a straightforward job on the capstan lathe; rough and finish 15-16 inch diameter, and likewise the 5-8 inch portion. The hole is then drilled, bored and reamed to size, after which the piece is cut off, leaving a little for facing off in the next operation, which is done by rechucking the bush in the capstan chuck. The drilling of the small hole in the side of the bush is performed in the jig shown. The body is of mild steel, the swinging bridge carries the locking screw, the washer on the end of the screw C being of the revolving type to prevent injury to the work. The rate of production will be as follows: First operation, 12 pieces per hour; second operation, 35 pieces; and the third operation, 40 pieces per hour. The cost of the drill jig would be about $45.

Knurled Grip

This piece is finished in three operations, the first being forming the outer portion and knurling, then drill, bore and ream to dimensions, and part off. The second operation is rechucking and facing to length. The final operation is the drilling of the pin hole, the jig used being shown in the sketch. The work is held on the pin B, and the screw in the swinging strap C, locks it in position. The washer revolves on the end of the screw to prevent scratching of the work. The rate of production is as follows: Four, thirty and thirty-five pieces, respectively, for the first, second and third operations. The jig cost will be about $60.

EXAMPLES OF CAST IRON CUTTING

Instances indicating the value of cast iron cutting as an economic factor in industry continue to multiply. The following cases are fairly typical of its emergency uses:

The superintendent of a large Indiana manufacturing plant, asked if he ever had occasion to cut cast iron, replied in the negative. In his opinion, it might be an entertaining stunt, but he saw no practical utility for the practice in his plant. Curiously enough, a few days later, in remodeling some of the powdered coal furnaces in the power plant, it was found that the cast iron floor plates for the upper deck were several inches oversize and would have to be cut off. The plates had been hoisted and bolted into position at one end before it was discovered that the other ends extended over instead of resting on the centre of the supporting "I" beam. The attempt to correct the fault by cutting off the excess lengths with drilling tools proved very slow work. After two and one-half days of continuous drilling, during which time gangs of brick masons and machinists were forced to wait in idleness, and only two of the four plates had been cut, the superintendent ordered a cessation of the drilling and asked the aid of oxweld operators to complete the job.

Using a standard oxweld type C-6 torch they cut the two remaining plates in one hour and forty-five minutes. The work was done so accurately that the finished plates were found to line almost perfectly with the centre of the beam. The plates were 1¼ inches thick and 60 inches long, the operation consuming 310 cubic feet of oxygen and approximately 100 cubic feet of acetylene. An interesting feature was the fact that the cutting was effected directly over, and without injury to, the beam.

Another demonstration was recently made at the works of a large Pittsburgh foundry where some heavy iron castings were cut by oxweld operators. It may be of interest to note that the acetylene for this job was furnished by a low pressure acetylene generator, and that, owing to the use of an oxweld type C-6 blowpipe it was not necessary to preheat the work, excepting as this was done automatically by the multiple jet flames of the blowpipe in pursuing the prescribed cutting manipulation.

BRITISH TURBO-ELECTRIC LOCOMOTIVE

Great secrecy is being observed regarding the turbo-electric locomotive which a leading British engineering firm is building for trial on a main line British Railway. It can, however, be stated that the principle adopted is similar to the system of electric ship propulsion which was first patented in Great Britain. The prime mover is a high speed turbine coupled direct to an electric generator; this generator supplies current through controllers to motors which drive the wheels through some form of gearing. The advantage of this arrangement is that it combines the great efficiency of the high-speed turbine with the flexibility of electric speed control. If the trials are successful they will probably lead to the conversion of many express steam locomotives to the electric drive. This turbo-electric locomotive is not to be confounded with a new type of "thermo-electric" locomotive which another leading British firm is building for experimental purposes. In this case the prime mover is an internal combustion engine of a novel and economical design, which can utilise any kind of crude oil. In countries where there is a deficient water supply along the routes of railways there is a good field for an internal combustion engine locomotive which proves to be really efficient.

TWO HINTS ON DIFFERENT SUBJECTS

By D. A. H.

If called upon to make an automobile axle or drive shaft in the smaller sizes, say 1-1/8 inch and under, and a length of axle steel cannot be located, the best material to use is a piece of chisel steel or drill steel. This is obtainable everywhere, it is a carbon steel of requisite strength, unannealed but soft enough so that it can be turned where necessary.

Planer driving pulleys of the larger sizes develop a rumbling, rattling noise as they wear looser and they thus get a chance to slap as they run. Circles of heavy pasteboard cut to fit inside the rim and applied to the inner and the outer pulley will greatly deaden this noise.

Improvement Necessary in Locomotive Design

Constantly Growing Passenger and Freight Traffic Makes Problem for Locomotive Designers—Efficiency and Capacity Should Be Increased—Labor Saving Devices Necessary.

By H. W. SNYDER

NO one, it is believed, will dispute the fact that the present-day operation of high-power locomotives is one of the most vital questions with which our railways are concerned. The demands of constantly increasing passenger and freight traffic have brought about a constant increase in size and power of aur locomotives.

It has not been so many years since an engine of 25,000 or 35,000 lb. tractive power was sufficient to take care of all requirements. Twenty years ago cylinders 22 or 23 in. in diameter were considered as about the limit in size. Constantly increasing demands on motive power since that time have brought us to the huge Mallet engines with tractive powers of from approximately 150,000 to 175,000 lb. Our simple engines have increased from 20-in. or 21-in. diameter cylinders up to 31-in. cylinders, with a tractive power ranging from around 35,000 lb. to 83,000 lb. In view of the rapid strides that have taken place in increasing the size and power of locomotives within the last few years, it seems rather out of place to predict that the maximum has been reached. It is also true that the use of improved devices has made possible the satisfactory operation of the large locomotives of to-day. Everything seems to indicate that we have not reached the maximum capacity of the locomotive even within the present limits of clearance and rail load, and we may expect to see these same engines made far more powerful and economical by the application of devices which are now available or which are already being given serious attention.

In view of the foregoing, the most vital matter which confronts locomotive designers and operating officials is that of increasing the capacity as well as the efficiency of the locomotives which we have to-day, and in the following paragraphs an attempt will be made to draw attention to some of the problems involved and upon the proper solution of which depends their success.

Combustion and Steam Generation

In order that large engines may operate properly, it is of course necessary that a sufficient supply of steam be furnished to cylinders so that they can be made to produce their maximum horsepower. It is not enough to provide a given number of square feet of heating surface in the firebox and the tubes—it is necessary that we take into account proper construction of the boiler, necessary firebox volume to produce the best possible combustion of fuel, and the design of grates so that fuel will be economically burned to such an extent only as required by the maximum evaporation of the boiler.

In producing heavy motive power it has been necessary on account of prohibitive axle loads to apply a sufficient number of axles under the engine to reduce the individual axle load to within reasonable limitations. This has lengthened out the engine to such an extent that boiler design and maintenance have become a serious problem. In the first place it is necessary to design a boiler that will properly function with the other vital parts of a locomotive. At the same time the length has become such that the use of combustion chambers is a necessity to avoid a prohibitive length of tube. Large engines have been constructed with a tube length of 25 ft. and it seems that no definite rule has been established as to what the limit of length of tube of a given size should be. Tubes 2 or 2¼ in. in diameter in excess of 20 ft. in length however are questionable, and this feature should be looked into carefully before a decision is reached.

The application of a long combustion chamber requires a large number of additional staybolts, and it would naturally be expected that a boiler of this kind would require more staybolt attention. Complete as well as partial installation of flexible staybolts has met with varying degrees of success on many railroads, but the consensus of opinion seems to be that their application goes a long way toward overcoming staybolt trouble. It has been proved by experiment that if flexible stays are properly applied to the boiler when built, while they may make a slight movement during the firing up of the locomotive, after the boiler has become completely heated and steam pressure raised these stays assume their original position. Although long combustion chambers require more attention in maintenance, this will be offset by the increased firebox volume and the resulting better combustion.

On account of height limitations, the height of the dome as well as the steam space in the boiler has been reduced to such an extent that difficulties are being encountered with the proper life and maintenance of superheater equipment, because too much water is drawn over through the throttle into the superheater. This is a question requiring experiment to determine as nearly as possible the minimum steam space which should be provided for boilers working on various grades. The height of the dome has a great deal to do with obtaining dry steam, and in the opinion of the author consideration should also be given to the height of the throttle above the water line as well as to the steam space in the boiler. Considerable development on this subject is now well under way and we can confidently expect results of value in the near future.

We have about reached the limit of size of cylinders and size of boiler due to road clearances, and to undertake to provide additional road clearance on practically all of the main lines to-day would mean a total expenditure of money entirely out of proportion to the benefits that would accrue.

On account of the apparent limitations of piston thrust and road clearances, the greatest problem we have with our large locomotives to-day is to increase their capacity without exceding greatly our present sizes. Anything to increase the hauling capacity of the locomotive without increasing the height and width limitations under which the locomotive must work might be called an essential capacity-increasing device. A few of these with which we are most familiar and which have proved beyond doubt their desirability are the superheater, the brick arch and the mechanical stoker, There are possibilities of still further increasing the efficiency of the superheater without increasing the size of the boiler in which it must operate. There are also possibilities and constant improvement in the design of brick arches which lend to higher evaporation and better combustion of fuel. It has been stated that when a locomotive requires as much as 6,000 lb of coal per hour it has gone beyond the limits of the ordinary fireman. Automatic stokers have been in use so long

Points Brought Out

In the opinion of the author, locomotive designers should study the problem of increasing the capacity and efficiency of present day locomotives. This should be done without adding much to their present size.

The design of driving boxes and driving box brasses has not successfully kept pace with the rapid increase in piston thrust. In the authors opinion we shall continue to have trouble in taking care of such brasses until a suitable design is produced—one in which the brass will cover much more of the front and back projected area of the journal than is now the case.

* Mechanical Engineer, Lima Locomotive Works. Abstract of paper presented before American Society of Mechanical Engineers at Chicago.

that their dependability for heavy power is no longer in question. Many men are studying this particular feature of locomotive design and operation, and we may confidently predict in the future a gradual increase in the efficiency of these mechanisms.

It has been proved without a doubt in foreign countries that the feedwater heater is an essential capacity-increasing device as well as an economical addiapaprently do not 3—chrld and thooob tion to the locomotive. In Germany they apparently do not now consider producing large locomotives without this device. In this respect, then, it would seem that we are somewhat behind the Euopeans, and there is no doubt that in the near future when the economies that can be effected by its use are realized it will become almost as general as the superheater to-day.

Another small item which has received only passing attention in this country is the variable exhaust. As is well known, a variable exhaust that can be properly operated and which will not require much maintenance attention will have a great tendency to relieve high back pressure at high speeds, and its operation will also provide the necessary draft at slow speeds. European locomotives in a great many cases are equipped with such a device which sems to give satisfaction.

The Engine Proper

There have been no radical changes in the general design of cylinders. The use of outside steampipes has resulted in advantages both from a casting and maintenance standpoint. It would seem well worth while to consider a design of cylinder by means of which the weight could be reduced to a great extent, permitting of additional weight of other parts and thereby increasing the capacity of the locomotive.

The design of valve gears has received a great amount of attention and many accepted types are now available. In all of these every effort has been to better the steam distribution. In maintenance we are far ahead of engines used twenty years ago. There is yet, however, much to be desired in steam distribution, and this subject will bear as careful study in the future as it has in the past.

Power Transmission

When we consider that as much as 150,000lb. piston thrust is being transferred through a single main rod and from this into the driving wheels of a locomotive, it is not difficult to understand why troubles are experienced with main crankpins and particularly siderod bearings at the main pin. In order to provide the proper strength to take care of this tremendous thrust it has been necessary to design extremely heavy main and side rods. Further the inertia forces, particularly in drifting, at times reach figures that are even greater than the piston thrust. Practically all of this must be taken care of through the main crankpin and the necessary connections to the side rods at this point.

All are familiar with the efforts made to produce a steel that would give a higher elastic limit than the ordinary high-carbon open-hearth steel successfully used until engines reached their present proportions. The employment of such steel for side rods, main rods and piston rods has been principally confined to heat-treated and quenched forg-

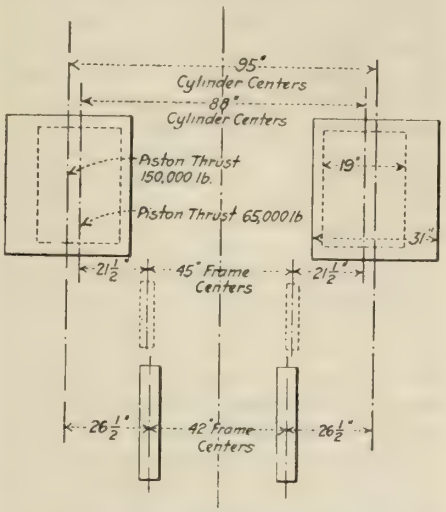


Fig. 1.—Diagram showing increase of overhang of cylinders in present-day locomotives.

ings, which are considerably lighter in section than when the ordinary open-hearth annealed forgings were used. Steel has also been produced which gives a high elastic limit and which can be successfully used with ordinary annealing. The use of such a steel does away with quenched forgings and permits of rods being heated for closing in straps and similar work without destroying the quality of the material as is the case with quenched forgings.

Main and side rods have been produced and have been in successful operation for the past few years in which the piston thrust is carried directly from the main rods to the side rods back of the main wheel. This does not in any way reduce the piston thrust that must necessarily come on the main rods. At the same time, however, it does reduce very considerably the piston thrust that must be transferred through the main crankpin into the side rods, thereby alleviating to a very great extent the troubles that have been experienced with large side-rod connections at the main pin. Such a design does not increase the total weight of the rods to an extent likely to cause any appreciable increase in difficulties from a counterbalance standpoint.

It is impossible to take into account all the stresses produced in rods when a locomotive is in operation, and for this reason the allowable fibre stresses in tension, compression and bending must be small in comparison with the elastic limit ordinarily obtained in such forgings.

Rod design is a study in itself and presents a subject the details of which cannot be covered in a paper of this nature. Hollowbored piston rods, light designs of crosshead and piston, the use of high-tension steel for side and main rods, as well as the use of hollow-bored crankpins, are familiar to all. More careful attention should be paid to the quality and upkeep of rod bearings, and every endeavor should be made to provide bearings of such quality and design that renewals will be reduced to a minimum.

Before the advent of our present-day large locomotives with their tremendous piston thrust it was not a particularly difficult matter to design a suitable main crankpin. In order for it to be of sufficient size to withstand heavier piston thrust and still maintain the fibre stress within workable limits, it was found necessary to increase the diameter proportionately. This brought up the question of rubbing speed. It is a well-known fact that if the rubbing speed is too high, bearings will heat and wear very rapidly regardless of the bearing pressure. A main pin designed properly for heavy piston thrust must therefore be so proportioned that the length will bear a certain relation to the diameter within very close limits. On account of the necessity for keeping cylinder centres as close together as possible because of road clearances, if a proper length of main pin is obtained, its proper size presents a difficult proposition. This is one of the great difficulties which the author is confident will be overcome in the future by the proper application of a design previously mentioned, wherein a large part of the piston thrust is transmitted directly from the main rod into the side rod, thus reducing the force that previously has been taken through the comparatively short and large diameter main side pin.

Counterbalance.

There is a great diversity of opinion in regard to the proper amount of counterbalance which should be applied to locomotives. We ordinarily think of a locomotive being counterbalanced properly when it will ride satisfactorily and without excessive vibration, and it seems that this is the rule by which counterbalance is judged.. There are in operation heavy Santa Fe type locomotives which have between 35 and 40 per cent. of the reciprocating weights counterbalanced, and they are said by traveling engineers to ride easy. The author believes that with our present heavy engines with long wheelbase it is not necessary to balance as much as 50 or 55 per cent. of the reciprocating weight. In fact, it is quite possible that we may be able to counterbalance a smaller percentage of reciprocating weight than has heretofore been attempted, especially for long, heavy engines, provided the revolving weights at the main pin can be properly taken care of. Every effort, however, should be made to balance all of the revolving weights on the

main pin. If, for example, we lack 400 lb. of balancing the revolving weight on the main pin, the effect on the track is exactly the same as if we had 400 lb. of counterweight on any of the other wheels to balance reciprocating parts.

On account of the extremely heavy weight required at the main pin in order to have the proper strength of parts, particularly for large freight locomotives, it is a difficult matter to balance very much—if any—more than the revolving weights at this point. This being the case, if as much as 50 or 55 per cent. of the reciprocating weights is to be balanced, it is easily seen that all of the counterweight for reciprocating parts must be added to the counterweight in the wheels other than the main. Thus, in order to balance a high percentage of reciprocating weights on engines of this class, it is necessary to add counterweight to the wheels other than the main to such an extent that track stresses and riding of the locomotive at comparatively high speeds become a very serious question.

The author is of the opinion that no definite set rule can be established in this regard, but that each particular design is a study in itself, and wherever revolving weights at the main pin are encountered such that they cannot be properly counterbalanced steps should be taken to provide the best means possible of reducing revolving weights at this point as well as providing reciprocating parts as light as possible consistent with strength. This of course has been accomplished in the past by hollow-boring the main pins and piston rods and by using a light design of piston head, which indicates that a steel having a high elastic limit with the proper elongation and reduction of area should be employed.

The Running Gear

On account of the large increase in the size of cylinders of present-day heavy locomotives over those used several years ago, the cylinder centres have been spread until they have reached practically the clearance limitations of the railroads; and the necessity for larger journals to carry properly the increased axle loads has caused the frame centres to be brought nearer together.

This condition increases very materially the distance from the centre of the cylinder to the centre of the frame, which of itself produces greater strain in the frame and at the same time increased pressures on the driving-box bearings as well as on shoes and wedges. In addition to the above, piston thrusts have increased from approximately 65,000 lb. to approximately 150,000 lb., and means must be provided to properly take care of the increased piston thrust along with the increased overhang.

Fig. 1, it is believed, shows very clearly the increased forces that a frame must stand in order to properly take care of the tremendous increases in piston thrust as well as the increased leverage caused by the very considerable lengthening of the distance between the cylinder centers and the frame centers.

Substantial and sufficient cross-braces should be applied between the frames and rigidly bolted thereto to form a rugged structure which will not rattle to pieces. Sufficient bearing for bolts and adequate bolting flanges are a very important feature. At the same time it must be borne in mind that there is a possibility of tying up the frame so rigidly that there will be a tendency for failures ahead of the front pedestal and just back of the cylinder to fit at a point where it is practically impossible to obtain sufficient reinforcement.

It seems as though the design of driving boxes and driving-box brasses had not successfully kept pace with the rapid increase in piston thrust. It is very evident that we shall have trouble in taking care of driving-box brasses until a suitable design is produced—one in which the brass will cover much more of the front and back projected area of the journal than is now the case. Many experiments have been tried, and in many cases they have gone beyond the experimental stage and have proved to be very satisfactory. Among these are driving-box brasses cast into the driving box. Many boxes are in use to-day where the brasses are keyed into the box, making them readily removable for replacement. However, the author feels that none of these has approached a solution to the problem which lies in producing a design that will surround the journal with a bearing as completely as possible and still lend itself to comparatively easy maintenance and reasonable cost.

Guiding and Trailing Trucks in Connection with Long Wheelbase

Santa Fe type engines with 22-ft. rigid wheelbase are not uncommon. Engines of this type and of this size will weigh in the neighborhood of 400,000 to 420,000 lb. When we stop to think that to move this tremendous mass of material around a 16 or 18-deg. curve a force of many thousands of pounds is required, is it any wonder that we obtain rapid flange wear and the necessity for returning tires before the proper amount of mileage has been obtained? In the majority of cases, it is believed, the force necessary to properly curve an engine of this kind has been applied at the front truck and the first driver. In most cases types of leading trucks have been used which produce a very small resistance on curves of small degree. In order to prevent rapid flange wear as well as to overcome the development of lateral play unnecessarily, designs have been produced which will give a high initial resistance of the front truck and provide a lateral motion for the front driver with adequate resistance so that some of the guiding force is transferred back to the second pair of drivers.

Since locomotives operate the greater part of the time on tangent track, it is necessary to have a high initial guiding resistance which will not be increased when curving. In other words, a flexible wheelbase is produced which has all the requisites of the ordinary rigid wheelbase, but at the same time will overcome many of the difficulties now encountered in an attempt to operate engines of this size and length. Many designs of trailing trucks have been produced with the idea in mind of helping to remedy the conditions which have been noted above. These of course have met in a way the conditions which it was necessary to overcome. What is needed is a positive centering device whose resistance will be adequate initially, can be always depended upon, and which will not mount up to prohibitive figures under the maximum swing of the trailing truck.

In addition to the foregoing, some work has been done in the way of producing a design by means of which the lateral play in locomotive driving wheels can be taken up without removing the wheels from under the engine or taking the boxes off from the axles.

The advent some years ago of the power reverse gear overcame one of the great objections that engineers had to large locomotives. It is a fact that it is almost impossible for one man to reverse one of our large locomotives equipped with the ordinary hand reverse lever. Power reverse has come to be an essential part of engine equipment and has been found to be economical even though it may be used on a locomotive which could be comparatively easily reversed by hand.

Probably no one thing contributes more to the failure of side rods than the improper adjustment of shoes and wedges. If these are allowed to run loose, stresses in the side rods will amount to a very high figure, and if they are improperly set up, the driving wheels are very likely to be out of true This in itself brings undue stresses on the rods, which in time will unquestionably produce failures. The author feels that there are many cases where in attempting to overcome the failure of side rods we have deliberately increased their sections without giving due consideration to the cause of failure. Consideration of the foregoing brings us to the point of providing an adequate automatic adjustment of the wedge so that the difficulties mentioned will not be encountered.

Means for Increasing Nominal Tractive Power

All railroads have points on certain divisions where there is a critical grade or the necessity of starting a heavy load under adverse conditions. At such places increased tractive power is required which is not needed elsewhere. We are therefore confronted with the problem of producing a device which can be set to work to increase the tractive power of a locomotive in such cases, thus enabling the engine to take its full tonnage over the entire division. This device should be so made that it can be applied when necessary and thrown out

when the additional tractive power is not required. Designs have already been produced wherein an additional tractive power of 8,000 or 10,000 lb. has been applied to the trailing trucks of large locomotives. There is also a possibility of applying such a device to the tender truck, thus availing ourselves of the adhesive weight of the tender to help boost the engine over the critical points in a division. There is always present a possible potential boiler capacity which can be brought out by the use of a variable exhaust or other device sufficient to obtain rapid combustion at slow speeds.

The Ash Pan

The question of ash pans is also one needing serious consideration. There are in use a number of rules stating what the proper air opening in the ash pan should be, and while many of these rules have in a way proved satisfactory, it would nevertheless seem that to get at the question logically we should determine the amount of coal that can be burned economically per square foot of grate and then on this basis provide an ash-pan air opening that will give the required amount of air to burn satisfactorily the maximum amount of coal which is expected to be consumed. The amount of air that will flow through a given opening in the ash pan, it is believed, can be very closely approximated from the vacuum produced in the smokebox. This of course is only a suggestion, and it may be that when the question is looked into more carefully a more desirable and accurate method of determining the required ash-pan air opening may present itself.

Lubrication

With our present high superheat the proper introduction of oil into the cylinders and valves of a locomotive is worth serious consideration. In many cases oil has been provided to both the cylinder barrel and the steam chest of superheater locomotive, and in other cases it has been provided to the steam chest alone. Both methods have given apparent satisfaction, but it is a difficult matter to state which is the better. It is common practice in European countries to provide a forcefeed lubricator located very close to the cylinder, with a pipe to each end of the piston-valve steam chest. This oil supply opens directly over each end of the valve when it is in central position. In addition an oil pipe is supplied to the cylinder at its center. It is reported that by this method there is less carbonization of the oil than when it is fed into the steam pipes or into the center of the piston-valve steam chest.

In order to increase the tonnage which a locomotive can haul it is just as vital to decrease the resistance as to increase the power. Now it is not an impossibility to provide roller bearings for passenger cars, and there seems to be no reason why they cannot be used on freight cars. The reduction of rolling resistance and the better facilities for lubrication which would be provided would be sufficient in time to overcome the necessary expense.

This question of lubrication may as well apply to other parts of the locomotive. The proper grooving of side-rod and main-rod brasses, or the use of babbitt inserts are questions that should be taken up in connection with lubrication of these parts.

In summing up the situation, it may be said that the use of the superheater alone has increased the capacity of locomotives when compared with saturated engines of the same design to such an extent that no one would think of building a large locomotive for up-to-date railroad service without the application of superheat. We must not content ourselves, however, with what has been done with this one device. What we need to do now is to avail ourselves of the opportunities offered in the application of many of the labor-saving and capacity-increasing devices which have already been worked out and are giving satisfactory service, and at the same time look forward to the possibilities of applying other devices which are yet in their infancy, but which have proved without doubt that they are well worth our consideration and are of sufficient importance to warrant their adoption. Without the capacity-increasing devices which have been mentioned the large locomotive of today would be impossible. It could not be operated satisfactorily. Our large engines are an absolute justification of these improvements. Further developments are ready at hand and in their use lie the possibilities of still more powerful and economical transportation units built to operate within our present limitations of clearance and permissible rail loads.

CONDENSED LAP JOINT TABLE

In selecting the best joints for water tanks, the question often arises whether it is more economical to use the thinnest possible plate with as many rows of rivets as possible, or a thicker plate with fewer rivets. With the net section required for any joint as a known quantity, the question of the proper combination for plate thickness and rivet size is somewhat of a problem. Most lap joint tables are of little assistance in helping you to settle the question, as a number of selections are usually possible.

Recently "Water Tower" presented the table shown, and as it is unusually concise we reproduce it for our readers benefit. Speaking on the subject the writer says that the user has no choice whatever but to take the joint giving the required strength. In the table, however, they have taken the ordinary complete lap joint table and eliminated the undesirable combinations, leaving only what they believe are the most economical joints for water tank work. The plates vary in thickness from ¼ inch to ½ inch by sixteenths of an inch. Plates thinner than ¼ inch should not be used for water tanks on account of corrosion. Plates thicker than ½ inch should be joined with butt straps on account of greater economy. No thirty-second inch thicknesses are given as these are usually odd weights, not kept in stock, and in normal times more difficult to obtain.

Furthermore, the pitch is not based on the extreme maximum efficiency obtainable, but is a number divisible into 69 inches, this being the distance between gauge lines of a 72-inch plate. A 72-inch plate is selected because it is one of the most common widths and a size usually kept in stock by tank manufacturers. In calculating the joint, the pitch giving the highest efficiency was first found and this modified slightly to conform to the above conditions. The true efficiency and net section were then calculated and in all cases are but slightly under the maximum. This gives a joint which more nearly agrees with actual working conditions than a joint based on the highest possible efficiency.

The usual assumptions are used in calculating the table; namely, the ratios of the values of the steel in tension, shear and bearing are as 1, ¾ and 1.5, and ⅛ inch was added to the diameter of the hole to allow for damage to the plate in punching.

LAP JOINTS FOR WATER TANKS

PLATE THICKNESS	RIVET DIAMETER	NUMBER OF ROWS	PITCH IN INCHES	EFFICIENCY %	NET SECTION SQ INCHES PER INCH
1/4"	5/8"	1	1.92	47.9	.120
		2	2.46	69.5	.174
5/16"	5/8"	2	2.23	66.0	.206
		3	3.00	73.5	.230
3/8"	3/4"	2	2.65	66.7	.250
		3	3.45	74.6	.280
7/16"	3/4"	3	3.14	72.2	.316
		4	3.83	77.1	.337
1/2"	3/4"	4	3.45	74.6	.373

The United States census bureau have issued figures showing the number of establishments and value of output of smelting and refining plants in the copper, lead, and zinc industries. In the copper industry there were 33 establishments in 1919, compared with 37 in 1914. The output in short tons (2,000lb.) at smelters and refineries respectively in 1919 amounted to 655,486 tons and 931,790 tons, compared with 575,069 tons and 782,854 tons in 1914. The works engaged in the lead industry in 1919 numbered 25, against 22 in 1914, while the output of smelted material amounted to 485,612 tons and 563,810 tons respectively. Zinc works numbered 38 in 1919 and 29 in 1914, while the output of smelted product amounted to 465,743 tons and 353,049 tons respectively.

Welding of a Caulking Edge on a Boiler or Tank

It Pays to Know More Than the Regular Routine of Work—Putting Refractory Plates and Angles in Place—Building Up a Broken End of a Shaft

THE welder who knows only the regular tasks, never goes far. He may hit up against some difficulty, and it is then that his resourcefulness is under test. The matter to follow illustrates and explains some interesting and useful welding dodges, so that those interested in this branch of the business should read each hint carefully, remembering them for future occasions.

For example, Fig. A shows a method of making a lapped plate joint where the edges do not come together flat or the plate bulges between the means provided to hold them together, such as a few bolt holes spaced some distance apart. Another use for this scheme is getting refractory plates and angles in place in ship barge work and perhaps later this scheme will be used in large size ships. The idea is simply to tack a bolt by its head upside down on the lower or inner plate, tacking it by single fillet across two edges only. The heavier plate used as a clamp is then brought down with a nut to bring the upper or outer warped plate into place. After this plate is tacked down and nut can be removed and the bolt knocked off at right angles to the weld or if this proves troublesome, one of the welded beads can be chipped off and then the bolt head can be knocked loose pushing from that direction. This method should be acknowledged to Mr. W. T. Bonner, who devised it and first used it in ship work.

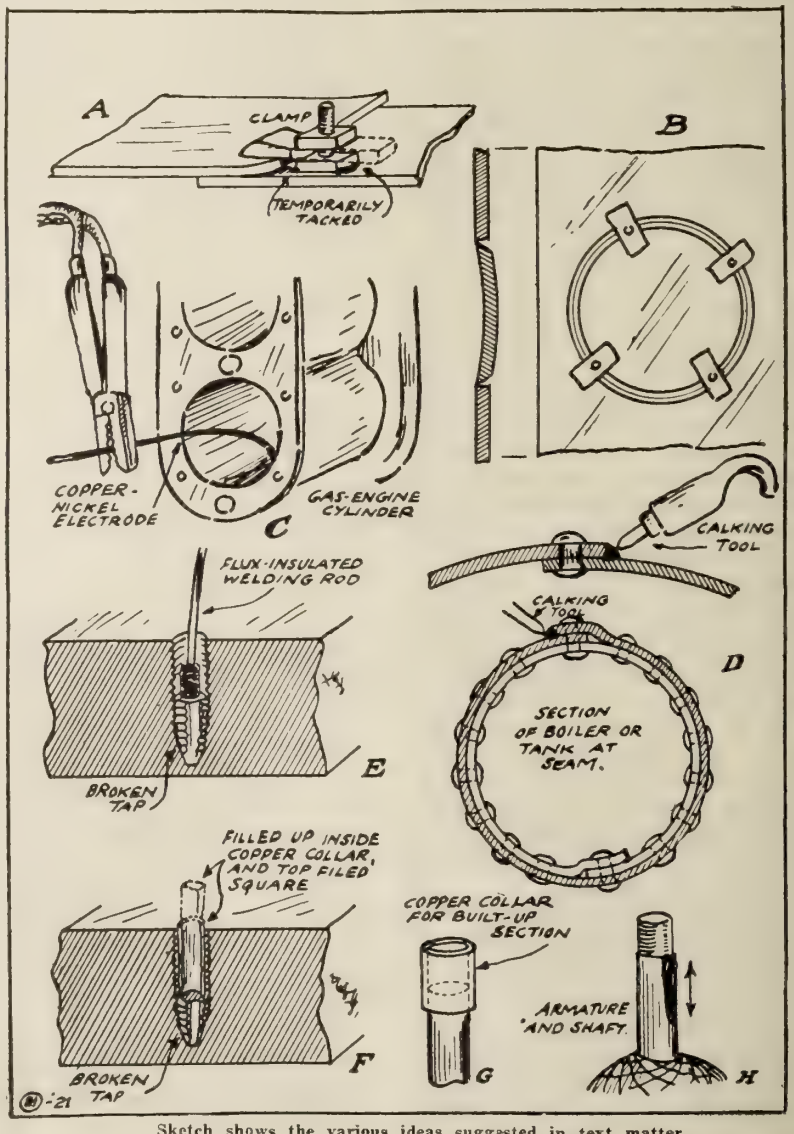
Illustration B shows a method of putting in a patch in a plate whether a plane, round or warped surface where much trouble has been experienced in keeping a welded patch from cracking during the welding or after welding or in service or where from experience such danger is liable. In the cross section you will note the patch is slightly dished, the idea being that the contraction during welding will just about take up the dishing and straighten out the plate that is used as a patch relieving all strains. The ideal patch in this case is a circular one but oft times a true circle cannot be arranged for but the nearer a circle is approached the better the chances are for success. For instance, if the hole is rectangular, rounding the edges will help a whole lot and if the hole is odd shaped, making it an ellipse or egg shape will approximate the circle where the stresses are even all around.

Where a machine formed dished patch cannot be obtained an ordinary sheet can be dished by hammering. If the sheet is over ¼ inch thick it should be hammered hot and it is best hammered hot for any thickness.

The four clamps show an easy method of holding the plate in place, simply putting a bolt through from the inside and clamping down with a heavy plate and nut on the outside. These clamps should be left in place as long as possible in this rigid system of welding. This system not being at all applicable to the non-rigid system as it is a rigid weld with the stress tranferred to the dished patch.

Fig. D shows an apparently easy job to the initiated, that is the welding of a caulking edge on a boiler or tank. This job is far from being easy, because in most cases the welder is called to fix up a leaky seam and the cause of a leaky seam is movement of the plates or rivets. Simply running a caulking edge along the joint will in general make the seam tight when not in use, but upon the boiler tank being put in service, especially under pressure, the plates are liable to assume a different shape or position under load than when quiet, the strain then being entirely brought upon the weld whereat it is broken or pulled away, adequate provision not having been provided to equal the strength of the plates to which it is welded.

It is not always the correct thing to do to make this weld stronger than the plate. In a boiler, for instance, where rivets have been installed for part of the seam, it is best to fire up the boiler and put it under full pressure, thus straining it into its final position before welding. Illustration D shows how a caulking seam should be approached with the tool so as not to drive the weld under the plate. A great deal of experience is needed in caulking for arc welding just as caulking experience is



Sketch shows the various ideas suggested in text matter.

Extracted from a handbook published by the Electric Arc Cutting & Welding Co., Newark, and reproduced through the courtesy of said company.

maker knows that an amateur will do needed for rivet work. Every boiler with a caulking tool more harm than good and similarly in welding; too much caulking is harmful instead of beneficial. A multiplicity of light rapid blows is the only reliable caulking method on a weld, whether the caulking is for a smooth finish or to make the surface denser against weeping. Also, too much caulking will cause the surface of the weld to crumble and repeated caulking of this nature will finally result in crumbling the welding all away.

Caulking rough looking welds for a finish is common practice, but in this case the rougher part of the weld must be chipped or ground approximately the size before caulking, or the efficiency of the weld will be much lowered, both as to strength and tightness. Working a weld cold except on the surface would be similar to working a sheet cold of similar dimensions which could be easily cracked or ruined. Working the weld hot is a different matter, but it is almost impossible to caulk metal arc welding while hot, although in many instances on very careful work each inch or two is caulked while hot (just after it is put down) with a ball peen hammer in the hands of the welder. In very few instances the weld can be reheated and caulked but these are very scarce as reheating would in general cause more strain and stresses than would be relieved by caulking.

Filling In Scored Cylinders

Illustration C shows the proper method of filling-in scored cylinders with the latest development, the copper nickel electrode, which has the property of so merging with cast iron that the usual hard spot underneath the weld is done away with. This copper nickel electrode is far better than the old pure nickel peened in, as the copper nickel can be welded in continuously; care being taken not to get the cylinder wall too hot, that is weld not over two or three inches at a time. The excess metal can be machined off with any common ordinary tool or a lathe or boring mill or can be ground nearly to size and can then be rolled and lapped afterwards.

The illustration shows the electrode bent so that the tip is approximately at right angles to the score to be filled. This is a repetition of previous instructions on this point, i.e. that no arc weld can be made properly unless the electrode tip is very nearly at right angles to the work piece surface. For this copper-nickel electrode even although the score is very small at least ⅛ inch size electrode must be used, as 130 amperes is about the smallest good value that will reliably weld the cast iron and a ⅛ inch electrode is the smallest that will carry this current. For larger work a 5/32 inch electrode is best.

Fig. E. and F. show two methods of reclaiming broken taps in thick pieces or castings which method is not new by any means. There is nothing more exasperating than to break a tap, especially a bottoming tap below the surface of the main piece. The tap must be gotten out or the work is ruined. If the hole is large an insulated rod can be used to build up on the tap until it is above the surface where a square can be filed on it and tap backed out. The insulation on the rod helps to prevent spoiling of the thread by accidental contact. The method here is to weld a bit at a time or if you have become expert at dipping in and out of the puddle, the building-up can be made practically continuously by shorting the arc in the puddle and pulling away to a very short arc before the puddle freezes, This method is also very useful in building-up oft-times at other places than in a hole.

Where the hole is small an extra tube shoved down inside the threads will allow of the added metal being built-up to the surface in order to file a wrench grip to back out the tap. Illustration G shows a method of building up a broken or chewed off end of a shaft where the end is not more than 4 inches to 6 inches long. The copper collar is here banded on the inside, the collar being not more than 1½ or 2 inches higher than the welding surface at any time, being pushed up successfully as the bilding up progresses. This method is far better for short pieces than trying to weld on a piece as it does away with the necessity of veeing out, aligning, etc.

After the weld is made the copper collar should be removed and a finish made for subsequent machining by welding lengthwise of the shaft, similarly as is shown on the armature shaft, illustration H. These welds should always be made lengthwise of the shaft in order to ensure an even deposit because in welding around the other way the welding setting is only right for one position and is too hot for the vertical welding and not hot enough for the horizontal. This welding of armature and other shafts, by the way, where the bearing is worn or scored or the keyway is chewed out, is one of the most useful applications of arc welding, as there is practically no danger of putting heat enough into the shaft to melt adjacent babbitt or ruin adjacent windings.

The illustrations on the sheet and angle work show some special applications of joining two or three or even more of the regular structural members for structural work. When joining two plates at an angle, if the sheets are left a bit spread the pieces can be joined reliably in the one weld. The wider the plates are apart, the more reliable will be the joining of the inner three pieces and at no time should the plates be apart a smaller distance than their thickness. The illustration to the right of this shows a method of stiffening a sheet either for attaching to an upright or not.

The angle bending and welding method shown in the center top is one of the most widely used applications of arc welding but is shown as an idea to extend the arc as arc welding is only started. You will note that any angle can be allowed for by cutting out the V to correspond. The illustration to the left of this shows a method of joining by a combination of arc welding and bolts, members which must be removable. The window frame method itself is self explanatory, it being found much easier to chamfer off the window slightly than to make a flush weld and perhaps ending by having to chip the weld. The corner sheet method is similar to the joining of the three pieces explained at the start of this section. A weld made in this manner and finished off a bit is the prettiest joint yet devised.

Where an angle would be objectionable or the plates are small the weld can be butted on the outside at right angles and not welded at all or just welded for finish only.

Unique Method of Welding

A unique method of welding is shown left of this where a lapped joint must be made for a third member and the three of them joined. The illustration shows how one of the plates is nicked out and the other one laid over the notch half way the width of the notch so that the weld can be made through this opening to the third member, at the same time joining the two sheets. The sketch of the veed out plates is shown for several reasons, one that the angle of the "V" must vary with the thickness of the plate for an even flush butt weld, being thicker for heavy plates. In general, however, a right angle opening is the maximum required.

Welding long seams butted brings up the question of the rigid or non-rigid method. In the rigid method the plates are clamped or bolted in their final alignment and the weld made in any manner, either continuously or broken up to spread the resulting contacting stresses over more time and plate. In the non-rigid system the plate is placed close together at one end and the part at the other end and the weld made continuously closing in the opening at an even rate which will just bring the closed ends together at the finish of the weld. This method requires more skill and experience than the non-rigid and in any ordinary job is not worth the trouble it entails, although for very careful work it may be desirable to use it where joining two pieces only.

It is evidently more out of place in setting in a patch as the only part of the patch on which this method can be used would be the first seam. There is a use for it, however, even in setting in patches in some very rare cases where the difference between success and failure depends on getting the first edge of the seam perfect so that it will not be pulled away due to the contracting strains when welding the opposite seams or the seams at right angles which exert a more tearing pull than the opposite seams in contracting.

An aid which is hard to obtain but which has been found very useful in very careful work is to vibrate the work while making the weld by light blows of the hammer or vibrating the work directly after the weld is made, i.e., while it is cooling and contracting. The vibrations of an air hammer set for a light blow is the best means for accomplishing this.



WHAT OUR READERS THINK AND DO

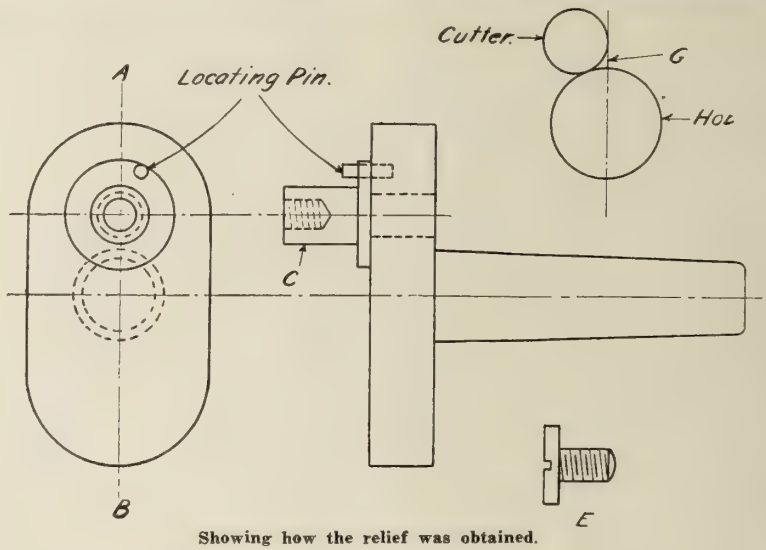


TOGGLE ACTION PLIERS

By F. M.

An unusual construction as applied to pliers is shown by the accompanying illustration inasmuch as the action of squeezing the pliers causes the jaws to open parellel with the pliers in such a way that they hold open the spring tempered ring shown in position.

These pliers consist of a pair of jaws A and B, jaw B is in part an extension of handle and frame C, attached to C by means of a pivot screw. D is a handle E, arranged in such a manner as to form a toggle. Operated by E is a link F. This is attached to jaw A by means of a screw G passing through an elongated slot in the frame portion of jaw B. In addition a spring H holds the operative handles apart, thus it is evident that by merely pushing the handles together, through the medium of link F, the jaws A and B are caused to spread apart to perform the desired function of opening the ring.

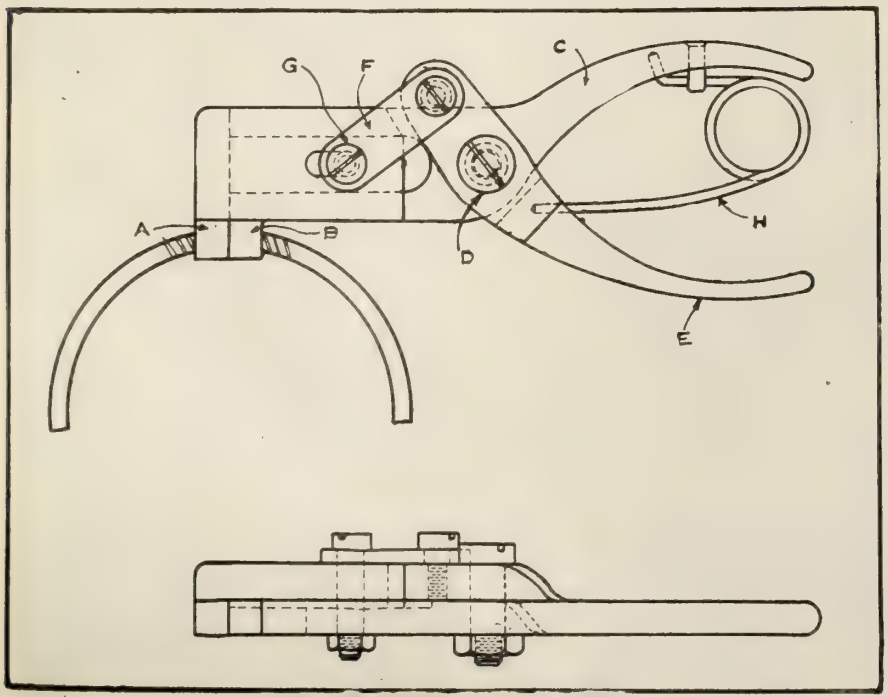


Showing how the relief was obtained.

RELIEF ON THREADED HOBS

By G. Russell

The jig shown in the accompanying illustration was recently developed to obtain the necessary relief on threaded hobs of the ring type on the milling machine. The Hobs were fluted in the usual manner having 12 flutes, the index head being placed with the worm screw at right angles to the face of the miller. The jig was placed in the head centre with its centre line A B at right angles to the table. The hobs were placed on stud C. A pin was used for locating, and was placed the distance of one flute off the centre line. The hob was held by screw E and an end mill was next placed in the miller to remove the excessive stock, being set up as illustrated at G. The worm crank was gradually turned by hand until the cutter ran into the next flute. Reversing the worm crank and loosening the clamp screw, the hob was turned one flute repeating the operation until all flutes relieved. Substituting the end mill for a threaded hob the operation was continued in the same manner until completed.



Showing the method of using the pliers.

KILLING "ATMOSPHERICS"

One of the most troublesome difficulties in wireless telegraphy is the interference caused by what are known as "atmospherics." The receiving instruments are affected by electric waves which arise no one quite knows how. They are worse during the day than at night and also during certain weather conditions. For many years a British company has been striving to overcome this difficulty and it has at last been rewarded by the discovery and perfection of a device by which the effect of "atmospherics" can be quite eliminated. What this means in practice is that existing wireless stations can carry far more messages than they have yet been able to do. Every now and again the use of automatic signalling at high speed had to be given up and oral reception employed, owing to the way in which the atmospherics played havoc with the machine records of the signals. A skilful operator could disentangle the human signals from nature's freaks, but the speed at which an operator can receive is limited. It is not too much to say that this invention will multiply the efficiency of wireless telegraphy ten-fold.



The Benefit Of Copper

AFTER conducting a series of tests to determine the relative loss of metal in tie plates of various compositions, including those containing a small percentage of copper, the New York Central lines have arrived at the conclusion that tie plates rust less when a certain percentage of copper is existent.

The length of time over which these tests were conducted varied from two years to a maximum of six years, and in fact some of the tests are still in progress. In all cases the maximum corrosion developed on the bottom or under side of the plates, contrary to the generally accepted theory of most engineers and maintenance of way men that the maximum corrosion takes place on the top or exposed portion. The percentage of copper in the plates containing that metal ranged between 0.25 per cent. as a minimum and 0.5 per cent. as a maximum, the plates so treated being rolled otherwise, according to the standards of the New York Central. The copper-treated plates so obtained were subjected to the same tests as the other plates. An exposed test on a number of steel tie plates rolled from mild Bessemer steel containing 0.25 per cent. copper and a number rolled according to the same specifications without the copper content showed an average loss of 8.88 per cent. for untreated plates and only 1.46 per cent. for the treated plates.

A second exposed test was made which covered a larger number of tie plates rolled from metals of various compositions. The plates used in this instance were cleaned and then exposed on the roof of a building at Hoboken, N.J., where the action of the salt air of New York Bay could be studied. Tests showed loss on the copper plates from 0.46 to 0.72 per cent, averaging 0.56 per cent.

In comparing the data so obtained the nearest approach to the results reported from the copper-treated plates was a loss of 0.59 per cent. for high carbon open-hearth steel, too hard to punch. The pure iron plate came next, with 1.17 per cent., and then the high-carbon Bessemer plate, with 1.77 per cent., the latter also being too hard to punch. The remainder, which were standard steel tie plates, varied from 4.70 to 6.60 per cent., showing for common or regularly accepted tie plates 8 to 10 times the loss for the special copper-treated ones.

* * * * *

Systematic Disposal Of Waste

THERE IS more than one method of selling waste material. Speaking on a recent policy adopted by the Crompton & Knowles Loom Works, on the other side of the line, "Iron Age" says that in the above factory a department has been created especially for the economical disposal of waste.

The principal items disposed of are wood, cold drawn steel, hot rolled steel and iron, tool steel, pipe and miscellaneous items such as glass rods, solder and so forth. The chairman of the committee is a member of the purchasing department, who is in a position to determine the relative values of articles recommended to be manufactured from scrap materials.

The committee meets the first of each month and the chairman calls on each member separately concerning scrap produced during the previous month for which he is responsible. A report is then submitted as to the quality of scrap on hand according to classification. This material is properly cared for in the stockroom, where men in charge are familiar with department raw material requirements. The labor charge of working up salvaged material actually is larger than it would be otherwise, but not sufficiently so to more than offset the savings in raw material cost. Workmen much prefer not to handle salvaged material; consequently, there is a tendency to eliminate it as much as possible.

In the company's foundries a Make-Every-Ton-Count committee is incorporated to work in conjunction with the main plant reclamation committee. Ways of disposing of scrap materials are varied. It is not always possible to net the company a profit, especially on falling markets, but instances cited illustrate the resorcefulness of committee members in the early part of last year.

* * * * *

Saving Worn Machinery

A BRITISH engineer has developed a method of depositing nickel on the worn parts of machinery. This, of course, means the saving of many machines which would otherwise be useless. It is already well known that welding has been used to build up engine crank shafts after they have reached a worn condition, the process being to weld fresh iron or steel on to the worn parts, and the whole then made true in a lathe. There are objections to this process in certain cases, and in order to overcome these objections, the new process has been evolved. Following is the method employed: The piece of machinery to be treated is first made free from grease and dipped bodily in a bath of molten wax. After the wax has cooled it is removed from the parts which have to be restored and is left on the others as a protective covering. Cleaning in a bath of acid is followed by immersion in an electro-plating bath which deposits nickel on the exposed surfaces. The coating of nickel is extremely hard, and when the process is properly carried out the nickel adheres with remarkable tenacity to the metal on which it has been deposited. Crank shafts, spindles, axles, pistons and similar objects can be made quite serviceable again by the nickel layer at a cost below that of replacing the whole part. Deposits up to one-eighth of an inch can be applied successfully. It is expected that this process will be developed alongside the welding processes which have been brought to so high a pitch of usefulness in many repairs, such as the mending of cracked or broken castings, which could not be handled by the deposition of nickel.

* * * * *

Proofing Fabrics

FABRICS may be proofed against soiling or staining by applying a solution of cellulose nitrate or acetate to the surface. The penetration of the solution into the fabric is prevented by impregnating it with some such volatile liquid as benzine before applying the cellulose solution.

A patent has been granted on a process of using insoluble alginates formed on fabrics by padding them with a soluble alginate and then passing them through a bath of zinc sulphate or similar heavy metal salt, and, according to "Scientific American," the alginate separates in a collodial form, giving a water proof finish which is said to resist a boiling neutral dye bath. Balloon fabrics are rendered more impermeable to gases by the use of a mixture of rubber and cellulose acetate. This is applied in the form of a collodial mixture in such solvents as tetrachlorethane.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Unfortunately, every reader had a different idea as to the correct solution of the questions in the Sept. 1st issue. Question No. 6 seemed to be the one that fooled the greatest number as only two readers had this particular question correct. No one however, submitted a complete correct list, so that we will award two scales for the contest next week.

CONTEST FOR SEPT. 22ND ISSUE

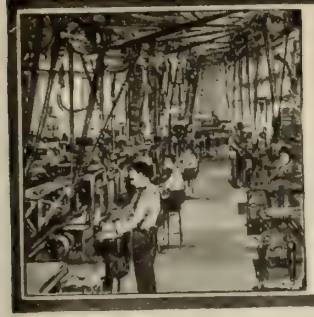
Contestants are required to write us, stating to which advertisements we refer in this number.

1.—How to get tanked up in spite of prohibition.
2 A case where preference is weighty testimony.
3- How to double the outdoor working hours.
4—A product produced at the rate of 3.333 per minute.
5—Something that pays in the long run.
6—A short life as a bad investment.
7—One of the secrets of efficiency.
8 Something that cries aloud for attention.
9 A good investment.
10 Something that does not depend on bulk or weight.
11—Small but capable of large work.
12 Something with quick smooth control.

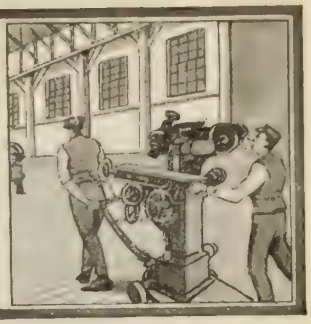
These are Correct Answers for List from September 1st Issue

1—Flexible Steel Lacing Co.
2—Fellows Gear Shaper Co.
3—The Burke Machine Tool Co.
4—The Warner & Swasey Co.
5—The Carlyle Johnson Machine Co.
6—The Chas. Parker Co.
7—American Lead Pencil Co.
8—Heald Machine Co.
9—Skinner Bros. Mfg. Co.
10—Landis Machine Co.
11—H. B. Underwood Corp.
12—Vanadium-Alloys Steel Co.

Closing Date for This Contest is September 27th



DEVELOPMENTS IN SHOP EQUIPMENT



SAFETY TOP HOLDER

The Apex Machine Co., Dayton, Ohio, have placed on the market a friction slip tap holder. The principal feature of this device consists of the arrangement which permits of slippage within the holder itself, in case the tap becomes wedged or strikes the bottom of the hole. It is said to be particularly adaptable to use on multiple-spindle drilling and tapping machines. Because of the small outside diameter of the device, use on multiple-spindle machines is quite easy. The tap holder will operate in any position, whether horizontal, vertical or inverted. These holders are made in two sizes. Type A has a body 1¼ in. in diameter and 3 in. long, and will tap all sizes of holes up to and including ½ in. Type B has a body 1¾ in. in dia- [illegible] will tap holes [illegible] the collet the tap is driven by the square and held in position by means of two dogs mounted in a slot at the end of the collet, with the ends protruding into the flutes of the tap. The collet may be inserted or removed by raising the sleeve.

A very large amount of friction surface is said to be provided in the holder, by the use of a number of alternate steel and fibre washers, thus making it easy to maintain the adjustment of the holder. The amount of friction may be quickly adjusted when changing from one size of tap to another. The holder embodies a 3-16 in. vertical float movement, to allow for a slight variation in the lead of the tap. There is also a lateral float of 1-32 inch.

TOOL BITS

The New England Tool and Machine Co., Springfield, Mass., has placed on the market a line of tool bits which are manufactured under a patented process. They are made to fit standard tool holders taking square stock in the following sizes:—3 16 in., ¼ in., 5/16 in., ⅜ in., 7/16 in. and ½ in. These tools are cut from annealed bars. The thread tools are ground on a special block and the flat and angles on the U. S. standard threads are ground with the same operation, proper clearance being allowed. They have a cutting edge on both ends and are offered to the machine shop trade with a view to cutting down production costs by eliminating time spent by workers in grinding tools. Their size permits checking in and out of tool cribs as are drills and other tools, thereby eliminating loss sustained in tool bits as usually handled in the shop.

ROTARY SERVICE GRINDING MACHINE

The Pratt & Whitney Co. Hartford, Conn., have placed on the market a rotary-table surface grinding machine which is equipped with an 8 inch wheel. This machine is intended primarily for the grinding of disks, rings and cylinders requiring flat and parallel surfaces and the maker claims that the sturdy, compact construction permits of heavy [illegible] are provided for grinding concave or convex surfaces.

The spindle is mounted on ball bearings, which are protected from dirt and provided with adjustments for wear. The wheel is cemented in a holder screwed to the spindle, to facilitate changing, and a band clamped around the wheel guards against breakage. Surrounding the wheel is an adjustable steel guard which automatically covers the entire wheel when it is raised to the idle position, so that chuck work can be handled safely.

The machine contains several other features and belt drive is regularly furnished, all necessary guards being provided. The main drive shaft and idler pulleys are mounted on ball bearing to take the load. The two-speed gear shaft is mounted on bronze bearings to take the load. The two-speed [illegible] bearings being lubricated by the splash [illegible] ible coupling takes care [illegible] Individual [illegible] ...nished.

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The Value of Suitable Clothing

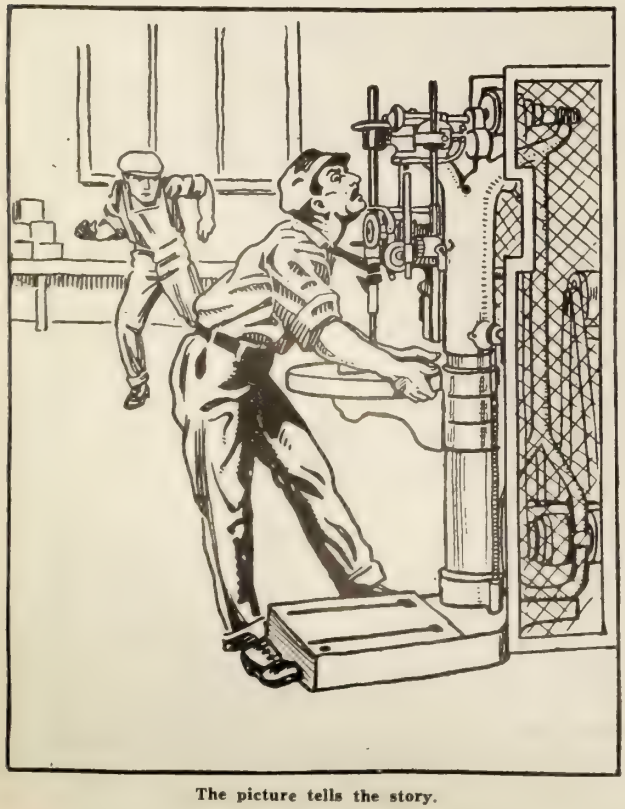
THE MISSIONARY work being accomplished by the various safety organizations throughout the country cannot be overestimated. There was a time, and not so very long ago, when accidents were considered a sort of necessary evil which, like the poor, would be always with us. The foolishness of this viewpoint has been brought home very forcibly during the past few years, and by means of educative methods, the number of industrial and general accidents has been reduced considerably.

In the early stages of development, workers in industrial plants were rather inclined to view the movement very much in the light of a new fad which would soon die out. The results accomplished soon convinced them that here was a sane movement worth backing to the limit, as it not only suggested, but in some cases enforced the necessary precautions. Efficient guards on machines are now a common sight, rather than an oddity, and it is the machine which is not properly protected which now causes comment. All this has taken time, and there is still much to be done, but the results so far have been reassuring and comforting.

One of the danger points which still exist in some plants is that of improper clothing. Usually a man or woman gives the subject of clothing little thought. They dress neatly, no doubt, but do they put on attire to suit their particular occupation? Take, for example, the illustration shown on the present page. Did the operator of the drill press ever imagine the loose end of his tie would get caught on the drill spindle? Of course not, for otherwise he would have used a neat, serviceable, and inexpensive tie clip to hold all loose ends securely. A little matter, yes, but a very important one.

Lest there be those who are inclined to treat the illustration as an exaggeration, let us quote a case in point. Some years ago, in a certain plant in Hamilton, Ont., an otherwise capable radial drill operator got caught by the shirt sleeves on the spindle of the machine. Before anyone could shut off the power his arm was broken and his back badly injured, owing to the drill swinging him sharply against the large casting he was working with. The shirt manufacturer would no doubt like to get the brand of shirt which held so efficiently, but looking at the thing seriously, what happened? Simply the fact that the operator hadn't rolled his sleeves up CAREFULLY. A small matter again, but think of the result.

No matter how trifling, it pays to be careful. If overalls are being worn, see that no loose flaps are hanging. If the shirt sleeves are rolled up, watch that the rolling is firm and neat. In the case of women, they should avoid waists with frills and loose edges, in fact any portion of their attire should be as simple as possible. Wherever a shaft, belt, or object of any nature is in movement it pays to watch the matter of proper clothing.



The picture tells the story.

* * * * *

Not A New Idea

"HENRY Ford is going to revolutionize railroading." At least that's what one would infer from the various stories which have been printed lately regarding his activities in the railroading game. Looking at the matter more closely, however, what do we discover? Simply that Mr. Ford is going to follow up a practice which is not only in existence, but has proved a decided success.

Anyone who visits Great Britain for the first time might be tempted to laugh at the miniature coaches and cars as used on that side for railroading purposes. The laugh however soon turns to wonder, for the speed and efficiency with which railroads in general in Britain are handled cannot help but call for favorable comment.

There is no question but that light cars save time for both the manufacturer and the railroad. They are easier to handle, take up less yard space, and naturally can be carried along at a better speed, and at less fuel cost. In the case of perishable goods the benefit of speed is all the more evident.

While we cannot expect a sudden change of policy, the time is gradually coming when lighter cars will be in use on many of our railroads. For some purposes the heavier cars will still retain their important position, but for general haulage a car of lighter design will be used. This in turn will mean added life to the rails.

The above comments are not intended to detract attention from Henry Ford's capabilities as a railroad owner, for he has already shown what he can do in this respect. He has taken a losing proposition and turned it into a dividend paying road. In a few years he may have worked similar wonders with his railroads, as he has with his world-wide known car.



MARKET DEVELOPMENTS



Market Situation Shows Further Improvement

Seasonal Activity In Steel Business—Production of Steel Mills Has Increased to 33 Per Cent. Capacity—Machine Tools Are Selling at Fair Rate of Speed—Scrap Market Poor

BUSINESS conditions continue to improve and with the exception of the scrap market, all lines show improvement. Steel production has increased in volume, being now 33 per cent. of capacity. Of course this figure is not an ideal one, but it is much better than the amount shown in the middle of July. The steel men also look for a steady gain from now on.

The machine tool market reports better business. Enquiries continue to come in and in many cases they look like real orders. On top of that this branch of the market has been working on prospects for some considerable time so that some nice sized orders are expected in the near future. Railroads are again beginning to buy, and several orders are reported. This business is expected to attain larger proportions in the near future.

The small tool dealers report a steady demand. While the orders are of the hand to mouth variety there are sufficient of them to make the going worth while. Dealers in this branch of the market are quite satisfied with their position.

The scrap market remains dead. Nobody wants to buy. This applies to consumer and dealer alike, so that one cannot expect a change in this line for some time to come.

The harbor at Montreal is experiencing considerable congestion owing to grain shipments. Elevators long since out of use are being brought into service. The grain freight situation is responsible for the present condition, and in fact so bad is the congestion that several shipments have been diverted to Quebec in order to eae up the Montreal end.

PRICE CHANGES IN SEVERAL LINES GENERAL BUSINESS IS PICKING UP

Special to CANADIAN MACHINERY.

PITTSBURG, September 22.—The latest report is that the Steel Corporation is operating at about 33 per cent. of capacity. Independents seem to be averaging about the same rate, though some are well below that rate and some well above it. If the industry as a whole is not operating at 33 per cent, it is not far below the rate. As production sagged below 20 per cent. at the middle of July there has been a very substantial recovery.

The present rate is, however, a very low one by any long range comparison. The point is that production recently was far below what anyone dreamed could occur. An interesting point about a 33 per cent. rate is that it represents approximately the minimum tonnage thought possible before the war. That is, the idea then was that the poorest demand that could occur would give the mills about a 50 per cent. operation at least, and the actual fact was that in the whole history of the steel industry, prior to the latter part of 1914, after the war had started, operations never went below about 50 per cent. of the capacity existing at the time. As there has been an increase of about 50 per cent in the capacity since 1914, a 33 per cent of capacity since 1914, a 33 per nage as a 50 per cent. operation in 1914, viz., about 17,500,000 gross tons of steel ingots a year, or about 185,000 net tons of finished steel a week.

Price Changes.

The best evidence that prices are nearly if not quite at bottom, as long as wages, freight rates and other fundamental items of cost are at their present levels, is that steel prices are moving both ways now. Our last report recorded an advance in wire products, prices having advanced $2 a net ton on plain wire, $3 a ton on barb wire, 10 cents a keg on cement coated nails and 15 cents on wire nails, the new prices being $2.60 for wire, $2.45 for cement coated nails and $2.90 for wire nails.

Against these advances in wire products may now be set reductions just made in tubular goods. Under the lead of the National Tube Company (Steel Corporation) new discount lists have been issued under date of July 16. Standard steel pipe is reduced, from the list of July 7, 1921, four points on all sizes of butt weld, four points on 9 to 12 inch lap weld and five points on 2 to 8 inch lap weld, the reductions therefore being nominally $8 to $10 a ton. Lap welded steel boiler tubes are reduced five points, while oil country goods are reduced about $10 a ton. The announced reductions in oil country goods are approximately equal to the average amount of shading there has been for a couple of months, while the reductions in pipe are much more than even the extreme shading.

By a similar antithesis, bars, shapes and plates are weaker while sheets are stronger. In bars, shapes and plates it is now relatively easy to place small orders at about $1.65, while attractive orders are reported to have gone at close to $1.50. On the other hand all the independent sheet mills but two or three have advanced their prices $5 a ton, and the American Sheet and Tin Plate Company (Steel Corporation) seems to be on the verge of making the advance. The independents that advanced are now quoting $2.50 on blue annealed, $3.00 on black and $4.00 on galvanized. It appears that they were careful to book all the business they could lay their hands on at the old prices before making their advances.

Wire products and sheets have evidently been too low. Even with a moderately full operation the mills could hardly break even, while with the light operation they have had they show losses. It is true they would have losses if they did not operate, as the overhead would continue, but the mills are apparently concluding that it is unwise and impolitic to allow competition to carry them so far that their losses in operation would be as heavy as their losses from idleness.

Present prices of steel products in ordinary lots, taking wire products at prices before the advance, since the dis-

tributors are covered for about 60 days, are about 28 per cent. above the ten-year pre-war average, 1904 to 1913 inclusive, and about 62 per cent. above the low point of December, 1914, while they are 40 per cent. below the war-control prices of 1918. This means, of course, that there has been a very thorough liquidation, as great a liquidation as can be expected of the mills when they are still paying wages 50 per cent. or more above the wages of 1914 while freight rates are up 75 to 100 per cent. and other fundamental items of cost are much higher than before the war.

General Business.

The fact must be emphasized that steel demand has been having a movement of its own, not in relation to the general business of the country. In the late months of last year and the early months of this year more steel was shipped than was needed for actual consumption, resulting in piling up stocks of steel and of manufactures of steel. These had to be liquidated, and during the process of liquidation the demand upon the steel mills dropped to an unprecedentedly low rate. At the middle of July steel production was at less than 20 per cent. of capacity, but it was not the case that 80 per cent. of the workers in the country were out of employment, or that the freight movement of the country was only one-fifth of normal or that the movement of money through banks was reduced in any such ratio.

The sum total of business in the United States in the past few months has been but little below the volume in 1920 and it is possible even that it has been greater, but there has been a different distribution. House building and road building materials have been moving better than in 1920. The money turnover in stores may be less, but on account of reduced prices the volume of goods handled may even be slightly heavier. The condition is not universally recognized, but it is proved by incontestible statistics.

The condition in steel has been that of a very subnormal demand, in relation to the work the country is actually doing. There is much talk of "unemployment" but there has also been much talk of factories producing more goods with greatly reduced forces, simply because men work now while many in 1920 were drawing wages without doing much work. The number now "unemployed" is said to be nearer 6,000,000 than 5,000,000, but in 1920 the total number of persons receiving wages or salaries was about 45,000,000, and if the remainder were on full time, which is not the case, they would probably, on account of working harder, be doing more work than the whole 45,000,000 were doing last year. With so many men on part time it is possible the total quantity of work being done is somewhat reduced, though that is by no means certain.

Obviously the steel industry is marked for further increase in employment, as stocks are liquidated and normal relations are restored. The tonnage rate of steel production has increased by between one-half and two-thirds in two months, but this does not mean that general business has grown more active by that amount. It means that steel is moving back towards a normal relation to business generally.

POINTS IN WEEK'S MARKETING NOTES

The Steel Corporation is now said to be operating at about 33 per cent. capacity. As production sagged below 20 per cent. at the middle of July, the present rate shows a substantial recovery.

Steel prices are moving both ways. This would look as if present prices are nearly if not quite at the bottom. Advances have been made on items as announced last week, while reductions here now taken place in tubular goods.

According to Pittsburgh reports, the steel industry is marked for a further increase in unemployment, as stocks are liquidated and normal relations are restored. It would appear as if steel is moving back towards a normal relation to business generally.

Montreal Harbor is experiencing considerable congestion at present. Grain freight rates are chiefly responsible for this condition. In fact so great is the congestion that considerable quantities have been diverted to Quebec.

The railroad shops are doing a fair share of repair work, and are buying small tool supplies from time to time. Small jobbing shops are also receiving a good amount of general business.

Several lines in the Toronto market show a reduction, and there is a rumor that some Canadian made machine tools are coming down in price. The latter statement is not verified however.

Small tools are still moving at a steady rate. Purchasers however buy only what they actually require, so that while business is steady, it is not for very large amounts.

The scrap situation is the same as last week, and it looks as if no change will take place for some time. Nobody seems to want to buy, even the dealers, who are sitting back calmly waiting for results.

The British Air Ministry are offering prizes for designers and inventors who submit specimens of safety tanks for fuel in aircraft. These prizes will reach as high as 2,000 pounds, and all entries have to reach the air ministry not later than Nov. 7th. The tanks will have to be ready for test by Dec. 1st.

TORONTO MARKET SHOWS IMPROVEMENT

TORONTO, Sept. 22nd.—It doesn't require a man with an optimistic nature to report better business conditions these days. Some little time ago, when you asked a dealer how business was he would generally say: Business, what's that?" But now his answer is entirely different. He will perk right up when you ask him the same question and say smilingly: "Oh, we can't complain at all. Business is rather better this week," etc. In other words, there is a feeling of confidence which was badly needed in the market. Not only is business better, but everybody seems to feel it will still further improve as time goes on.

"People have got tired waiting for still lower prices which cannot come," said one dealer. "They forgot for a time," he continued, "that we had actually lowered our prices, and were waiting on them to buy. It can't be expected that we can reach 1914 levels in all lines again, for our production costs are altogether different from those days."

Following this idea up, Canadian Machinery asked a dealer in machine tools and general supplies how present prices were in comparison with his 1914 figures. "I don't see that that would get us anywhere," was the reply, "because," continued this dealer, "our production and selling costs are altogether different from 1914. Take for example the following items: Our labor costs, the paper used for correspondence, packing, etc., the cloth bags; our rental, the packing cases and numerous other things entering into the cost of the product to be shipped have all gone up. Why then can people expect a 1914 price level? It's out of the question under present conditions."

A Novel Scheme.

Another machinery dealer told Canadian Machinery of a scheme which he would have very much liked to see put into effect some time ago when things were at their worst. In fact he suggested to one of the firms which he represents, that they try it out. However, for some reason or other the suggestion was not taken up, but viewed in the aftermath of events, the scheme is well worthy of consideration.

It was this dealer's idea to have the firm advertise broadcast the lowering of prices to the 1914 level. This naturally was a risky thing to do on the face of it considering the fact that such a price would never cover the actual cost of production. The scheme went further than that however. After two or three weeks, it was proposed to have the same firm announce that they found it impossible to sell their product at this low figure, therefore were forced to raise their prices 15 to 20 per cent., but that orders would be taken for a period of 30 days at the old figure.

The next month a similar announcement of further increase would appear

and so on until the price had reached where it should actually have been in the first place. In other words educate the buyer that machine tools cannot be made for a mere nothing. Those of course, who bought at the lowest figure would be the ones who would benefit, but it is very unlikely that many would have bought at rock bottom, for it is human nature to wait until the upgrade in any commodity has started before buying commences. However the scheme was not tried out, but we cannot help but wish we had seen the result of such an action.

Speaking to another machine tool dealer on the value of the Toronto exhibition as an order getter, this particular dealer stated that he believed he had received good results from his efforts to please at the exhibition. "Many of the prospects I met," he said, "were men I could not reach in any other way." While no actual orders resulted, the prospect of business in itself was well worth while.

Taking the machine tool trade as a whole, this week's business can be said to be very good. Enquiries are coming in every day and many of these look like real orders. The railroads have started to buy a few odds and ends, and this business is expected to increase very shortly. The Durant Car Co. coming to Toronto has caused considerable activity among dealers. At present it looks as if this new company will be an assembling proposition only but even then some equipment will be required.

In the supply business there have been some reductions, these including several lines of pipe, fittings, steam gauges, pressure gauges, a few valves, etc. The Yale and Towne Mfg. Co. have announced a reduction in their lines, and there is a rumor to the effect that Canadian-made lathes are due for a drop. A peculiar point has come to our attention regarding the price of torches. Some time ago the price of these came down to 1914 levels, then gradually they were boosted until now they are sold at the same figure as they were at previous to their drop. Almost sounds like the machine tool dealer's idea adapted to torches?

The Steel Market.

Seasonable improvement in the steel market continues. Sheets are moving quickly, also structural material of all kinds. Reinforcement material is especially active. Prices remain very much the same in all lines, and buyers seem to be more ready to close business.

Small tools are plodding along in steady fashion. Dealers in these lines are not worrying. Business is good considering general conditions, so that they are content to pick up what they can get. One dealer reports that while he was on the road he found that everybody he met was sure business was on the royal road to recovery.

The only branch of the market that needs to hold its head down this week is the scrap market. Consumers are right out of the market and dealers refuse to sell at lower prices, or to stock up any further. Asked if things looked better for next week, one dealer said that one was between the devil and the deep sea so far as the scrap situation was concerned. "To my mind," he concluded, "things are going to be dull for some time yet." The market from every angle but the latter looks good however, and there is every reason to feel confident that things are on the upgrade.

MONTREAL HARBOR IS CONGESTED RAILROAD SHOPS DOING REPAIR WORK

Special to CANADIAN MACHINERY.

MONTREAL.—For the past few weeks there has been a distinct improvement in general business conditions throughout the province, which fact seems to conform the statement that has been so often quoted, namely, "that the corner has been turned" and that we are at last on the upgrade. The week just passed has brought in some satisfactory reports. The fact that some of this business was seasonable trade, and only of a temporary nature, however, cannot be denied, but at the same time a large proportion of the business improvement reported is of a staple and permanent nature. The movement of supplies for heating plants, sheets for stove pipes and range boilers, etc., are all enjoying a largely increased business during the last few weeks.

Shipping along the water front of this city has been particularly active and the present congestion in the harbor is greater than anything that has ever been experienced before. This condition is a result of freight rates on grain for export via Montreal from the American ports of Duluth and Chicago, being cheaper than via Buffalo and New York and a large quantity of American grain is passing through Montreal, and this added to the regular shipments of Canadian grain has created the congestion. In fact considerable quantities of this grain have been diverted to Quebec to relieve the situation there. All the local elevators are working to capacity night and day and the old floating elevators, idle for ten years or more, have been pressed into service. The local press reports that the Harbor Commissioners are seriously contemplating extending their operations to the South Shore and erecting grain elevators at Longueuil.

The railway shops are doing a fair share of repair work and although buying no new equipment are in the market for small tool supplies from time to time. Small jobbing shops seem to be enjoying their fair share of trade. The larger shops have been actively engaged in looking up orders and they seem to have been successful in gathering in a number of small orders, but the large ones are conspicuous by their absence. This situation, however, enables these shops to keep their plants in operation and their organizations more or less intact.

Building seems to be going on in a comparatively satisfactory manner, and plans for next year's business indicate a greater activity than has been seen locally for a number of years.

The only quarter where steel seems to be moving in any quantities is in sheets and plates. The usual large demand for stove pipes is creating a demand for sheets. In addition there has been quite a large call for the heavy type of sheets also some light plates. There has been an increasing demand for range boilers and many large industrial concerns have been making steel drums and containers, replacing the older wooden types for oils, greases and similar lines. This has all resulted in quite a movement of this class of material.

There is practically no call for bars, and jobbers are not attempting to replace stock that has been exhausted. Thus many orders have to be sent on to the mills for fulfillment. The price of steel has nothing to do with this action on their part. There just appears to be no outlook for conditions in this line to improve and it would not seem to be good business policy to tie up money in a line that is not moving and does not promise to do so within a reasonable time.

Rails and rail bonds are being produced in limited quantities. There will be a nominal amount of this business all through the next year as most Canadian roads have deferred many maintenance jobs and feel that such work must receive immediate attention.

Structural shapes are very quiet. The only orders coming through are still for stock replacement purposes, and now and then for a small construction job.

Pig Iron.

The pig iron trade seems to continue in its gradual trend towards improvement. After the slight strengthening price from time to time in the last few weeks, it has evidently reached a point where it has decided to remain for a while, as there has been no change for ten days. The present price is only about that of production cost and as soon as the demand increases there will doubtless be a further increase in price. No one seems able to predict when anything approaching normal consumption will take place and until then no settled or staple price can be assured. A large percentage of the furnaces are idle and will not "blow in" until more attractive prices and a larger volume of business is offering.

Machine Tools.

Prices of machine tools are considered too high by the user and no sales have been reported for some time. There appears to be some attempts at reduction from some quarters. During the war all manufacturers increased the

capacity of their plants and in many cases the equipment they installed was not the best suited to their requirements but as delivery had to be made, this type of machinery had to be pressed into service. This did not tend to reduce costs and together with the high labor costs, machine tool prices soared. Reductions that seem reasonable have not yet been made, but to-day there is a general tendency toward more or less substantial reductions. Machine tool manufacturers are also getting rid of this surplus equipment that was not the most economical for them. Thus to-day there is a large quantity of second hand and rebuilt machinery for sale at relatively low prices. These tools are moving almost to the exclusion of the new tools. Manufacturers are also devoting themselves, during the quiet period, to the improvement of their products, and from time to time in the near future we can look for announcements of new tools having some very marked improvements, and many labor saving devices. These features with the inevitable increase in business will bring the users of machine tools into the market. Meanwhile business remains very quiet with only small sales being reported.

The sale of small tools and supplies still continues to be of the hand to mouth variety. A certain small volume seems to pass every week. Prices are unstable as liquidation by some firms and dealers has not yet been completed. Manufacturers are trying hard to get their lines in the hands of the jobbers with only fair success.

Little or no non-ferrous metal business is moving and the prices have remained unchanged. There is little or no promise of any immediate improvement in these lines.

The scrap metal market shows no improvement. Business is moving slowly and the prices are very weak.

FRANCE WANTS CANADIAN TRAIN

Opportunity is Afforded Canada to Send a Train to France for Exhibition Purposes. Special Privileges will be Afforded any Such Train

The French exhibition train has visited, and left Toronto. Without question it created deep interest. In fact one was lucky to get near the train, far less pass through it, so dense were the crowds. Our department of trade and commerce, and our Canadian railways are assisting in every possible way to make the tour a success, the latter handling the train free of charge.

As a complement to the French train exhibit, it is expected by the French goverment and greatly desired by the department of trade and commerce that a similar train containing Canadian exhibits will next year make a tour through France for the purpose of presenting to the French buyers, in an attractive and practical way, the resources of the Dominion. In turn the French government offers:—

1—The free transportation of the Canadian sample goods both ways across the ocean. 2.—The free warehousing of the Canadian sample goods in the docks of the French port selected. 3.—The gratuitous use of the railways and other equipment required for a complete exhibition train and its circulation throughout the principal cities of France. 4.—The use of the best theatres in practically every city visited by the Canadian train with the net proceeds of the entrance receipts for theatrical displays of films and other devices demonstrating the natural resuorces, industrial development, and natural beauties of Canada. 5.—The free use for a period of six months of the most suitable building in the city of Paris, presumably Le Petit Palais in Les Champs Elysees, for a fixed exhibition of the Canadian sample goods.

Speaking on the offer, the department of trade and commerce says that there appears to them no better method of instilling a greater knowledge and intimate appreciation by the French and Canadian peoples of their respective capabilities, than an exchange of commodities. The privileges granted by the French government are an exact replica of those which Canada has granted to the French exhibition train, but it must not be overlooked remarks the trade and commerce dept., that in such an exchange of facilities Canada will be the more largely benefited.

Canada will have an opportunity to advertise its resources to a market of 38,000,000 people, whereas in return, France will appeal to a market of less than 9,000,000 people. In addition, Canada will have the advantage of having an exhibit for an extended time in one of the most beautiful buildings in the world, where it would be viewed not only by the large population in Paris, (2,850,000.) but by the great travelling public, tourists and buyers who congregate in the French capital from all over the world.

Concluding their above remarks the dept. of trade and commerce say that they will be glad to take up the responsibility of the initial work in connection with any permanent organization to be formed later, and they also state that they will be pleased to receive suggestions and opinions from anyone interested. Such communications should be addressed to the Deputy Minister, Dept., Trade and Commerce, Ottawa.

The Hotel Mossop, Toronto, are going to build an addition to their present structure which will cost around $750,000. It is expected that the new portion will be completed around June or July next year, and this will mean that 140 more rooms, with a bath to each room will be available.

COMPETITION NOT WORRYING STEEL MEN

Believe That Competition Cannot Harm Them Much—Expect That Demand Will Increase Shortly

While American manufacturers of steel products admit that Germany and Belgium are showing activity in the export field, they nevertheless express complacency as to their own future. They base their reasons on the following points:—

1. The decreased activity by these countries during recent weeks. 2.—The demand by German workmen for a higher wage scale. 3.—The oversold condition of the German and Belgian markets making prompt delivery uncertain, and 4.—The betterment in the American situation indicated by a decline in prices here because of lower production costs and reduced freight rates for shipments to coast ports.

It is estimated that to keep American steel mills running at capacity 20 per cent of the output must be shipped abroad. The proportion applies at times when conditions at present are so far below the usual levels that to keep busy the full quota of steel workers and machinery today the exports would have to be something like 70 per cent of production.

As a matter of fact, continues a New York report, the average rate of output to capacity is estimated at less than 30 per cent., and of this the foreign shipments of raw steel material represent considerably less than 5 per cent. Export trade in steel has been particularly hard hit by the present world wide depression and its decline has been proportionately much greater than of domestic business.

The reasons for this are first, because the foreign markets, like our own, are suffering from overproduction and overloading, and from a consequent rapid decline of values. Time alone can work off the surplus.

But there must always be at least some demand, and for the few business opportunities offering in South America, Japan, China, India, Africa and the Dutch East Indies and other countries, there has developed a keen and unequal competition between the principal steel producing nations, which include the United States, Great Britain, Belgium, Germany and France, Great Britain, by reason of her coal strikes, has been almost out of the reckoning, and is only beginning to prepare for export trade. The most aggressive competitors of the United States are Germany and Belgium, neither of them comparable with America in point of out-turn, but amply able in quiet times like the present to provide the world, outside of the United States with its comparatively small requirements.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago.	30 00
Standard low phos., Philadelphia.	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Montreal	Toronto
	Gross.	
Lake copper	$17 50	$17 50
Electric copper	17 00	17 50
Castings, copper	16 75	18 00
Tin	34 00	39 00
Spelter	7 00	7 50
Lead	7 50	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 20%.

Standard couplings, 4-in. and under, 20%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 9 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	8 00
Red brass turnings	7 00	7 50
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less.	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	45
Can. carbon cutters, plus	10
Standard drills, all sizes	45
3-fluted drills, plus	10
Jobbers' and letter sizes	45
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	10 to 15 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$7.00 base
Hexagons and flats	7.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5 75	$5 25
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 50	6 00
Can. plates, all bright	7.75	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	8.00	....
Fleur-de-Lis, 28 B. W. G.	7.50	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	....
Premier, No. 28, U.S.	6 75	6 50
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	27 00
1¾ in.	29 75	24 00
2 in.	29 25	22 00
2¼ in.	33 00	25 50
2½ in.	44 75	28 00
3 in.	49 25	34 00
3¼ in.	.....	42 50
3½ in.	63 50	37 50
4 in.	85 00	48 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21	Atlas	19
Peerless	22	X Empire	15
Grand	21½	Ideal	18
Superior	21½	X Press	13½
X L C R	16½		

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	17	Dark colored	13
Mixed colored	14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 10% Best grades 15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

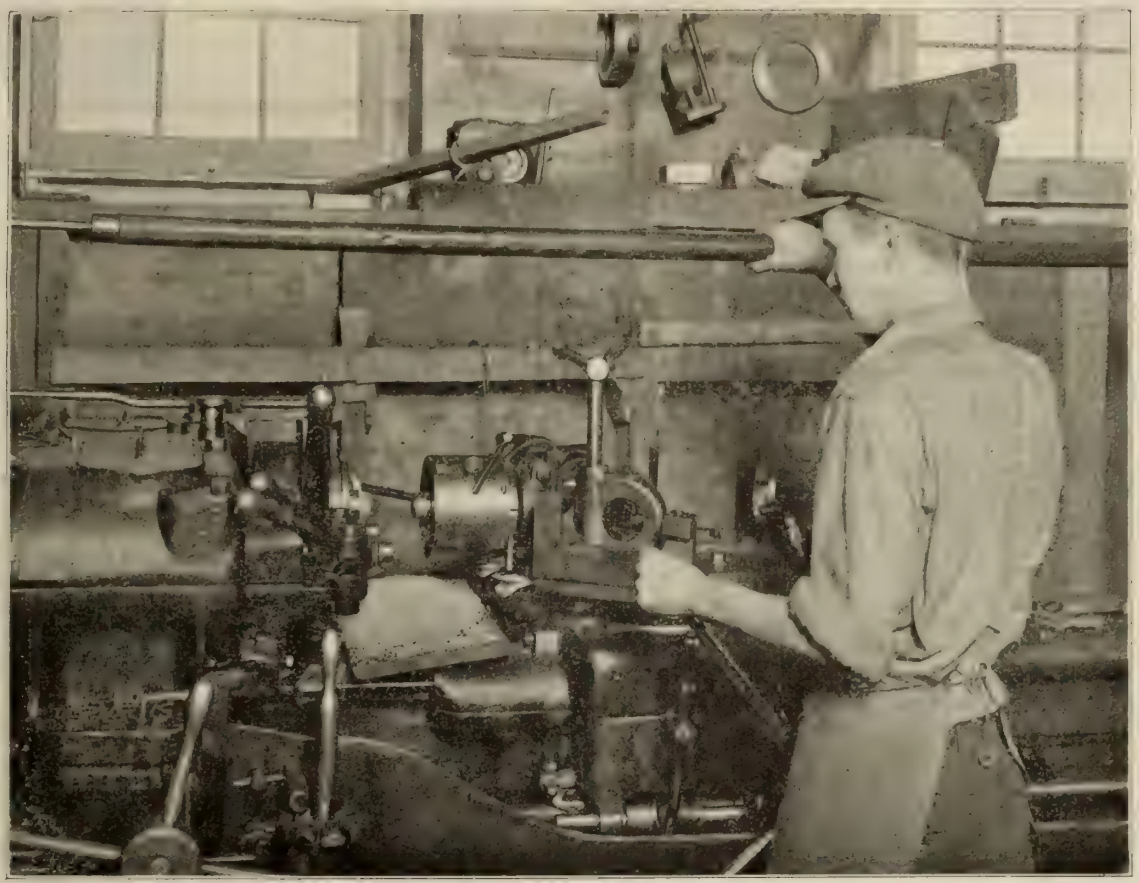
Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

200 Caps per Hour
With a Geometric Self-Opening Die Head



Threading Aluminum Ford Radiator Caps 2" - 16 U. S. F., 5/8" Long

The Foreman of a Machine Shop was recently asked why he used Geometric Die Heads in preference to any others.

The Foreman replied that he HAD to use Geometric Die Heads because they were the ONLY ONES HE COULD FIND THAT WOULD CUT A STRAIGHT AND CLOSE ENOUGH THREAD FOR THEIR WORK.

It is such facts as that which leave the Geometrics without a rival.

GEO MET RIC

Right on the Lead

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

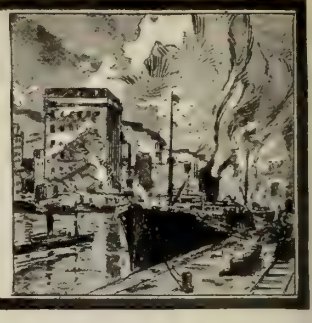
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INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



PUMPING STATION FOR MONTREAL WILL BE MODERN IN EVERY RESPECT

MONTREAL is growing. In fact is growing so rapidly that its present water supply service has to be increased again. As the city has grown, additions to the water supply have been made, but during the last year the water consumption increased two million gallons per day. The capacity of the Point St. Charles low level pumping station has been increased several times, but the later additions include electric driven turbine pumps. In the old pumping station are three of these units. There are two units each of thirty million gallons per day capacity, and one of twenty millions. One of the larger is a De Laval pump, and the other a Worthington. Both are driven by Westinghouse motors. The smaller pump is a Mather and Platt, driven by a Canadian General Electric motor.

Together these pumps have a daily capacity of eighty million gallons. During the hours of peak load however, they cannot take care of the city's requirements, and steam units are thus daily called into service. After due consideration it was decided to build a new pumping station as the old one had been enlarged to a point where it was neither practical nor advisable to go farther.

The new station is located a short distance from the old station, and very close to the filtration plant. The water is taken from the St. Lawrence River at a point some distance up the river and is conveyed to the pumping station by means of an aqueduct. Almost twenty-five feet of lead is obtained and some three thousand horse power can be developed, if desired, from the water passing through the aqueduct without increasing the velocity beyond that which is necessary to carry away any sediment and thus prevent the gradual filling up of the aqueduct. The present lining of the banks is designed for water supply only and not for power purposes. At present all water passes through the filtration plant and experiments have been conducted, the results of which, lead the engineers of the Montreal Water Board to believe that the capacity of the filtration plant can be so increased that the requirements of the city can be taken care of for several years to come.

The new station is to be the best equipped and most elaborate of its kind in Canada and one of the most complete on the continent. It will have a capacity of three hundred million gallons per day, divided in two similar wings, each having a capacity of one hundred and fifty million gallons per day and situated symmetrically about a central control portion of the building. It is only proposed to build one wing and the central control section of the building at this time. The wing will contain six pumping units of thirty million gallons capacity a day. As one unit will be always held ready as a spare the nominal capacity will thus be one hundred and fifty million gallons per day.

The building will contain its own machine shop, the executive offices of the Montreal Water Board, and one section will contain the transformers, oil switches, etc. The feature however, is the central control. One man will be able to operate and control every unit in the station. Besides, the operator will be so advantageously located that he can see every part of the room where the motors and pumps are located. In addition a very complete signalling system is installed, similar to the marine telegraph used by ship's officers on the bridge of a vessel to communicate with the staff in the engine room. The feature of this, is that every order is confirmed by the man receiving it before it is executed.

Rarely has it been the privilege of the writer to see an installation where greater care and thought have been exercised to prevent a breakdown from either electrical or mechanical failures. The electricity is received from the power company in two towers each quite separate from the other and both distinctly apart from the pumping station building. Here lightning arrestors and other protective apparatus are found. Several separate underground lines lead from the towers to the transformers. All equipment is of generous proportions and amply protected. Throughout, duplicate installations of leads, switches, etc., are found, and where there is any chance of even a temporary tie up, triplicate and quadruplicate installations are made. No risk from hot contacts in switches are taken. All equipment is spaced well apart so that a "short" or fire in one piece of equipment will not in any way jeopardize another. Mr. Chas. Des Baillets of the Montreal Water Board had charge of the design of the building, and the selection of equipment. Great credit is due him for the precautionary measures he has taken to prevent a breakdown in the equipment.

Each pump discharges at 95 pounds pressure into a 36 inch pipe, thence through a Venturi meter into a large 72 inch main. The contract for the building was recently let to the Atlas Construction Company of Montreal. Work is being started immediately and will be rushed to completion. The first pump will be operating in the new station in September 1922. Power is taken from the Montreal Light, Heat and Power Company which Company has transmission lines from Shawinigan Falls, Cedars Rapids, Soulanges, Chambly, and Lachine, all hydro electric power, and also from the steam driven plant at Ville La Salle.

IRON CASTINGS DECLARED SUCCESS

Demonstration Has Been Given—One Melting is Now Sufficient—Second Blast Furnace Soon to be in Operation

If the reports of the Ford interest are authentic, their new method of pouring iron castings is a decided success. A demonstration has already been given, and it is said that more than 75,000 cars have been built with castings made when the molten iron was poured direct from the River Rouge blast furnaces. Heretofore, castings had involved two meltings. The first, when the iron ore is converted into iron and the second when it is placed in the cupola furnace to be used for castings. In the Ford direct method the molten iron is drawn into caldrons having a capacity of 85 tons each. The caldrons are mounted on railway trucks and drawn to the foundry. The iron remains in a liquid state for 36 hours. Conveyor chains bring the molds past the pouring point and the iron is poured directly into the molds. Twenty conveyor lines are under construction.

The company now produces practically all the iron used on approximately 4,200 cars daily. A second blast furnace will soon be placed in operation A great deal of the work of the Highland Park foundries will then be transferred to River Rouge.

SURPLUS PLANT FOR SALE

LATHES

No. 16—16"x4' Centres, Lodge & Shipley.
No. 17—16"x4' Centres, Reed Prentice.
No. 18—16"x4' Centres, Lodge & Shipley.
No. 19—16"x4' Centres, Reed Prentice.
No. 20—20"x3' 6" Centres, Reed Prentice.
No. 21—14"x5' 6" Centres, C. M C.
No. 22—14"x3' 6" Centres, C. M. C.
No. 356—Brightside Roll Turning Lathe.
No. 30—14" Springfield.

TURRET LATHE

No. 31—3¼" No. 2A. Warner & Swasey.

AUTO SCREW MACHINES.

No. 51—¾" Cleveland Automatic.
No. 52—1¼" Cleveland Automatic.
No. 53—2" 6 Hole Turret, Cleveland Auto.
No. 54—1¼" 4-spindle Cleveland Automatic.
No. 55—2¼" Gridley Automatic.
No. 56—4¼" Gridley Automatic.
No 57—2" Cleveland Automatic.

MILLING MACHINES.

No. 72—Reinecker Plain Miller.
No. 79—P. & W. Duplex Spindle Profiler.
No. 82—Cincinnati Plain Miller, Lincoln Type.
No. 83—Cincinnati Plain Miller, Lincoln Type.
No. 84—Cincinnati Plain Miller, Lincoln Type.

RELIEVING LATHES.

No. 101—Holroyd Universal
No. 103—Flather Plain.
No. 104—Armstrong Whitworth Plain.

RELIEVING LATHES.

No. 101—Holroyd Universal.
No. 103—Flather Plain.
No. 104—Armstrong Whitworth Plain.

GRINDERS.

No. 112—Walker No. 3 Double Stroke Surface Grinder.
No. 113—Walker 10" Single Stroke Surface Grinder.
No. 116—B. & S No. 3 Universal Reamer and Cutter Grinder.
No. 121—B. & S. Universal Reamer and Cutter Grinder.
No. 122—B. & S. No. 2 Cutter Grinder.
No. 127—B. & S No. 10 Plain Grinder.
No. 132—Heald No. 70 Boring Grinder.
No. 134—Rivet No. 3 Boring Grinder.
No. 135—Landis 10"x20" Grinder.
No. 136—Landis 12"x42" Plain Grinder.
No. 183—Ford-Smith Tool Grinder.
No. 191—Holroyd Grind Relieving Machine.
No. 200—Wilmarth & Morman Drill Pointing Grinder.
No. 312—Ford-Smith Duplex Tool Grinder.
No. 341—24" Wheel, Swing Grinders.
No. 2014—36" Sandstone.
No. 183—Hand Grinder. National Acme.
No. 200—New Yankee Drill Grinder.

DRILLS.

No. 166—Knight Drill No. 208.
No. 167—Herbert Single Spindle Drill.
No. 168—Avery 15" Drill Press.
No. 467—Myers Sensitive.

CENTERING MACHINES.

No. 176—Hendey Centering Machine.

FLUTING MACHINES.

No. 188—Holroyd ¼" to ½".
No. 189—Holroyd ½" to 1".
No. 190—Armstrong Whitworth ½" to 2".

BORING MILLS.

No. 306—100" C. M. C. Boring Mill
No. 310—72" Stirk Boring Mill.

PRESSES.

No. 319—Morgan Hydraulic Stamping Press.
No. 324—Morgan 1,000 ton Steam Hydraulic Press.
No. 328—Morgan 2,000 ton Steam Hydraulic Press.
No. 329—Morgan 600 ton Steam Hydraulic Press.
No 334—United Engineering 500 ton Steam Hydraulic Press.

ROLLING MILLS.

No. 320—Morgan Tyre Rolling Mill.
No. 322—Morgan Wheel Rolling Mill.
No. 350—Lamberton 12" Rolling Mill.
No. 351—Boonton 9" Rolling Mill.

STEAM ENGINES.

No. 321—1,000 H.P. International C. C Steam Engine.
No. 353—350 H.P. Porter Allen Steam Engine.
No. 355—1,000 H.P. Tod Reversing Engine.

CRANES

No. 323—Wellman, Seaver & Head Furnace Charger.
No 427—5-ton Whiting Travelling Crane, 48' span.
No. 431—15-ton Whiting Travelling Crane, 72' span.
No. 432—Wellman, Seaver & Head Low-ground Open Hearth Charger.
No. 433—Wellman, Seaver & Head 25-ton Crane, 37' 5" span.
No. 434—Wellman, Seaver & Head 15-ton Crane, 72fi span.

BOILERS AND BOILER EQUIPMENT.

No. 326—Smart Turner 5" x 7½" x 8" Boiler
No. 327—Smart Turner 5"x7½"x8" Boiler Feed Pump.
No. 454—Epping Carpenter Duplex Pump, 6" x 4" x 6".
No. 470—250 H.P. Goldie & McCulloch Boiler.
No. 472—100 H.P. Goldie & McCulloch Boiler.

FOUNDRY LADLES.

No. 417—10-ton Ladle.
No 526—20-ton Ladle.
No. 2091—3-ton Ladle.
No. 2093—2-ton Ladle.
No. 2065—Small Ladle, 23" dia. x 22" deep.

METAL TESTING MACHINES.

No. 424—A. W. Tensile, Bending and Compression Testing Machine.
No. 531—Johansson Precision Blocks, No. 1206
No. 208—A. W. Measuring Bench in 1/10,000"

ELECTRICAL EQUIPMENT.

No. 435—40 K. W. Belt Driven Generator, 550 volts, D.C.
No. 485 to No. 487—300 K.V.A. Can, General Electric Transformers, 22,500 volts to 2,200 volts.
No. 488 to No 493—140 K.W. British Electric Transformers, 22,500 volts to 2,200 volts.
No. 494 to No. 495—350 K.W. Bruce Peb.es Motor Convertors, 2,200 volts A.C. to 250 and 500 D.C.
No. 496—375 K. V. A. Steam Driven Generator, Swedish General Electric Co., 2,300 volts, 3 phase, 60 cycles. Complete with engine, exciter set and switchboard.

ELECTRICAL EQUIPMENT (Cont.)

No. 547 to No. 549—25 K. V. A. General Electric Transformers, 2,200/550. volts.
No. 558 to No. 560—250 K. V. A. General Electric Transformers, 22,500/110 volts.
No. 561 to No. 569—500 K. V. A. General Electric Transformers, 22,500/110 volts.

PUMPS.

No. 332—Deane 2⅞"x10" Triplex Hydraulic Pump, Gear-driven.
No. 333—Darling 5"x7"x10" Vacuum Pump.
No. 450—Bawden 7"x9"x10' Pump.
No. 553—March Deep Well Pump, 3' stroke x 8" bore.

STEAM HAMMERS.

No. 335—3-ton Bertram Hammer, Arch Frame
No. 336—1-ton Massey Hammer, Arch Frame.
No. 337—12-cwt. Massey Hammer, Arch Frame
No. 338—8-cwt. Massey Hammer, Arch Frame
No. 339—4-cwt. Massey Hammer, Arch Frame

SHEARS.

No. 349—Craig & Donald Shear, Capacity 3½" to 4".
Noi. 352—Long & Alstatter Shear, Capacity 6"x⅞" M.S.

ELECTRIC FURNACES.

No. 382—3-ton Heroult Furnace.
No. 383—6-ton Heroult Furnace.

MISCELLANEOUS.

No. 181—Amer. Tool Co. Oil Separator, No. 2
No. 187—Noble & Westbrook Stamping Machine.
No. 194—Automatic Machine Co. Threading Machine.
No. 196—Hoefer Tap Threading Machine.
No. 270—Tilghman & Brooksbank Sandblast.
No. 305—No. 2B Platt Reeling Machine.
No. 573—Brown Radiation Pyrometer.
No. 570—Brown Recording Pyrometer.
No. 574—Shore Scleroscope.
No. 553—8" x 36" Marsh Deep Well Pump.
No. 447—18" Jeffrey Single Roll Crusher.

PLEASE REFER TO MACHINES BY NUMBER

Large Stock of Small Tools, High Speed and Carbon Steels, Motors, Etc., of all sizes, A. C. or D. C. Current

Plant can be viewed at Longueuil Works—Full details on application.

ARMSTRONG WHITWORTH OF CANADA LIMITED

298 St. James Street -- Montreal

LAURENTIDE MILL INSTALLS TWO NEW PAPER MAKING MACHINES

THE Laurentide Co. at Grand Mere, Que., have recently installed two new 166-in. news machines. This means that they will be able to produce marketable paper at the rate of at least 1,000 feet per minute. The machines have a daily capacity of 75 tons each, and were made in Canada. The Dominion Bridge Co. are doing the work under the supervision of George D Kilberry, chief engineer of the paper machinery department of the Dominion engineering works, and the preliminary designs were started in October 1919. It was found that the design work was handled more efficiently than had been even hoped for, with the result that Canadian labor completed the machines in splendid shape, in spite of the fact that America is said to have had more experience in this respect.

The new machines embody no new principles in paper making, but have some features not common to most machines, chiefly the method of putting on new wires; the application of suction couch and suction press rolls; a novel arrangement of compressed air jets for passing the tail or ribbon of paper from couch to press, and between the presses as well as at the calenders and reel, also the very generous use of ball bearing at the wet end of the machines.

Each machine has four presses with the first press of the Millspaugh suction roll type, and the other three of the standard construction with granite tone top rolls and rubber covered bottom rolls. Special provision is made on these presses for oiling journals of both press rolls, the bottom rolls having collar oiling bearings and the top rolls a special bath oiling arrangement formed by the peculiar construction of journal. The felt arrangement on all presses is very simple and each felt has only one loop. This is made possible by allowing the felts to pass down through the pit into the basement where the automatic take ups are located. The hand and automatic guides are located on machine sill plates and accessible to machine tenders. The press felt rolls are rubber covered and operate in self aligning grease lubricated bearings. All presses are forward presses, that is the paper passes straight through them to the dryers. Outside of the above there is nothing unusual in the construction of the press part, save that it is built rigid and of pleasing design.

The Dryer Portion

The dryer part of each machine is composed of forty paper dryers 72-in. diameter, and one first dryer 36-in. diameter. The 72-in. dryers are arranged double deck style with the bottom dryers resting in bearings mounted directly on the sill plates. The top decks are arranged so that each dryer comes over space between two dryers, or what is called staggered formation, which is the usual construction. There are no felt dryers as the return felts are fully exposed to the drying effect of hot air. One top and one bottom felt are used for all dryers, necessitating all being reared together in one unit. Each felt is equipped with two long range automatic take ups, two hand guides, and two automatic guides. The felt rolls are made from 14-in. steel pipe and operate in ring oiling bearings with renewable linings.

The dryers are mounted in rigid bearings having babbitted linings. Each bearing has two oil rings made in halves easily removable, The dryer gearing is heavy and all gears machine cut with driving pistons of forged steel. The dryer shells are 1⅝-in. thick and bored on inside to make them of even wall thickness and remove all blisters from inside surface. This makes a better drying unit as well as eliminating the necessity of balance weights which are always a source of anxiety, especially when bolted in. The paper dryers are all equipped with bronze blade doctors with levers and weights for maintaining contact with dryers.

The paper is passed from dryer to dryer by means of the "Sheehan" paper carrier, which consists of a pair of endless ropes, running side by side on sheaves bolted to front end of dryer shells and almost equal in diameter to the dryers. The ropes part company at the last top dryer thereby letting go of the paper tail and returning over suitable sheaves to first dryer, where they join company again, and are ready to have the tail of paper thrown by hand into bite when required to thread paper through dryers from presses. This system works very well here and the Laurentide Company have all of their machines equipped with a similar carrier.

A novel arrangement is used to pass the paper to the calenders from the last top dryer, when threading paper through machine. It is accomplished by means of a series of air jets that blow the sheet which is about 10-in. to 12-in. wide from the doctor on last top dryer to the desired nip on calenders by means of guiding guards, so located that the sheet is blown between them to the nip. Should a break occur between dryers and calenders, a second novel device is used to pass the full width of sheet through calenders. This works along the lines of the squirt for cutting sheet at suction boxes on fourdrinier part, with the difference that a needle coming in contact with dryer is used instead of jet of water as at the fourdrinier part.

The needle arrangement consists of a piece of ⅜-in. round steel ground to a tapering point and carried in a frame in such a manner that it can be tilted away from face of dryer when not in use and at the same time travel across face of dryer to cut the sheet, when a break occurs at stack. This arrangement makes the passing of paper at stack a very simple matter, whereas without it, it would necessitate considerable skill on the part of the operatives to get the paper through and then only with considerable loss of paper at this point.

Without entering into further detail, it might be well to state that these machines were erected in the mill without the use of shims anywhere in their makeup. This speaks volumes for the class of work, for had the alignment been out, shims would have become an absolute necessity. Canadian mechanics are to be complimented on the successful conclusion of this work, also Mr. Kilberry who made its success possible.

CANADA'S TRADE SHOWS BIG DECREASE

Merchandise Exported Drops More Than 50 per Cent

A sharp decline in Canadian trade for the month of August, 1921, as compared with August, 1920, was recorded in the summary of Canadian trade just issued by the Department of Customs. Total Canadian trade for August, 1921, amounted to $127,510,299, as compared with $238,085,409 for August 1920. For the five months of the fiscal year closing with the end of August total trade was: 1921, $602,315,038; 1920, $1,063,358,170, a reduction of $461,038,132.

During August, 1921, imports entered for home consumption had a total value of $65,147,301, as compared with $124,318,014, a reduction of $59,170,713. For the five months ending August 31, the total merchandise entered for consumption was valued at $319,009,763, as compared with $597.890.603 in 1920. In August, 1920, domestic merchandise exported had a total value of $112,278,064, as compared with $61,485,993 for August, 1921.

Shows Heavy Decrease

In the five-months' period ending August 31 this year the total value of merchandise exported was $227,413,949, as compared with $454,390,487. Foreign merchandise exported in August, 1921 was valued at $877,005, as compared with $1,489,331. In the five-month's period ending August 31 this year the total foreign merchandise exported was valued at $5,891,326, as against $11,072,080 for 1920.

One of the most pronounced decrease was recorded in the fibre and textile business. In August, 1920, importations of these products totalled $28,590,352, as compared with $12,659,038 in August, 1921. Exports of these products, both domestic and foreign in August, 1920, totalled $1,598,716, as against 0381,098 in August, 1921. A considerable drop was also registered in the importation of mineral products. In August, 1920, the value of mineral importations was $22,779,680, as against $1,540,173 for August of this year. Exports of minerals and their products for August, 1920, had a value of $5,832,7[illegible] as against $2,418,231 for August, 19[illegible]

Trade Gossip

The Fort William Car and Foundry Co. are to get an order for repairing 1500 Government cars, according to Dr. R. J. Manion, M. P.

Toronto—John McLean, Danforth Ave. contemplates the erection of various stores and apartments, these to cost around $20,000.

Woodstock, Ont.—John Morrison, clerk, will receive tenders until Sept. 12th for the construction of steel truss bridge. Alternative tenders being received for construction of earth filled reinforced concrete arch. Plans with F. J. Ure & Son, Engrs.

Toronto—Contracts have been awarded for two stores and apts. for W. T. Liddell, 113 Rusholme Rd. These are as follows:—Electrical, W. Whittaker, 2½ Bellwoods Park; plumbing, E, Emmott, 51 Amorth Ave.; plastering, G. Warren, 65 Fern Ave.; painting, W. Crook, 32 Wilshire Ave.

Roofing and sheet metal contracts have been issued for alterations to building for offices, automobile sales room and garage for Superior Realty Co., care of Wood, Fleming & Co., Royal Bank Bldg., are placed with Carmichael Waterproofing Co., Ltd., 918 Palmerston Ave.

An arena costing $20,000 will be erected at Milton, Ont., for the Milton Arena Ltd. The steel contract has been placed with Dominion Bridge Co., and the general contract for construction has been awarded to T. F. Norman 24 Blandford Avenue Toronto.

A new company, in Montreal, is arranging to erect 1,700 new homes by a special financial scheme. The houses are expected to cost $6,000 and easy payments will be available, these going as low as $10 per week.

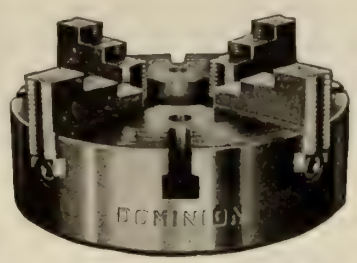
Mr. Lucien Besnard, a representative of Schneider and Co. France, is in Montreal. The firm which he represents is owner of the Creusot iron and steel works. Mr. Besnard, who was formerly a member of the staff of the French High Commision in New York, and is now connected with office which the Schneiders opened in New York during the war, is in Canada for the purpose of ascertaining what market exists here for pig iron and fabricated steel from France. During his stay in Montreal he will confer with various trade bodies and will interview representative steel manufacturers and building contractors. He is registered at the Windsor Hotel.

The Eastern Equipment Co., Montreal have opened up a new office and show room at 234 Beaver Hall Hill. They intend keeping a full line of contractor's equipment as manufactured by St. Clair Bros. Galt, Ont., and they also represent the Koehring Co., of Milwaukee Wis. In the basement they have a portable Elliott wood worker connected, where an exhibition of the various operations of this machine is given to prospective purchasers. In addition to this exhibit at the office and wareroom, the company have a yard at Dorval where the largest part of their stock is kept.

Toronto—Tenders for the construction of the new east-end branch Technical High School, totalling $771,593, were approved at yesterday's meeting of the advisory industrial committee of the board of education. This figure marks a reduction of twenty-five thousand dollars on the total of the tenders rejected earlier in the Summer. A bulk tender of $607,192 was awarded to Witchell and Sons for twelve trades including masonry, stone, steel, carpentry, roofing, plastering, etc. Plumbing, heating, heat regulation and refrigeration were lumped, being allotted to W. G. Edge Company for $117,000. The next lowest figure for the whole building made up of tenders on individual trades, totalled $780,165. The new school will have a front center section of three storeys, with a wing one storey high to the rear. It will be of fireproof construction throughout and will accommodate approximately 1,000 day pupils and 2,500 night pupils.

* * *

Employees of General Motors in Oshawa now number about 1,350. There is not much likelihood that this will be increased in the immediate future, but hopes are entertained that the working force will be enlarged within a few months.



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LIMITED
Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
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Classified Opportunities

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Fattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

ELECTRIC STORAGE BATTERY LOCOMOtives for sale. Two. 36-inch gauge. Complete and in good condition. R. T. Gilman & Company, Dept. "E," 211 McGill Street, Montreal. (ctfm)

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WOOL WASTE

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98 John Street
TORONTO, ONT.

Prices on application

CLOSING TIME

Condensed advertisements for this section must be in our composing room Tuesday morning prior to day of issue. Display advertisements for this section must be in Monday afternoon.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

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Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

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1—No. 21 4 Spindle National Acme Automatic Screw Machine, No. 54, capacity 1 7-16 in., with countershaft.
1—No. 20 National Acme Automatic Screw Machine, No. 53, 4 spindle, 1 1-8 in. capacity, with countershaft.
1—No. 19 National Acme Automatic Screw Machine, 4 spindle, 1 in. capacity.
1—No. 17 Cleveland Automatic Screw Machine, single spindle, 1 in. capacity.
1—No. 16 Cleveland Automatic Screw Machine, singel spindle, 1⅛ in. capacity.
1—No. 15 Cleveland Automatic Sere Machine, single spindle, 1 3-16 in. capacity.
1—No. 79 Warner & Swasey Automatic Screw Machine, 3-step cone, fitted with air chuck, one stop to turret, diam. of turret 6 in., size of hole 1 in., friction countershaft.
1—No. 33 Brown & Sharpe No. 2 Automatic Screw Machine.
1—No. 10 Garvin No. 128 P Screw Machine, automatic chuck wire feed, power feed to turret, hex. turret head, size of hole in turret 1 in., double cut-off slide, oil pan and pump, 3-step cone for 2 1-2 in. belt, friction countershaft.
1—No. 8 Single Spindle Cleveland Automatic Screw Machine 3-4 in. capacity.
1—No. 7 Single Spindle Cleveland Automatic Screw Machine, 1 in. capacity.
1—No. 6 Single Spindle Cleveland Automatic Screw Machine, 1 in. capacity.
1—No. 4 Single Spindle Automatic Cleveland Screw Machine, 1¼ in. capacity.
1—No. 3 Single Spindle Cleveland Automatic Screw Machine, 1 1-4 in.
1—No. 4 Warner & Swasey Turret Screw Machine.

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WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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We carry right in stock a large quantity of used Belting, Pulleys, Hangers, Shafting, etc., in good condition, which we sell at half the price of new. Inquiries solicited. In writing mention sizes wanted. L. S. Tarshis & Sons, 92 Wellington St., Montreal.

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Tool Room, Manufacturing Machines and Miscellaneous Equipment, for sale

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1—14″ x 6′ Reed, Q. C. G., Taper and Relieving, oil pan, and collets.
1—14″ x 6′ Lodge & Shipley, Q.C.G., Taper, collets and oil pan.
1—16″ x 6′ Cisco, Q.C.G., Taper.
1—16″ x 6′ Hendey, Taper, collets and oil pan.
1—16″ x 6′ Hendey, Taper.
1—16″ x 6′ Pratt & Whitney, Taper, and collets.
1—16″ x 8′ Hendey, Taper.
1—16″ x 8′ American, Q.C.G.
1—16″ x 8′ Prentice, Taper, collets and oil pan.
1—16″ x 8′ Pratt & Whitney, Q.C.G., and taper.
1—18″ x 8′ American, Q.C.G., and Taper.
1—18″ x 8′ Hamilton, D.B.G., Q.C.G.
1—18″ x 8′ Walcott, D.B.G., Q.C.G.
1—21″ x 8′ Le Blonde, Heavy Duty, D.B.G. O. C. G.
2—24″ x 10′ Lodge & Shipley, D.B.G., 2 C.G.
1—24″ x 10′ Can. Mchy. Corp. D. B. G. QCG
1—24″ x 12′ Can. Mchy. Corp., D. B. G. Q.C.G.
1—26″ x 10′ Lodge & Shipley, D. B. G., Q.C.G.
2—26 x 12′ Can. Mchy. Corp., D. B. G., Q. C. G.
1 26″ x 14′ Nile Bemont Pond, D. B. G., Q. C. G.
1—30″ x 14′ Niles Bemont Pond, D. B. G., 2. C. G.

Hand Screw Machines

30—No. 1 1/2 Star G.F.H., 1 1-2″ Cap., Power Feed Turret, oil pan and pump.
6 No. 3 Superior, Plain Head, 1 1-4″ Cap., oil pan and pump.
1—No. 4 Warner & Swasey, G.F.H., 1 1-2″ cap., Power Feed Turret oil pan and pump.
6—No. 4 Smurr & Kamer, G.F.H., 1 5-8″ cap., Power Feed Turret, oil pan and pump.
2—No. 4 Millholland, G.F.H., 1 1-2″ cap., Power Feed Turret, oil pan and pump.
11—No. 2 Smurr & Kamer, Plain Head, 1 1-16″ cap., oil pan and pump.
8—No. 2—Warner & Swasey, Plain Head, 1″ cap., oil pan and pump.
4—1 3-4″ x 7″ Gridley Multiple Spindle Automatics.
7—2 1/4 x 7″ Gridley Multiple Spindle Automatics.
8—3 1-4″ Gridley Single Spindle Automatics.
7—No. 55 Acme Automatic, Multiple Spindle.
12—No. 56 Acme Automatics, Multiple Spindle.

Shapers.

2—20″ Smith & Mills, B. G., Crank Shapers.
1—20″ Gould & Eberhardt Crank Shapers.

Milling Machines.

1—No. 3 Ford Smith Universal.
1—No. 2 Kempsmith Universal.
2—No. 3 Cincinnati Plain.
1—No. 2 Ford Smith Plain.
9 No. 1 Burke Bench Millers.

Drilling Machines.

2—Alfred Herbert 7″ overhang, ball bearing.
3—No. 1-2 Avey, Pedestal.
2—No. 1-2 Avey, Bench.
1—Leland Gifford, 6″ overhang, ball bearing, pedestal type.
1—Sipp, ball bearing, pedestal type, swing 16″.
4—Leland Gifford, 6″ overhang, ball bearing, bench type.
6—1-4 Rickert & Shafer, vertical tappers on pedestal.
1—5/8″ Rickert & Shafer, horizontal tappers on pedestal.
1—No. 1 1-2 Cincinnati.

Tool & Cutter Grinders.

1—No. 1 Norton.
1—Greenfield.
6—Stevens.
1—No. 2 Brown & Sharpe Surface Grinder.

Miscellaneous.

1—14 x 9 x 12 Can. Ingersoll Rand Belt Driven Air Compressor with receiver.
2—75 H.P. Crocker-Wheeler Motors, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
1—75 H.P. Can. Westinghouse, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
3—Gas Furnaces.
2—High Speed Hack Saws.
1—No. 2 Standard Double Acting Press.
1—2,500 Ampere Plating Dynamo.
1—No. 9 Buffalo Conoidal Fan.
1—No. 5 Sheldon Exhauster, Motor Drive.
1—No. 2 Garvin Screw Slotter.
1—No. 1 Garvin Screw Slotter.
1—No. 2 American Oil Separator.
1—14 x 24 C.H.V.W. Mechanical Plater.
6—No. 2 Garvin Screw Shaving Machines.
8—B. & S. Polishing and Finishing Machines.
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Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Peterborough Canoe Co., Ltd., Peterborough, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
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McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
Belt Fasteners
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.
Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Blocks, Chain

For list of Dealers see the last page of This Buyers' Directory

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Machine and Carriage
Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
[illegible]
[illegible] Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

ngs, Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shefield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press

(See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable

Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening

Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads

Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine

Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables

Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials

American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel

Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Drill Holders

Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads

Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic

National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand

Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable

Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive

Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret

Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist

Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings

Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments

Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices

Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical

Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Perdue, W. B., San Francisco, Calif.

Expanders, Tube

Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)

Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis,

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre

Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps

Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines

Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)

Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe

International Malleable Iron Co., Guelph, Ont.

Flexible Shafts

Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing

British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding

L'Air Liquide Society, Toronto, Ont.

Forging Machinery

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop

Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid

Can. Steel Foundries, Montreal, Que.

Furnaces, Electric

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal

Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric

Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing

Brown & Sharpe Mfg. Co., Providence, R.I.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furniture, Machine Shop

Garlock-Walker Mchy. Co., Toronto, On

Gages, Comparator

Jones & Lamson Machine Co., Spring

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto, Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Ranold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Rawhide (See Gears, Cut)

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis,
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Q
Japanning and Varnishing Ovens
[illegible] Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Albenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co. Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oils
Canadian Oil Companies, Ltd., Toronto, Ont

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Imperial Oil Ltd., Toronto, Ont
Brantford Oven & Rack Co., Brantford, Ont

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Pure Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strellinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto. Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

ubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto,
Keller Pneumatic Tool Co., Grand Haven Mich

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton,

BUYERS' DIRECTORY

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Rockefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
art & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

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Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
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Morse Twist Drill & Machine Co., New Bedford, Mass.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

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Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
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Thread Cutting Machines
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Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
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National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, t.
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Machine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
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Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
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POWER EQUIPMENT AND SUPPLIES

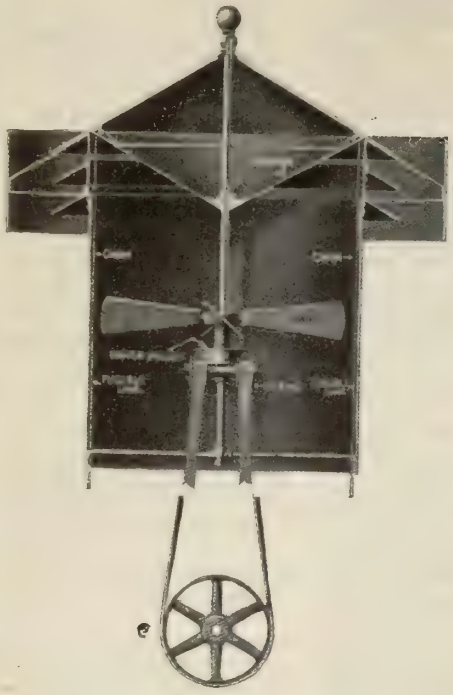
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MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co. Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
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H. W. Petrie Limited, Toronto, Ont.
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Consult this Buyers' Directory when you want the names of reliable makers of machine tools, parts, steel, in fact any equipment you may need.



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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

What Are Your Costs?

THE other day a man walked into the offices of a well-known Ontario Company. He asked for Mr. ———, the Manager, and in due course got him.

This caller—he proved to be a well-trained expert on factory production costs—almost startled the manager by asking point-blank, "What Are Your Costs?" The manager, hardly understanding the question, asked what was meant.

Now, in the answer he got, there is something that every factory production man may well think about. He did, and he was so impressed that, after investigation, he changed one of his manufacturing methods entirely! The answer was: "Mr. ——, I would like to know if your operating costs are the lowest possible, consistent of course, with efficiency. I know, of course, that you do a good deal of welding on tanks. I know further that you are using acetylene or forms of welding other than electric. I do not know what this costs you, but I make you this proposition. On your next tank order acetylene weld or rivet half the tanks here. Send the other half to Toronto. Our shop there will electric weld them and return them to you. I will let you know the time it took and the cost. When you have these figures compare them with your own. If they are lower and the workmanship as good, or better, let me then go into details as to whether you should install a Lincoln Welder in your own plant here—or whether it would save you money to do it in our welding shop. You decide only after you have the figures."

This manager adopted Lincoln Welding some six months later.

YOUR costs! Do you check them when business is slack or when it is booming? Why not do it while you have ample time? Let us put our figures before you. Make your own comparisons—that is the only fair way for you. The Lincoln Electric Co., of Canada, Limited, 136 John St., Toronto. Phone Adel. 7200.

LINCOLN ELECTRIC WELDING



P & W

Pratt & Whitney Taps

"With the 'Con-eccentric' Land"

P & W Taps are **Good** taps—easily the best where accuracy and high speed are essential. They cost more to buy, but less to use than others.

If you're doing work that calls for big production and for unusual precision, give them a trial. You'll be back for more when you see them prove themselves.

The "con-eccentric" land — the special feature of Pratt & Whitney Taps, permits sharpening on face of the cutting edge without affecting size. It lengthens life and assures accuracy hitherto thought impossible in a commercial tool.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Works: DUNDAS, Ontario

MONTREAL
723 Drummond Bldg.

TORONTO
1002 C.P.R. Bldg.

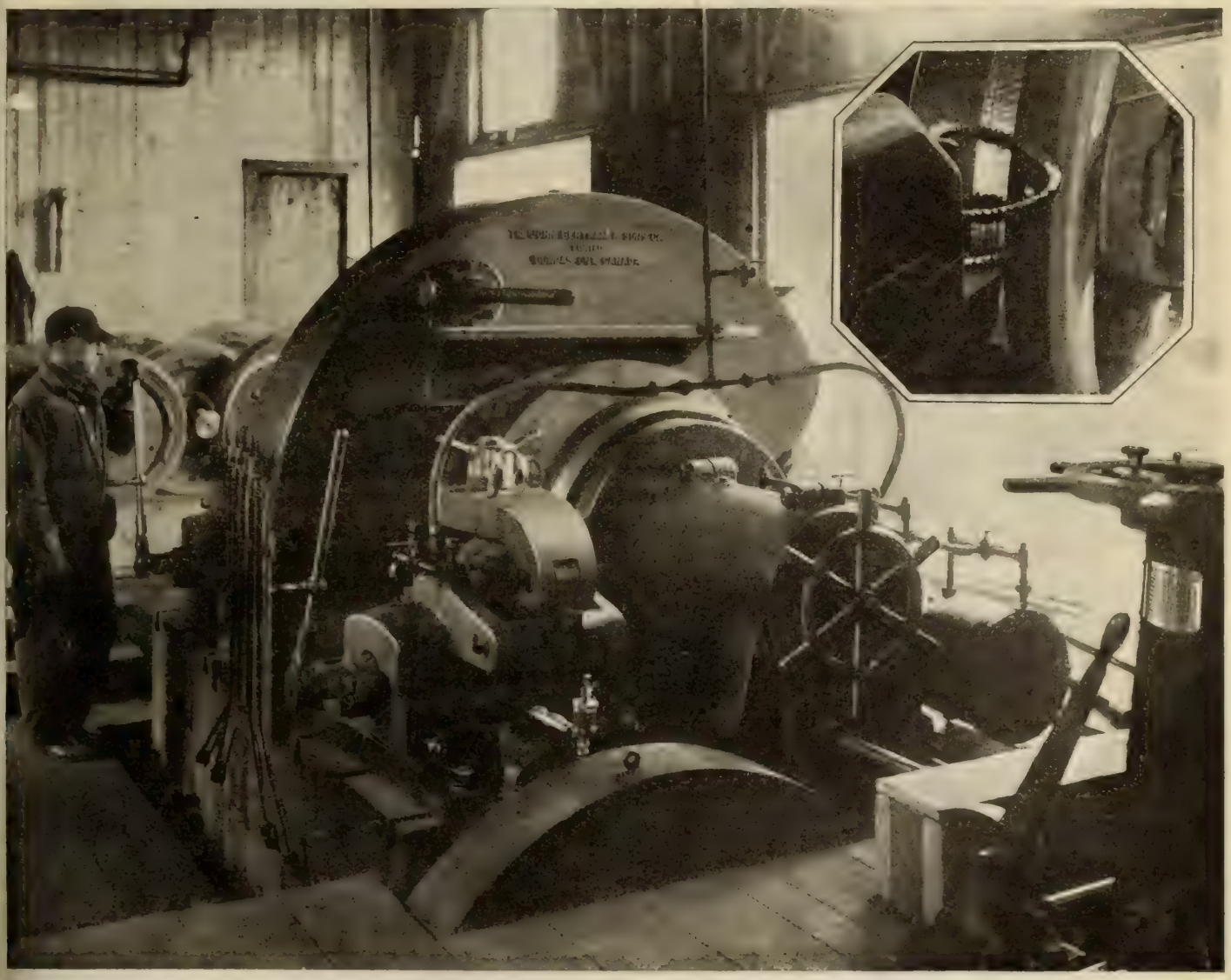
WINNIPEG
1205 McArt hur Bldg

HALIFAX
Roy Building

VANCOUVER
B. C. Equipment Co.

WALKERVILLE, 103½ Sandwich Street

BERTRAM
MACHINE TOOLS



Shop View of NO. 5 CAR WHEEL LATHE, a number of which we have recently furnished to Canadian Railways. (Inset—enlarged view of cut on wheel.)

Note these Features:

Pneumatic Tool Clamps,
Movement and Clamping of Tailstocks, by Air Cylinders,
Automatic Gap in Driving Gear,
New all-steel Herring-bone and spur gear drive,
A.C. Motor Drive through Speed Box,
Hardened, ground and lapped shoes on Tool Slides,
Full magnetic lathe controller with "start," "stop" and "slow down" push button control stations,
Maximum Feed on Work ⅝" per revolution of wheel.

If interested, write us for photos and specifications.

The John Bertram & Sons Co., Limited

DUNDAS, ONTARIO - CANADA

MONTREAL 723 Drummond Bldg. | TORONTO 1002 C. P. R. Bldg. | VANCOUVER 609 Bank of Ottawa Bldg. | WALKERVILLE 103½ Sandwich St. | WINNIPEG 1205 McArthur Bldg. | HALIFAX Roy Bldg.

Labor cost is the big item in a filing job. Money is saved in the long run by discarding a file that has got the least bit dull and buying a new one, because a dull file means two or more strokes where one should do the work. The following brands will be found to give maximum service before showing wear:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

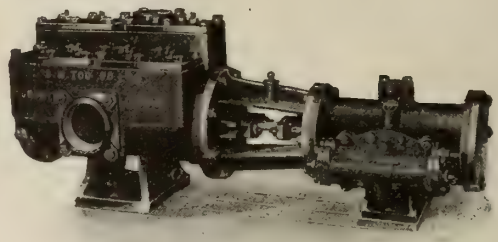
How to Plant an Advertising Crop

Until the advent of the Audit Bureau of Circulations, advertisers sowed their business seed in a vast but fallow field. Some of it grew and returned a fair harvest—much of it was cast upon barren ground and was lost. There was no standardized method of determining the fertility of a publication's field. Experimenting was expensive.

The A. B. C. has eliminated the barren spots of circulation. Planting an advertising crop is no longer an experiment. Advertisers **Know** the field through audit reports. They know whether it is fertile ground and sow their seed accordingly.

The Canadian Machinery circulation has been audited by the A. B. C. Advertisements placed in this publication are seeds well sown.

HEPBURN PUMPS



An Improved Self-draining Type

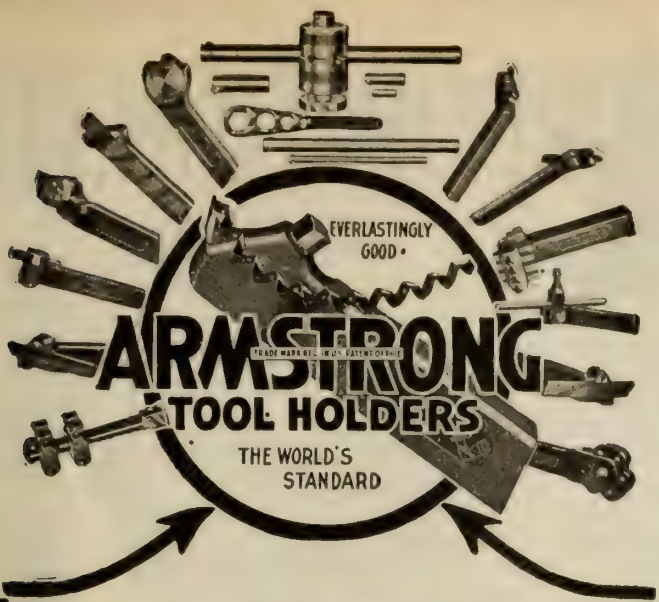
Practical users of pumps will appreciate the many advantages—the increased length of service—the greater efficiency made possible by the use of this adaptable pump. The self-draining feature, economy of steam, and the accessibility of the valves are a few of the reasons why this pump merits your earnest consideration.

Ask us for the particulars. We also make Vertical Engines, Compressors, Cranes, Winches, Derricks, Planers and other Machine Shop Equipment.

JOHN T. HEPBURN LIMITED

Engineers and Iron Founders

18-60 VAN HORNE ST., TORONTO



WHY NOT?

Why not Save Time, Grinding Wheels and High Speed Steel by using Armstrong Tool Holders on Your Lathes and Planers? Refuse Imitations and Substitutes.

Catalogue free.

Armstrong Bros. Tool Co.
"The Tool Holder People"
335 N. Francisco Ave., Chicago, U. S. A.

WRIGHT HOIST



The positive safety lock and non-fouling chain make the **Wright High Speed Hoist** absolutely safe and easy to operate.

Have you our Catalogue?

WRIGHT MANUFACTURING COMPANY
LISBON, OHIO, U. S. A.

STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

ALGOMA STEEL CORPORATION, LTD.

SAULT STE. MARIE, ONT., CANADA

SALES OFFICES
Montreal: 606 McGill Building Toronto: Bank of Hamilton Building

STEEL RAILS
Open Hearth Quality (All Sections from 12 lbs. to 100 lbs. per yard)
SPLICE BARS
STEEL TIE PLATES
PIG IRON
BASIC, FOUNDRY—MALLEABLE
SULPHATE OF AMMONIA
BLOOMS, BILLETS
SLABS
STRUCTURAL STEEL
MERCHANT BARS
CONCRETE REINFORCING BARS
IRON, BRASS and BRONZE CASTINGS
All of these steels we supply in HOT ROLLED BARS
We also furnish in BLOOM, BILLET AND SLAB FORM

MARK OF ALGOMA O.H. QUALITY

SULPHURIC ACID
NITRE CAKE

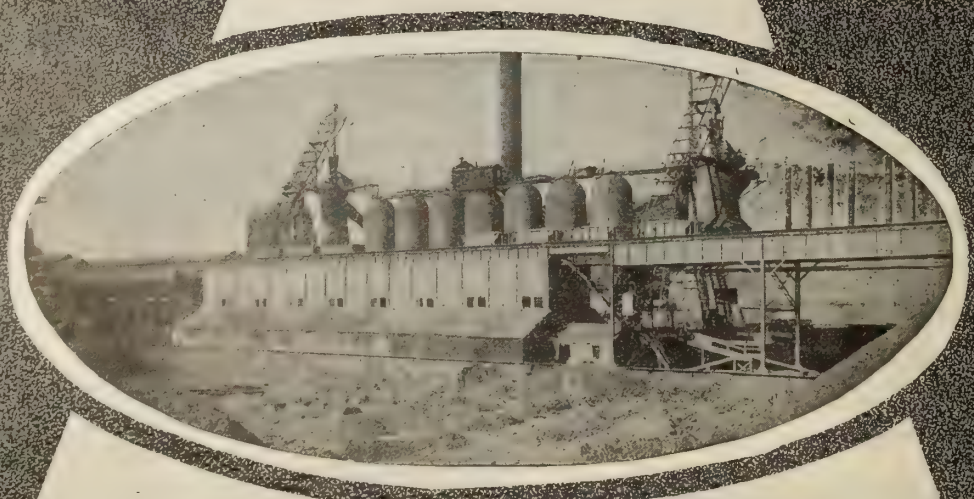
MARK OF ALGOMA O.H. QUALITY

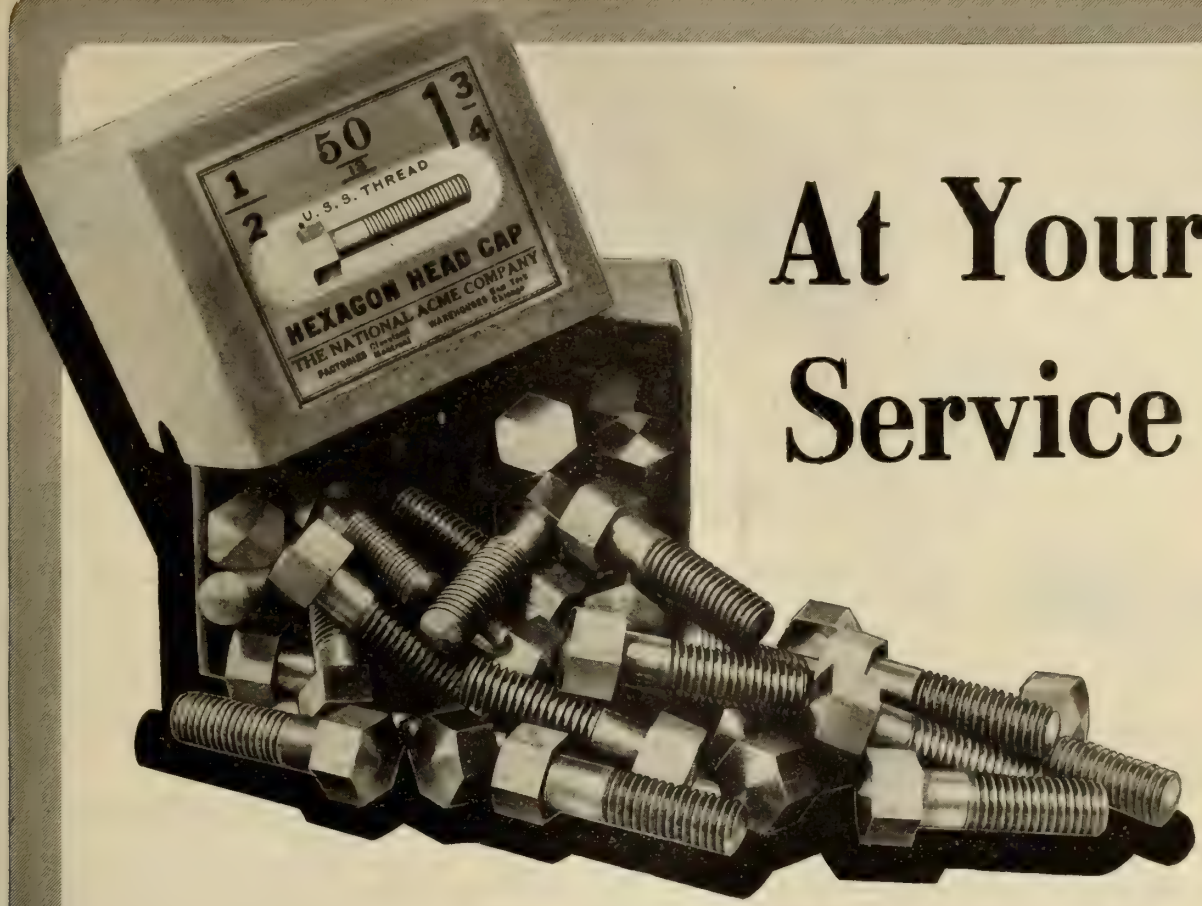
Open Hearth
Alloy Steel

Chrome-Vanadium Chrome-Nickel
Nickel

The quality of our product is of the very best—and is exclusively steel made by the Open Hearth Process, and can be furnished in all grades, from the softest rivet stock to high carbon special spring materials.

Order from us and you'll get both quality and prompt service. A trial is convincing.





At Your Service

STANDARD

V., U.S.S. & S.A.E. Cap Screws
V. & U.S.S. Set Screws
S.A.E. Plain & Castellated Nuts
V. & U.S.S. Semi-finished Nuts
Standard Studs

SPECIAL

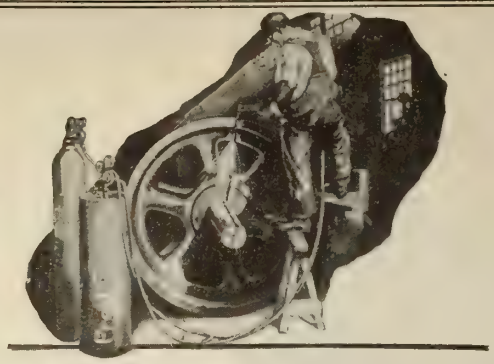
Screw machine product up to 2¼" diam., to specifications. Hardened and ground product to specifications

---

THE NATIONAL ACME COMPANY

MONTREAL, P.Q.

DeCourcelles G.T.R.R



A job like this is all in the day's work

THIS pulley was cut and the frozen shaft removed in perfect condition—one of hundreds of successful operations of the oxy-acetylene process being daily effected in machine shops everywhere.

Prest-O-Lite Dissolved Acetylene has made the welding and cutting blowpipes available **anywhere** by supplying uniformly pure gas in easily portable and instantly accessible cylinders—a system of distribution so flexible to meet perfectly every possible demand.

A centrally located chain of plants and warehouses forms the ground-work of Prest-O-Lite Service, the operation of which insures a never-failing supply of Prest-O-Lite Dissolved Acetylene in any quantity at any place.

Prest-O-Lite
DISSOLVED ACETYLENE

PREST-O-LITE COMPANY OF CANADA, LIMITED

Hillcrest Park, - Toronto

Branches at: Montreal Toronto Winnipeg.
Plants at: Toronto, Ont. St. Boniface, Man. Merritton, Ont. Shawinigan Falls, P.Q.

P.W.C. - 540

United States Electric Drills and Grinders



The "BUZ"

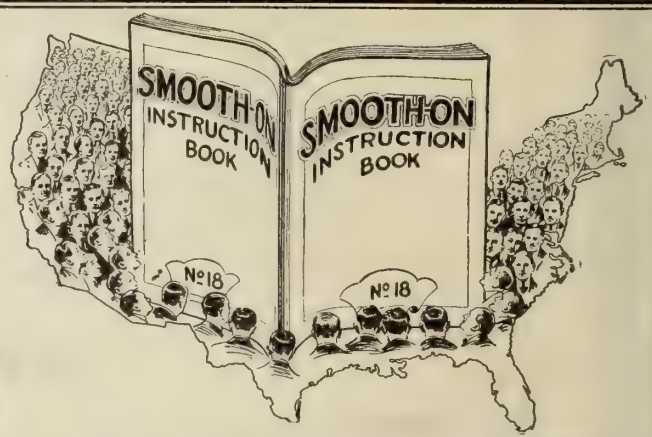
For all kinds of general drilling in metal up to 5/16"—name plates, cotter pin holes, oil holes, etc.

The "BUZ" is especially adapted to corner drilling—drills within ¾" of corner. Switch is located in handle; under absolute control at all times. Attaches to any lamp socket, alternating or direct current, 110 or 220 volts. Guaranteed the most powerful electric drill of its weight on the market.

Order a few to-day for trial. Their time and labor saving ability will convince you you need more!

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO



A Book of Knowledge---FREE

Compiled, endorsed, read and appreciated by engineers, this

Smooth-On Instruction Book No. 18

will help you solve your most serious Engine and Boiler room repair problems. Engineers the country over have contributed their experience to its pages.

Send for this book to-day—144 pages of valuable information. A Postal will bring it.

SMOOTH-ON MFG. CO.
JERSEY CITY, N.J., U.S.A.
Canadian Distributors
CANADIAN ASBESTOS CO., MONTREAL, QUE.

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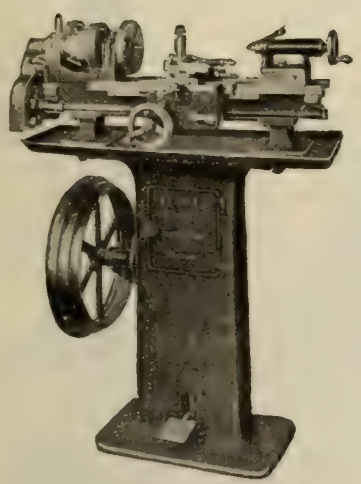
BANFIELD

METAL STAMPING - DRAWING -
FINISHING - ASSEMBLING
IN ALL METALS
TOOLS DIES JIGS

W. H. BANFIELD & SONS, LIMITED

370-386 PAPE AVE. - - - TORONTO

The Small Lathe for the Big Job



Type B-4
Foot Power Lathe

Actual Swing 7¼ inches
Length of Bed 30" and 36"

Write for Bulletin BC-612

"DALTON SIX"

Dalton Manufacturing Corporation
Sound Beach, Connecticut, U. S. A.
Cable Address "ALEDAL Stamford"
Also Manufacturers of Type B-6 Lathes

GISHOLT

LABOR SAVING EQUIPMENT

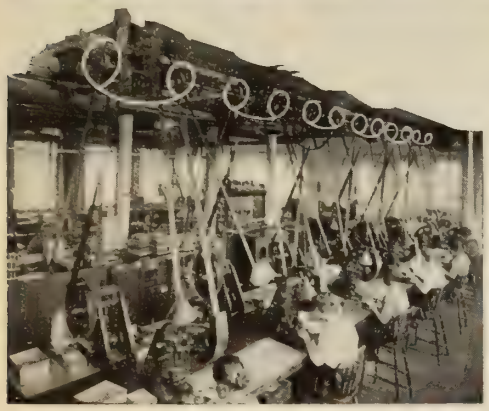
TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING AND DRILLING MACHINES
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories

Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.

1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

THE JOHNSON FRICTION CLUTCH



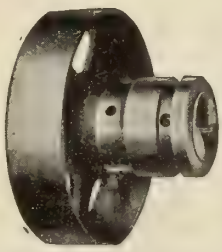
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

If You Need Supplies for---

The Machine Shop or the Factory—

For the Foundry or Construction Purposes—

Get in touch with—

We can supply you with Pipe Vises and Pipe Wrenches, Micrometers, Torches, Set Screws, Cap Screws, Machine Screws, High-Speed and Carbon Drills, Files and Machinists' Tools of every description.

We carry large stocks of Bar Iron, Sheet Iron (black and galvanized,) Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, also miscellaneous lines including Liquid Cement, Roofings, Sheathing and other construction supplies.

We have had 70 years experience in the supply business. Ask for quotations and delivery dates.

Crescent Belt Fasteners maintain a uniform grip the entire width of the belt.





Rice Lewis & Son, Limited, Toronto

Established 1847 **19 Victoria Street**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

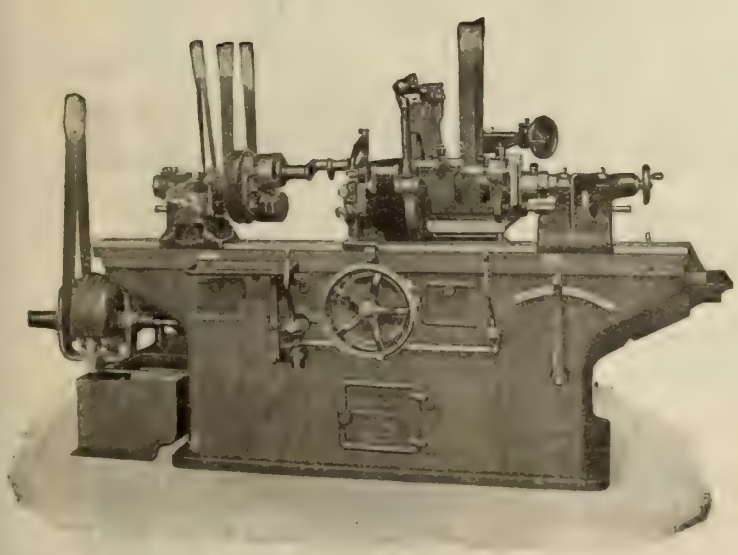
Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

LANDIS

No. 4A SPECIAL GRINDING MACHINE



The Landis Grinding Machine can perform all the operations necessary to put the gasoline motor in first-class condition and repaired as good as new. The installation of one machine in your shop is not limited to work of any special nature, it is designed to handle any grinding operation connected with the repairing of automobile, truck, tractor and other gasoline engine parts.

Let us show you what Landis Machines can do for you. Write to-day for literature.

LANDIS TOOL COMPANY

Waynesboro, Pa. New York Office: 51 Chambers Street

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

CANADIAN MACHINERY wants a representative in every town and city where there is a metal working plant or large machine shop.

We require first of all the ability to demonstrate to mechanics the value of reading technical journals in general and CANADIAN MACHINERY in particular, and to secure their subscriptions.

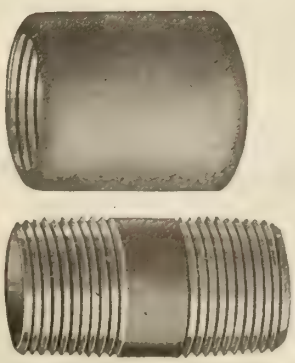
Second—we want men who can tell news when they see it. Not necessarily men who can write, but men who are alert for news, and who will give us the facts, briefly and plainly.

Canadian Machinery and Manufacturing News

143 University Ave. Toronto, Ont.

WROUGHT PIPE
COUPLINGS and NIPPLES





Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

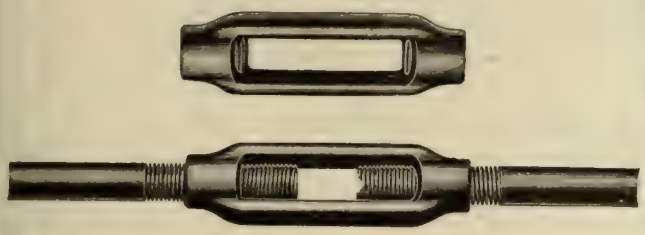
Supplied in black, or galvanized.

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL

CANADA
FOUNDRIES & FORGINGS
LIMITED

Drop Forged Steel

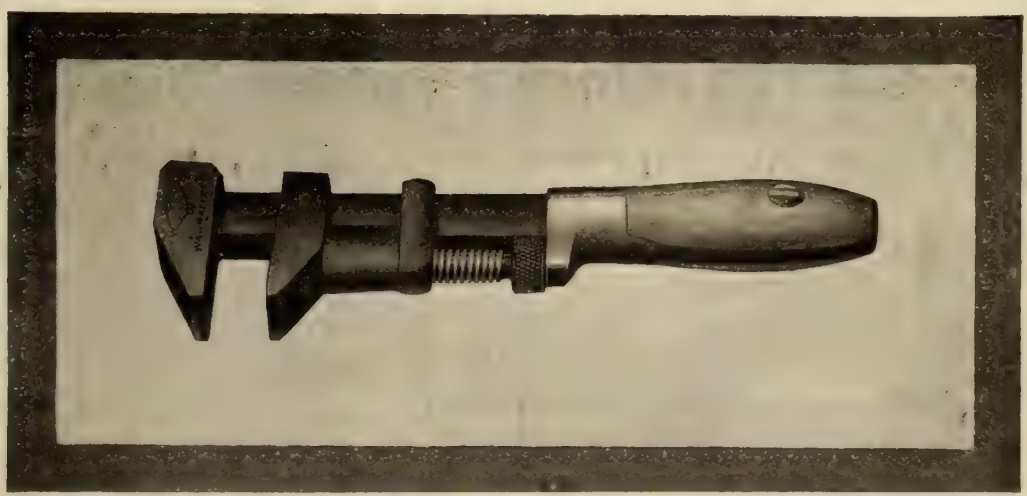


SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.





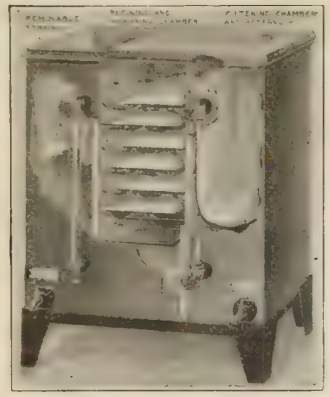
Better Tools make
better Workmen—

There are no better Screw Wrenches made than the "W & B" Knife Handle Pattern.

7 sizes—6 to 21 inches
2 other models also.

MADE IN CANADA

J. H. WILLIAMS & CO., Limited
"The Wrench People"
45 Thorold Road St. Catharines, Ontario



The Life Blood of the Factory

Dirty, gritty lubricating oil will junk your machinery long before its time. *Friction is production's worst enemy,* and the wear and tear caused by dirt and grit in oil slowly but surely wears out expensive bearings and other machinery parts.

Clean oil prolongs the life of machinery. Bowser Lubricating and Filtering Systems assure clean filtered oil on all bearings and restore the oil to its original lubricating quality. Try the Bowser Perfected Process of Seepage Filtration.

Installation takes a minimum of floor space.

WRITE FOR ILLUSTRATED BOOKLET C-13

Bowser Equipment is MADE IN CANADA by

S. F. Bowser Co. Ltd., 1368 Fraser St., Toronto, Ont.

BOWSER ESTABLISHED 1885



THE
ACKWORTHIE
TAPPING
ATTACHMENT.

BRITAIN'S PREMIER CHUCK

Made in 6 sizes.
To tap from ⅛ in. to 1¼ in. Whit.

We have made some thousands of these Chucks during the last 11 years, every one of which has given satisfaction. For tapping holes there is nothing to equal them for speed and handiness.

Shall we mail you particulars.

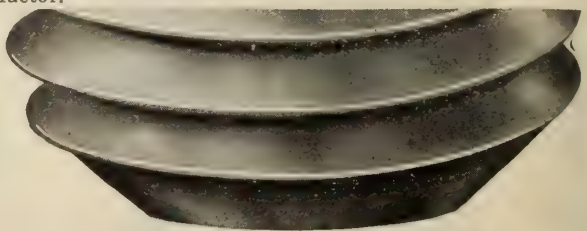
J. ACKWORTHIE, Ltd.
Coleshill Street,
BIRMINGHAM

TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE
PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.



Get copy of new Bulletin I-810

THE BRISTOL COMPANY
Waterbury, Conn., U. S. A.

Bilton

GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

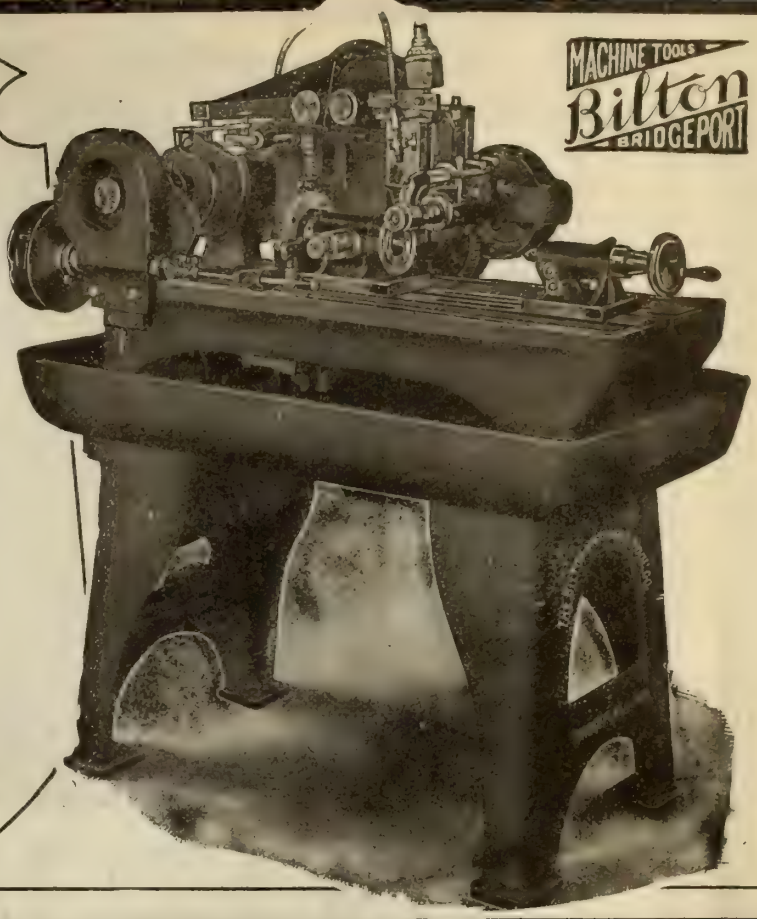
Big business everywhere is adopting the Bilton for high production on accurate work.

May we send you our catalogue?

Bilton Machine Tool Company

Bridgeport, Conn., U.S.A.

Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co., Ltd.
M. Mett Engineering Co.



LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also 1/8" to 3½" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

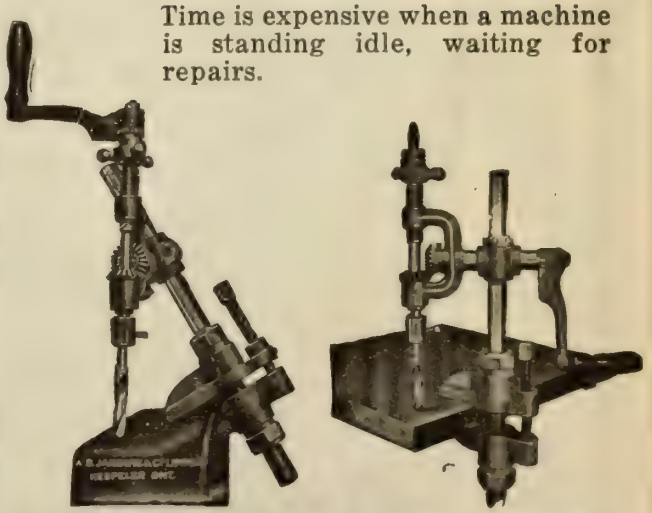
A. R. Williams Machinery Co., Ltd.

64-66 Front Street W., Toronto

Halifax St. John, N.B. Montreal Winnipeg Vancouver

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



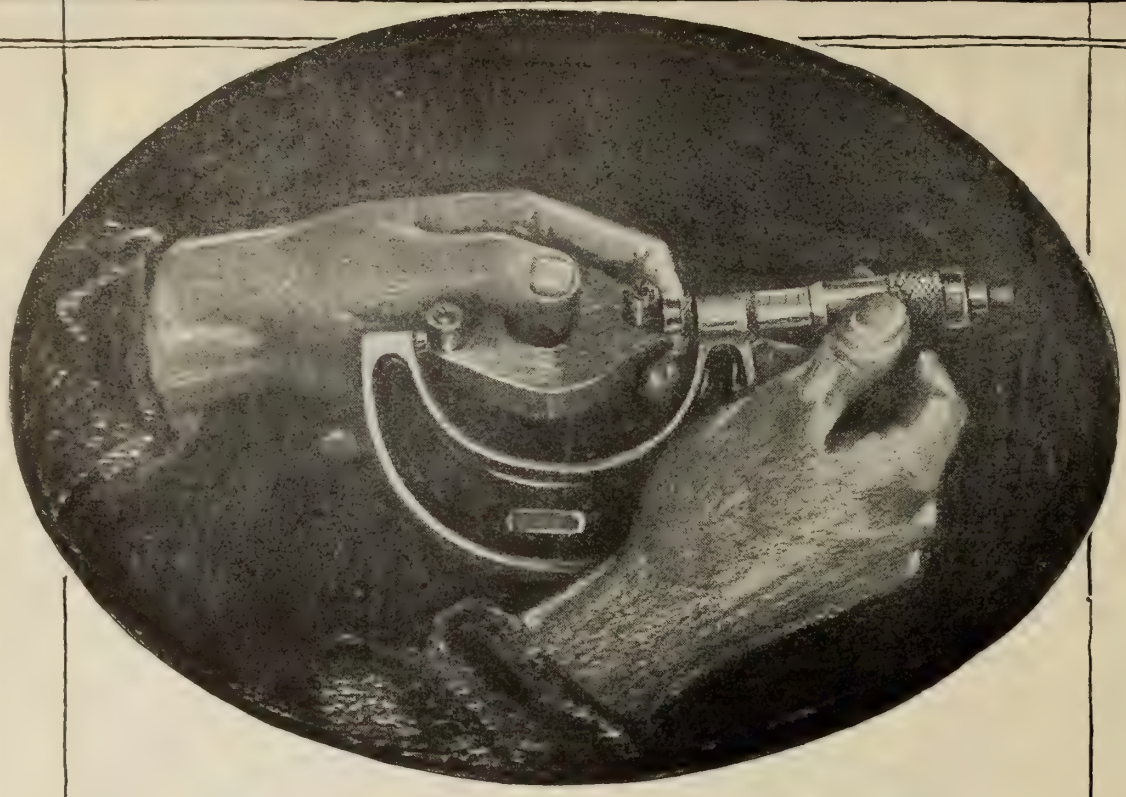
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

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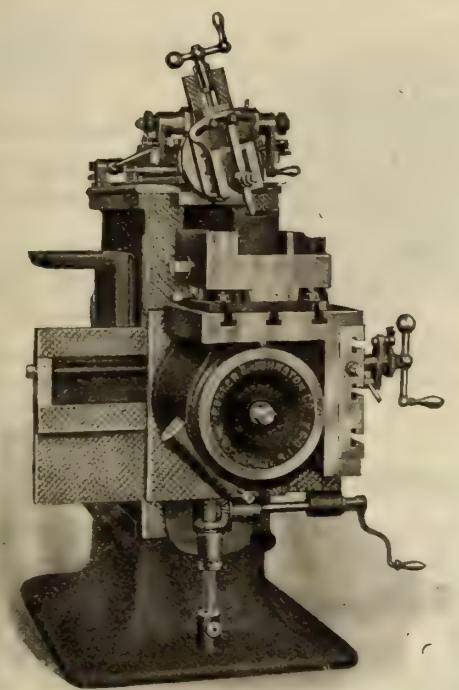
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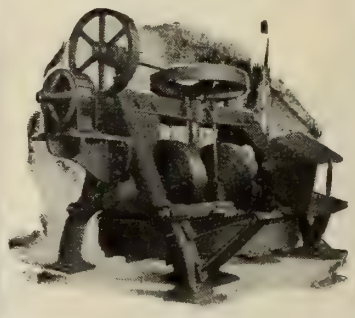
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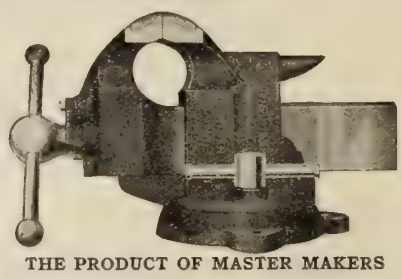
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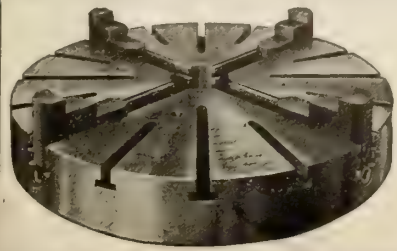
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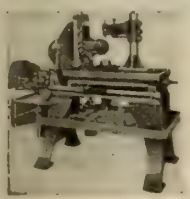
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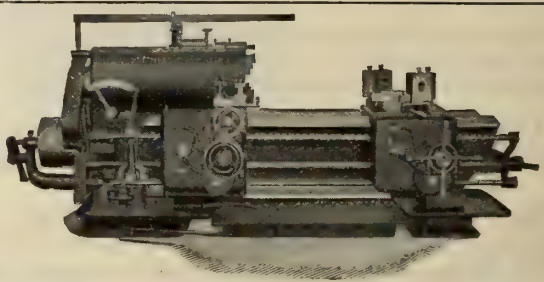
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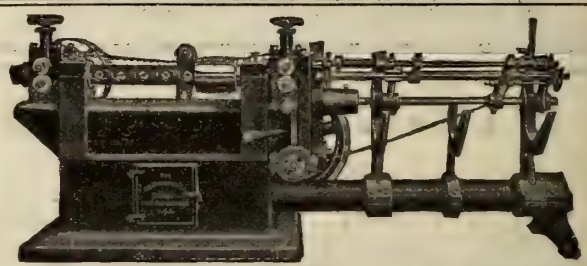
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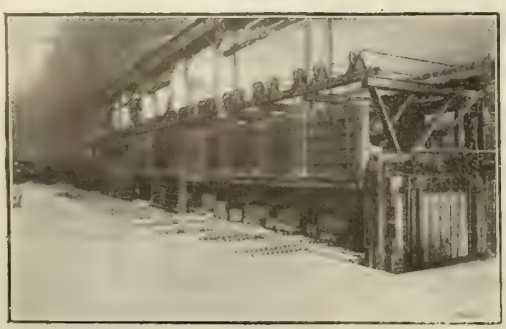


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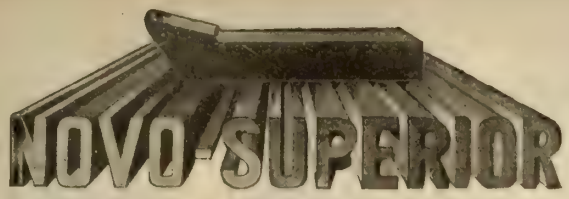
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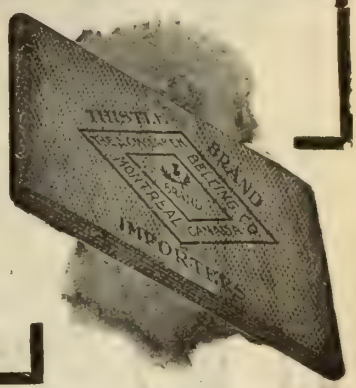
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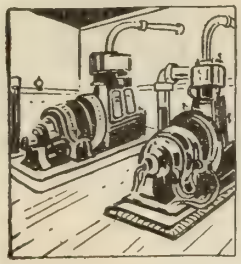
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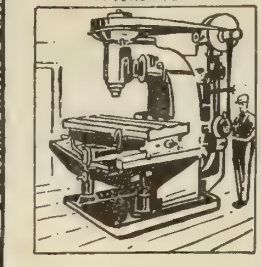
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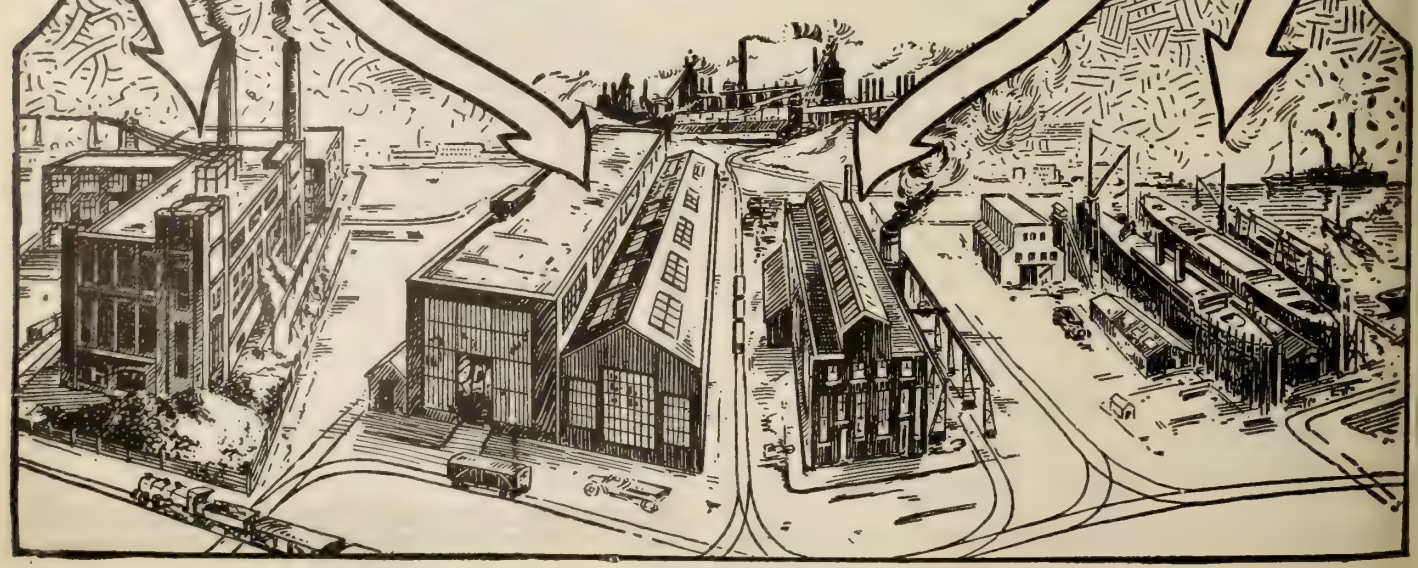
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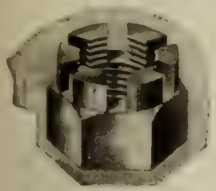




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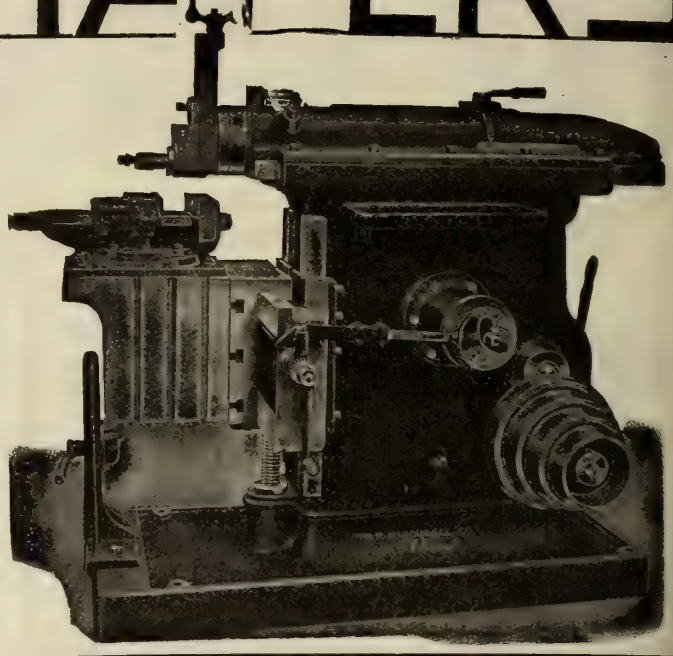
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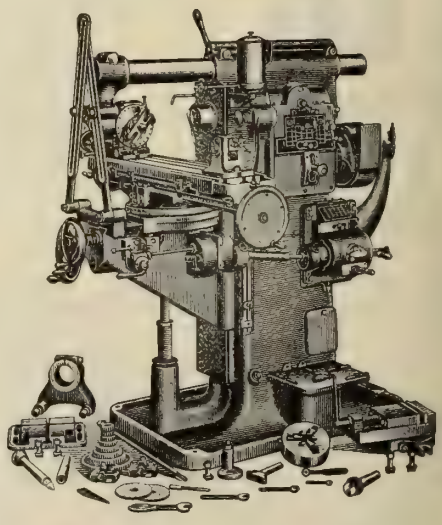
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI., No. 13 September 29, 1921

The Need of Gauges for Modern Manufacturing

Modern Gauges Are Very Necessary If Production and Accuracy Are To Be Obtained—Definite Limits Should Be Set—These Depending Upon The Nature of the Work.

By A. C. WICKMAN, B. Sc.

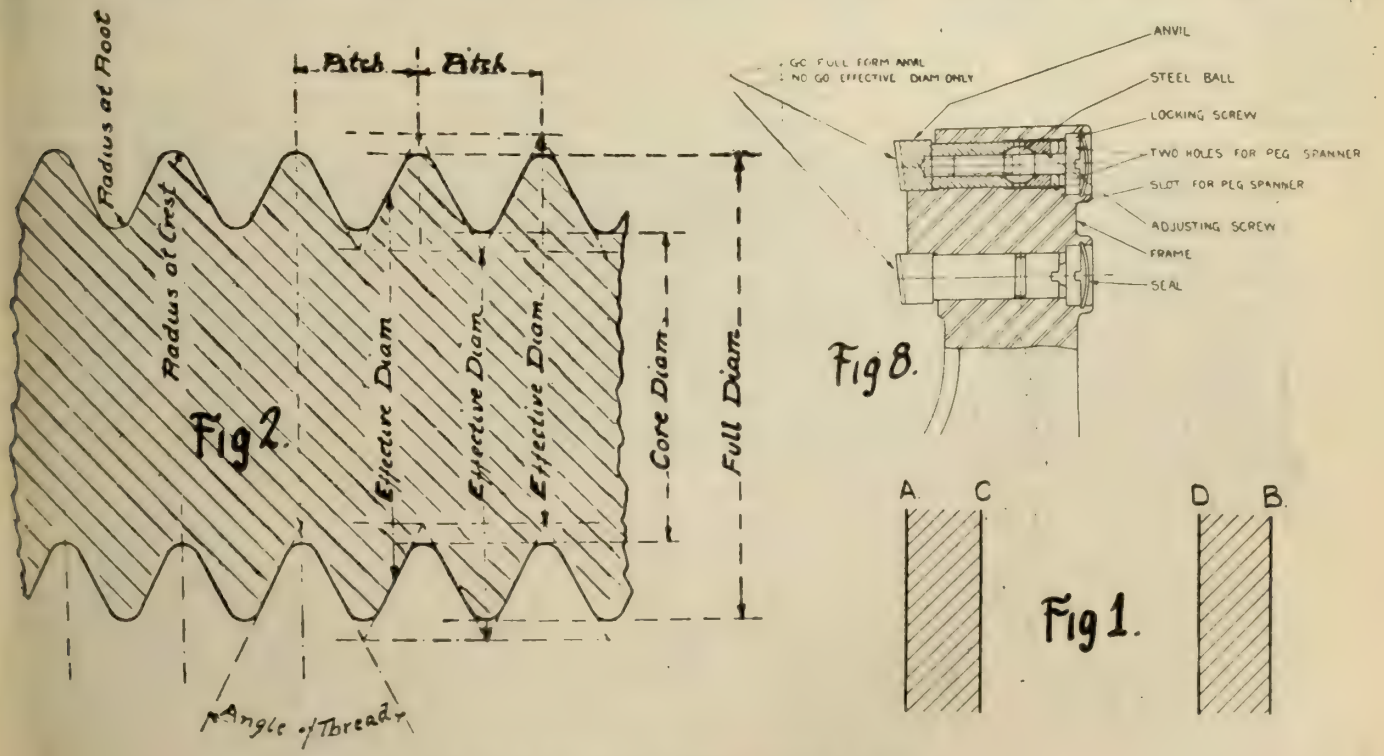
IN ENTERING a subject of such wide possibilities, it is only natural that we shall have to keep to some definite trend of thought, otherwise we will never arrive at a successful conclusion.

The hypothesis which we shall have to take will be first the need of gauges for modern manufacturing purposes, and secondly the need of definite limits for particular jobs. No attempt will be made to discuss the different types of limits as this would be subject matter for an article in itself. The plain gauging of parts such as plain holes and shafts can also only be treated very curtly, while location and position gauging will have to be omitted altogether.

The subject matter will refer particularly to the method of gauging screws, as this is a section about which more conflicting ideas and wrong conceptions exist than about any other type, while the part dealing with fine measurements, in addition to including screws, will deal particularly with the accurate comparing and checking of gauges which warrant the finest methods possible, also the types of measuring machines which are required by the modern factory.

While limits on components have been recognized for many years, it was not generally realized until the beginning of the war that gauges which were required to test components had, of necessity, to be made to limits also, and that these limits were governed to a large extent by the limit of the component. It had been customary for years to mark gauge dimensions as an exact figure, sometimes running to the fifth decimal place, it being left to the judgment of the tool maker (who had no knowledge of the limits of component) whether the gauge was scrap or not.

This state of affairs arose entirely out of the fact that the measuring equipment available was not sufficiently accurate and, when combined with the personal element of the measurer, by which it was greatly affected, could be made to produce results with errors which were equivalent to the practical errors of the craftsmen. I have often met with the argument that if this is so, why is it that machines built in those days were as well fitted as modern ones, and further, why worry about fine measure-



Figs. 1. 2 and 8. Showing the conditions spoken of in text.

ments and expensive gauges? This argument is easily answered, if the conditions under which the articles were made, are examined.

It is quite obvious that an easy way of making parts fit irrespective of price, is actually to fit the parts together in the same shop, an operation at which some of our old mechanics excelled, and which was responsible for their pride of craftsmanship.

Now so long as everybody made articles in this way, the method had no serious competitor, but in America, about the time of the Civil War, manufacturers had discovered that an article could be considerably cheapened by making its components interchangeable and devoting whole shops to the production of one such component. This also, of necessity did away with fitting, but brought about the great difficulty which necessitated the almost complete overthrow of our ideas of mechanical craftsmanship. The new factor was the reproduction of size. This had never been necessary when parts were fitted together, and it was found that while a man could fit a shaft to a hole to an extremely fine limit, he was unable to reproduce the size of the shaft or hole to much wider limits. While mating one piece with another is entirely dependent on the personal element of the operator for its accuracy, this same personal element made reproduction of size an impossibility, and it is an impossibility to-day.

It is true that the limits of error have decreased to an extent which a few years ago would have been thought impossible, nevertheless they still exist and for all we know will always exist.

Keynote of Interchangeability

As reproduction of size is the keystone of the arch of interchangeability, it will be seen how necessary it is to employ means both of gauging and of measuring which will make this as easy as possible.

Perhaps I ought to make this more clear. When I say that reproduction of size is essential to interchangeability, I do not mean reproduction of a certain size in the component itself, but reproduction of that component within limits, though wide ones, of the finest possible definition, and it is in fixing the boundary line that reproduction of size plays such an important part, as a limit can only be defined and exists as such by means of boundary lines. The statement, therefore, that reproduction of size is the keystone of interchangeability is a sound one. It may seem very paradoxical to say that the more accurate we make our gauges, the greater will be the limit on our component, but this is true nevertheless, as the diagram at Fig. 1 will illustrate.

Suppose a component with a limit of .004; this limit is fixed by the use of the component in practice and in the manufacturing conditions under which it is made. It is obviously made as large as possible in order to reduce the cost as much as possible. Let the two lines A and B represent this amount enormously magnified; suppose the error in the Go gauge to be .0005" and a similar error in that of the Not-go gauge; let us also allow .0005" of wear to take place before scrapping the gauges; we see that the boundary of error and wear in the Go gauge can be represented by a line C and similarly in the not go by a line D, we see that the component will be made within the limits CD instead of AB. It is obvious that we cannot allow the spaces AC and DB to fall outside our final limit, otherwise we shall at some time or other be producing work outside those limits and therefore scrap.

From this it will be evident that the narrower we can make those spaces AB and CD, the better it will be, but to do this again brings us up against the problem of duplication of size. When we consider that for many holes made to Newall, A limits the complete limit X is only .0005, you will see how much of that limit is swallowed by inaccuracy of the gauges of as little as .0001". This shows how the limit on a gauge is controlled by the limit on the component.

We are also faced with a third factor which we have just mentioned, namely, the question of wear on gauges, just in the same way as a limit is fixed on the manufacture of a gauge, so there will have to be a limit of error allowed, after which the gauge is scrap. This is just as important as the manufacturing limit of the gauge, as the sum of these limits has to be subtracted from the limit of the component.

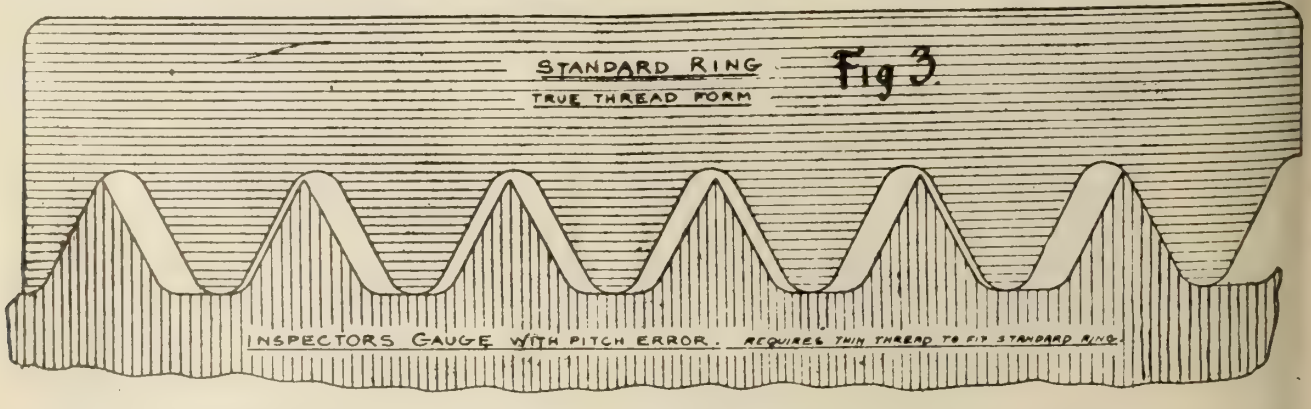
It is true that this quantity wear would not influence the fit of the components if we scrap the ring gauge at the same time as the plug, and if we could allow that the wear on the plug be equal to the wear on the ring. When however we consider that Not-go gauges scarcely wear at all compared to Go gauges, and that in a large factory new plug gauges may be used with old ring gauges, and what is more, a component made in six months time must interchange with one made today, we see that the question of wear cannot be neglected.

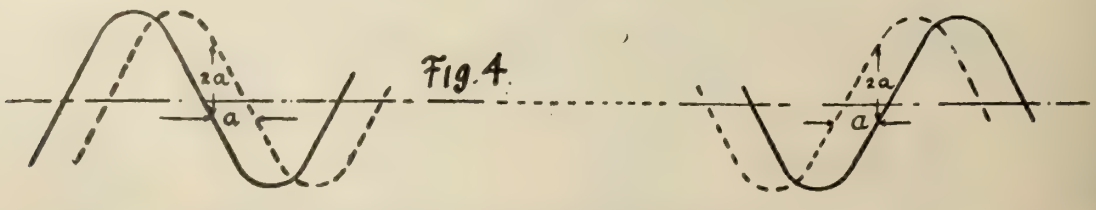
Now, in many factories gauges are not scrapped until it is noticed that components which have been passed by inspection do not assemble. As the Production Shop is always anything up to a month ahead of the Assembling Shop every article from the first one that does not assemble to the one when the machine is reset to the new gauge, has to be resized or scrapped. The enormous loss due to this is obvious.

The only way to overcome this is to inspect periodically all gauges, either in the Tool Room or Gauge Inspection Department where all limits of allowable wear are known. The period of use between inspection will vary according to the wear limit, the frequency of use and the type of gauge—anything from 24 hours to a month.

Interchangeability of Screws

With these preliminary remarks w





Figs. 3 and 4.—Text matter explains everything thoroughly.

will deal with the question of the interchangeability of screws. In Fig. 2 we have a few threads of Whitworth form, and it will be interesting to note the important points. Of course, the denominations of the various parts of the thread, such as "major diameter," "effective diameter," "core diameter," "pitch radius" and "angle," are well known, so now let us see which of these elements is the most important, and how they are co-related.

To begin with, we must take the natural function of screws; they are usually required to hold two pieces together, and in so doing may be subjected to great strain. From the first principles of machine design, the two parts of the bolt or screw, that is the shank and the thread must be of equal strength.

We also see that screws of the pitches usually employed are very inefficient machines, due to the low helix angle, and that most of the wrench power when tightening up is lost in friction. This friction naturally causes quick wearing of the threads and therefore in places where screws during their life have to be taken out and replaced frequently we have to make an additional allowance for the threaded portion in order to give the screw a useful life. The latter point is most important in small screws used in electrical and scientific instruments where the removal and subsequent tightening up of the screws a few times often scraps them, and when the tapped hole fails in the same manner it scraps the component as well.

Now it will be obvious, in view of the foregoing arguments that the only place where threads can take up side strain under the best conditions, is the flank; so that threads which are to function properly, as described, must fit on the flanks and can, without harm, clear both on the core and on the crest.

I always think that next to hardening there were more legendary and silly beliefs in the art of screw gauge making and the use of screw gauges than in any other mechanical process. I still come across the man who tells me that he has never used screw gauges and has no trouble with the fit of his screws. Of course not! He does not realise that it is only when the form of the thread is made accurate in order to obtain flank contact, that trouble in interchangeability occurs. I could make you screws without gauges that would always assemble into a tapped hole, just as in the same way I could produce a 1" shaft which would always go into a 1/16" hole. That man has never realised that he is producing a thread the effective diameter of which is many hundreds of an inch (not thousands) below nominal. That is, the thread is a mere wafer, and is then thin enough to take up any pitch error that may occur, either by clearance or by bending, and if the major diameter fouls, well it is crushed down when screwed into the tapped hole.

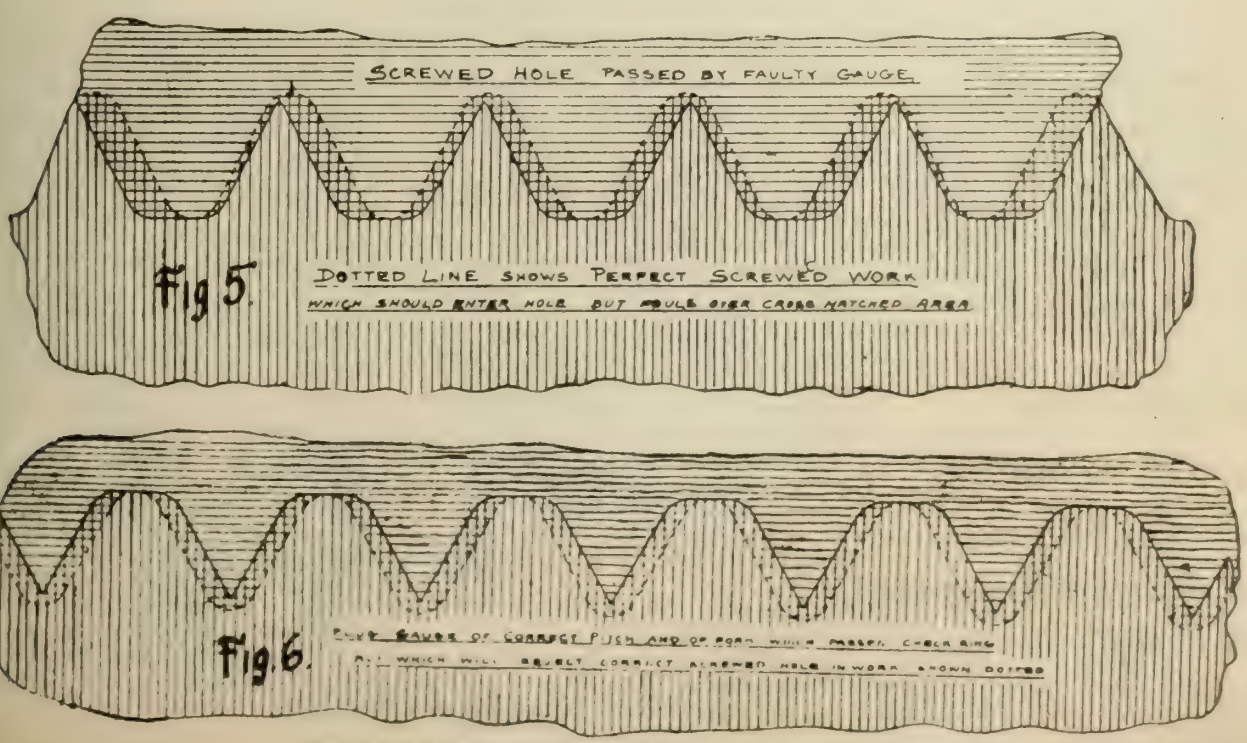
Now the curse of a condition like that is the fact that such a screw, if correct size on major, will assemble into a tapped hole tight, and that manufacturer sits back and thinks he has made a good job. Has he? Imagine that thread when it is strained and taken out to be replaced, it will nearly fall into the tapped hole next time, and how delighted the owner of the part will be when he buys a new screw from some source or other which is correct, and finds that due to this manufacturer making his screw threads so thin, he has been able to use a tap long after it has got below standard size, and that the screw he buys will not go into the tapped hole into which the old one practically falls. Yet this is not an exception, it is a daily occurrence.

To attain a good fit on the flank of a screw, would at first appear quite a simple proposition, it being merely necessary to watch the form and angle of the thread, but when we examine the thing more closely we shall see that this quality is more difficult to attain than it first appears.

Fig. 3 shows 6 threads of a screw in engagement with a tapped hole; it will be seen that the screw has a plus error in pitch compared with the tapped hole. The major and core of the two parts could agree, the angle of the thread on both being 55 degrees, yet due to this pitch error there is a fundamental difference between the two parts. On any strain coming into action from any direction, due to the tightening up of a nut, the first threads will have to bear all of the load or be partially sheared axially in order to allow the other threads to come into engagement, and so take their proportion of the load. While we are ready to admit that this must happen in all screws, due to the impossibility of perfection, it is evident that some limit must be imposed if strength and long life are to remain.

We notice in Fig. 4 that an axial displacement of plus "A" minus "A" gives rise to an increase of effective diameter of approximately 2A, this is doubled on the diameter so that the maximum displacement 2A, increases the effective diameter by 4A, therefore a displacement of "A" increases the effective diameter by 2A; but according to our description of effective diameter, that is a measurement of any line at right angles to the axis cutting the flanks, this effective diameter will not have altered.

We really require another term to designate the rise of effective diameter due to pitch. For the time being we will designate the effective diameter as measured with the needles across any



Figs. 5 and 6—Read explanatory text in connection with these views.

two threads, as the "simple effective diameter" and the effective diameter—due to pitch error in a length of thread, as the "compound effective diameter," therefore if K equals the pitch error per inch, Es equals the simple effective diameter, and Ec the compound effective diameter, then we know that Ec minus Es equals 2K, or Ec equals Es plus 2k. The figure will not be quite 2 as the angle is 55 degrees instead of 60 degrees, but for simplicity we will take this to be sufficiently accurate. The British Engineering Standards Committee have used the terms "Grade" and "Play" of a screw in order to differentiate between the compound effective diameter and simple effective diameter, but personally I prefer the latter definition, as it is not so open to misunderstanding.

You will notice that while Es is dependent on diameter only, Ec is a function of length as k is expressed in inches per inch, and therefore the increase, that is Ec minus Es will be twice as much for a screw 2 inch long as for a screw 1 inch long, and if we regard the quantity 2k as a constant, we can grade our screws by a designation which we may call pitch engagement, that is the number of threads or length of screw required to give it a compound effective diameter equal to nominal. Obviously the better the screw, the larger the number of threads would be. In a theoretically perfect screw, Es would equal Ec, so that the length could be infinite.

The whole accuracy of this designation rests upon the possibility of calling the quantity k, that is the pitch error, a constant; the fates have unfortunately decreed that pitch error shall be one of the most inconsistent things possible, and no matter how a thread be cut, whether by a die, tap or chaser, consistency of pitch is impossible, and therefore the quantity which we have called 2k will be twice as inconsistent, and therefore it is all the more impossible for us to call this quantity a constant.

Designating Screws

Next let us consider what happens if we designate screws by the length of thread required to bring their compound effective diameters to nominal. Take two screws, one with a pitch error plus .001″ per inch, and the other with a pitch error of plus .002″ per inch; assume the pitch engagement or number of threads to bring their compound effective diameters to nominal to be 10 threads, therefore we have

$$Ec_1 = Es_1 + .002''$$

$$Ec_2 = Es_2 + .004''$$

But $Ec_1 = Ec_2$ both screws having the same pitch engagement

Therefore $Es_2 = Es_1 - .002''$

That is the simple effective diameter of the second screw is .002″ less than that of the first, but as we have shown before, the simple effective diameter is a measure of the strength and longevity. It stands for quality, and therefore the second screw is only half the quality of the first, yet has the same pitch engagement, so that in order to be able to grade screws in this way, we must know the pitch error, the actual term pitch engagement without that, gives us no idea of the quality of a screw.

From the foregoing it is clear that we must keep pitch variation as low as possible.

There is still another aspect of compound effective diameter which we must examine, since compound effective diameter is co-related to pitch error and pitch error is got by comparing a certain pitch with a standard pitch, a screw will have a different compound effective diameter according to the standard, against which it is compared. Let us imagine a screw of sufficiently large diameter to be chased in a lathe, say an axle tube of a motor lorry and imagine it having to fit into a screwed hole in the axle tube bracket which bears the brake arms, etc. Suppose both the parts have a pitch error of plus .004″ per inch; now we know that the compound effective diameter of the axle tube will rise .008″ and therefore it will have to have a simple effective diameter of minus .008″ in order to screw into its gauge tight, the compound, effective diameter of the axle tube being got here by comparing its pitch with the standard, that is the pitch of the gauge. In the same way the compound effective diameter of the hole will be reduced .008″ and therefore in order to pass the plug gauge the simple effective diameter must be increased by a similar amount, the pitch again being compared to the standard; but when the two parts are screwed together we see that both of them have the same pitch, that is, co-relatively they have no pitch error, and therefore their compound effective diameters are equal to their simple effective diameters when compared with each other, but as we have shown these differ by .016″ approximately 1/64 inch, the two parts will therefore fall together and may be scrap.

From Figs. 5 and 6 it will be seen that the Screw Ring gauge does not fulfil the conditions necessary to produce good screws on an interchangeable basis. In the first case, its true size is extremely difficult to measure, involving the use of a large number of Go and Not-go Check Gauges, complete set of these for every Ring Gauge in use being far too expensive for the every day Shop; so that we can take it that as a general rule the wear on a Ring Gauge can never be accurately measured. In the next place, the fact that a Ring Gauge screws on to threaded work gives no indication that the work is any use. This we have shewn; also, if the Ring Gauge does not screw on, no indication is given of what is wrong:

A system of gauging which would: (1) Be accurate; (2) Allow of easy periodical inspection; (3) Be adjustable so that it can be kept to standard size and the wear limit reduced to a negligible minimum; (4) And of such form as to put a definite limit on the simple effective diameter; will give us the advantages required to produce good work. Such a gauge is shown at Fig. 7.

Adjustable Gauge

As you will see, the gauge is an adjustable thread snap gauge and has been developed from the plain adjustable type of snap gauge. The frame is of a high quality chilled cast iron of such a section as to reduce elasticity to a minimum. If this frame be thrown with sufficient force on a hard floor it will fracture. This is a safety feature. A frame made from a drop forging would in such cases be intact but there would remain in all probability a gauge having a considerable error, resulting in the scrapping of valuable work.

The first set of anvils is threaded on a precision lathe to true form, and after hardening is tested for pitch and projected for accuracy of form. The various elements are also measured by means of vees and needles in the same manner as a screw plug gauge. The second set of anvils is shorter in length than the first, consisting only of 2 or 3 threads which are cleared completely at the root and topped off at the crest; they merely test the effective diameter of the screw; they are calibrated by means of standard N. P. L. needles and the distance from the topped-off portion to the true effective diameter is etched as a constant on the back of the anvil

Assuming the first set of anvils set up to a hardened and ground plug (the size of which is the true core diameter of the thread to be gauged) or to a standard reference Screw Gauge kept for that purpose, the anvils will present a section of a Ring Gauge with the accuracy of a Screw Plug Gauge. On the work being passed through them it will be obvious that no element of the thread on the work is larger than nominal. Assuming that .006″ is the predetermined limit which can be allowed as a decrease of effective diameter or thinning of this thread in order to produce satisfactory fits and long working life, the second set of anvils is set this amount below nominal by means of another plug gauge. The second set of anvils will now represent the true section of Not-go effective Ring Gauge .006″ below size, and if the work does not pass through these anvils it is obvious that the effective diameter is not below this predetermined amount and therefore the screw will not only assemble into the component but will also assemble to a predetermined and have a known length of useful life. If the screw will not pass the first anvils, on holding the gauge up to the light with the screw between them, the operator can easily see what element is interfering and know what to correct. Each of the anvils has an adjustment of ⅛ inch, making a total adjustment of ¼ inch.

The references can be either hardened and ground steel cylindrical gauges or reference screw plug gauges and for inspection the reference need only be passed through the anvils to see if any wear has occured. If this is the case, the gauge is easily adjusted back to standard size. In this way there need never be any inaccuracy of the set up gauge of more than .0008", a condition impossible with a ring gauge, for, as we have shown, the amount of wear of this is never accurately known. The mechanism of the gauge is so arranged that it is impossible for the anvils to get out of square and also the gauge is absolutely tamper-proof. Fig. 8 shows the details of construction.

Details of Construction

The adjusting screw is covered by the locking screw which in its turn is covered by a lead seal closed into the recess at the top of the gauge by means of a special press. This press indents the firm's monogram or trade mark in the seal thus preventing any unauthorized tampering or alteration. The inspector on issuing such a gauge to the shop can feel confident that he will not have spoilt work returned to him, together with tampered gauges. The press when out of use can be locked with a padlock and the key retained by the inspector.

The adjustment of the gauge is very simple and is such as permits of extreme accuracy; the stem of the anvil, which is hardened and lapped to fit the hole, is coned out on the top to an angle of 60 degrees in which rests a hardened steel ball. The adjusting screw, which is also hardened, has a similar cone underneath it and presses down on the same steel ball. The locking screw, the head of which bears in a counterbore on the top of the gauge, passes through the hardened adjusting screw, through the clearance hole in the steel ball and into a tapped hole at the bottom of the countersink in the stem of the anvil. Two holes are provided in the head of the locking screw, and a special peg spanner (with prongs which go through these holes into the slots of the adjusting screw) is used for setting the gauge.

To set the gauge, screw out the locking screw with a screw driver a few turns; drop the peg spanner in position and rotate. The pegs will drop into the slots of the adjusting screw and rotate it. The cone of the adjusting screw will push down the hardened steel ball which, in its turn will force down the stem of the anvil. Adjust the gauge so that it grips the standard slightly tighter than required. Remove the peg spanner and lock the lock screw.

By giving the locking screw an extra twist with a screwdriver it is possible to get any desired feel between the anvil and the setting gauge. The hardened steel ball is compressible a few ten-thousandths of an inch and on twisting the locking screw an extra amount the

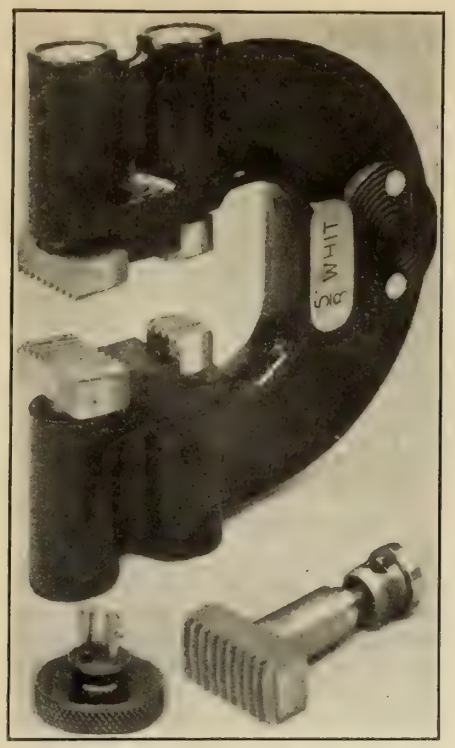


Fig. 7.—Gauge explained in text.

anvil can be slightly drawn back to a limit which is quite impossible with the ordinary type of adjustments in use at present. When so locked it is impossible for any back-lash to be existent between the adjusting screw and the stem of the anvil, and, finally, after sealing, tampering becomes an impossibility, as an attempt to set the gauge in a vice would result in the fracture of the frame. Summing up the advantages briefly we have, length of life, complete visibility, absolute limit on the minimum effective diameter, easily adjusted, easily inspected, and absolutely tamper-proof when adjusted. It tests out of roundness or concentricity, and is really a combination "Go" and "Not-Go" gauge, so that the only one adjustable thread snap gauge is required. Last but not least the maintenance changes are negligible.

This then gives us a method of looking after production of the screw, but obviously we must in some way look after the limits in the tapped hole. How this is best accomplished will be considered in the next portion of the present article.

THE PRICE OF PAPER

In an effort to reduce production costs by getting lower prices on their paper supplies, publishers who are members of the Canadaian National Newspapers and Periodicals Association asked for a conference with paper manufacturers. This took place in Toronto recently and the situation was fully discussed. It was pointed out that at the present time some publishers are actually paying more for paper than in 1920, while the ruling price on book paper is 100 per cent higher than in 1914. In some cases even more than 100 per cent increase is being paid. Unfortunately no relief is promised by the paper manufacturers. This does not, of course, refer to the grade of paper used by daily newspapers, which is materially lower in price now than in 1920. Publishers of agriculture, business, educational, religious and technical newspapers and magazines in the United States, all of them in direct competition with Canadian publishers, are buying their paper at from 25 to 40 per cent less than the prices paid for paper used in the magazines noted above. To make it worse, the U. S. publications are admitted to Canada free of duty.

According to reports British blast furnaces are again firing up. Forty out of 300 are already started and 200 more are expected to be in use within the next two weeks.

TRAIN RECORDS IN VARIOUS PLACES

A table of interest, insomuch as it shows various records of trains, and boats, is shown below. These figures of course cannot be taken as average conditions, but rather as records established at some particular time. Take for example the first two items, viz, the Empire State express in America, and the Great Western express in England. While the American train shows a better speed per hour, the road run over may have had a lot to do with the record made, for as an average, the English trains run at a faster speed than those in the United States. It would also be interesting to compare the Mauretania record with some of the old time sailing ships that used to cross the same stretch of water.

Noteworthy Train Records

Vehicle—Country.	Date	Miles pr. hr
Empire State Express, United States	1893	112.5
Great Western Express, England	1842	72.0
London-Aberdeen, Britain	1894	63.3
Paris-Calais Express, France	1899	57.1
Electro locomotive, Germany	1901	130.0
London-Exeter Express, England	Now	57.9

Other Noted Speed Records

Mauretania, transatlantic	1910	4d. 10h. 41m.
Destroyer Reid, United States	1918	43.1
Miss America (motor boat), Lake George	1920	77.85
Spad airplane, France	1921	193.0

Experiences in Sixteen Years of Drop Forging

How Long Should a Die Be Kept in a Furnace?—Proper Method of Hardening Drop Dies—Round Corners Save Many a Break—Counteracting Warpage

*By WALTER ROWLANDS

HAVING read an article on the subject of "Hardening Drop Forge Dies," in the August 4 issue of Canadian Machinery, I decided to write you regarding my experience of about 16 years in drop forging, designing drop hammer dies, or rather designing the break down, because that is the important part of such dies. During my years of experience I have read a great many articles and have seen quite a number of sketches in the various mechanical journals from time to time, but I don't think I have read an article on the above subject that gave any idea of how long a die should be kept in a furnace, taking into consideration the fact that a regular and steady heat is kept up on a good type of muffle furnace.

My object in referring to the subject in this light is because so much has been said and printed about helping the new beginners or apprentices, not only in the forging business but in all other lines of the mechanical trades. I mention this designedly, because it is quite noticeable as you travel around that so few youths are learning the blacksmithing or forging business, and you cannot very well blame them for the simple reason that it is a hot, dirty, and laborious job, and seldom does a blacksmith get beyond a foreman's position.

After the completion of King Solomon's temple it was decided to give a banquet to the artisans who had been instrumental in building it, and in order to seat them in order of merit at the table each one was asked who made his tools with which he did such splendid and magnificent work. One after another acknowledged that the blacksmith had made his tools, and when he was brought forward to answer the same question he answered "I make my own tools." He therefore, was given the seat of honor at the banquet.

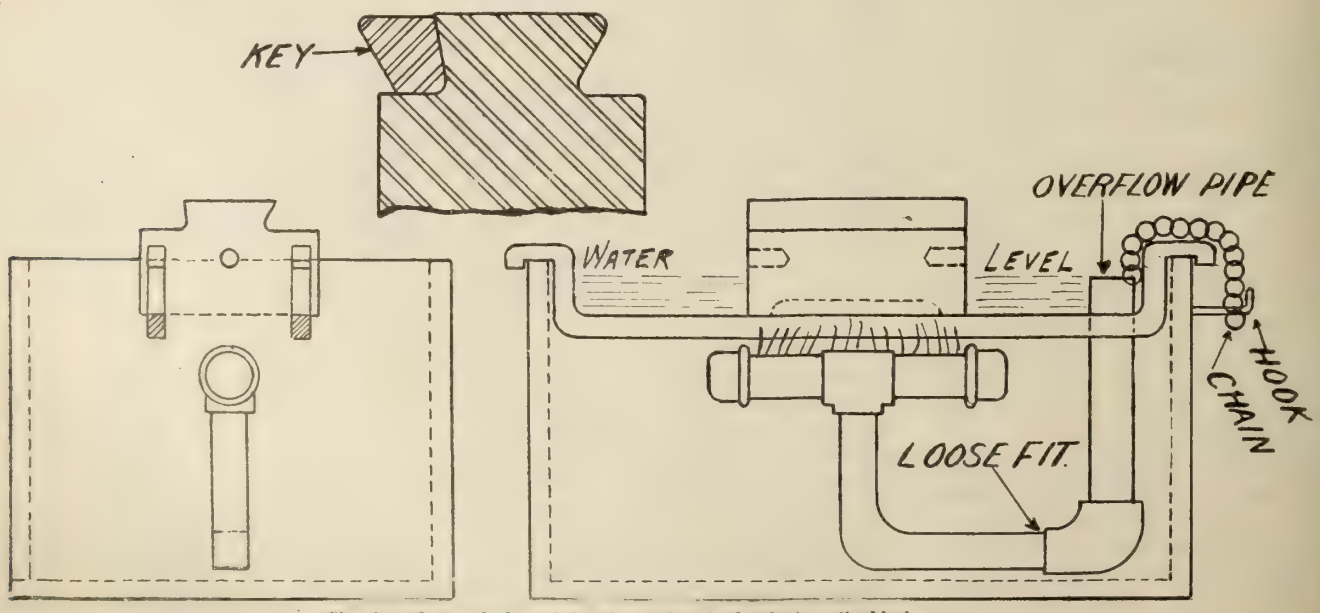
*Author was formerly chief of forge department in the International Harvester Co., Hamilton, also in the Farm Machinery Co., Montmagny, Quebec.

Proper Method of Hardening

To get back to the hardening question and arrive at some definite time per inch of thickness of drop dies, the writer has found that close to three quarters of an hour per inch of thickness worked out very satisfactorily, although some very good firms in the U. S. advocate one hour per inch of thickness. However, after 16 years supervision over this branch of the forge foreman's work, by adopting three quarters of an hour per inch of thickness we only broke two dies in that length of time. One of these dies was traceable to a flaw in the steel. It parted in a deep impression some eight or ten hours after it left the forge and it so happened that the steel had a very perceptible flaw on the same line as the impression.

Take for instance a man who has never hardened a die taking the place of an experienced hardener who has left to go to another job. He from experience has been fairly successful in estimating the time and heat to give a certain die, but of course he takes this information with him, the die after being in the furnace about three hours looks to an inexperienced man to be O. K. to harden. It is superficially hot all over, and so we will all admit the heating of drop forging dies is all important. Then why not have some rule for length of time per inch of thickness. The pyrometer gives heat of furnace but does not indicate anything more. Consequently for a given heat with a good type of muffler furnace, why not a given time per inch of thickness I think if all drop forge proprietors would have this looked into some very valuable information would be found that would be beneficial to all concerned. In view of the above I maintain that articles that are published in mechanical journals for the benefit and guidance of its subscribers should give as near as possible something definite and decided. A case in point: A few weeks ago another article on the length of time to heat die blocks was from 3 to 5 hours at a certain heat, say about 1450 Fahr.

The same idea applies to sketches. We all know that round corners are better than square roots in tempered articles, and how important it is in a drop die that has cost say $300 or $400 to eliminate as far as possible any faulty construction or practice that has a tendency to cause fracture or break. The writer has yet to see a sketch of a drop die that showed what it ought to be like in this respect. Take for illustration the article and sketch that appeared in your issue of August 4th, 1921. The sketch shown has square roots at tang. Why have this which is inciting fracture and liable to scrap



Showing the method used by the author in hardening die blocks.

the whole expensive die. It is just as easy to machine a fillet say ⅛ or 5/32 radius in the corner, and why not put bar holes in the front and back of the die? This feature has 3 or more distinct advantages.

1. It enables the machinist to clamp the die on table of either the planer, shaper, or miller without having to change his clamping when machining either the face, tang, front and one side of die as is the usual practice for drop dies with most firms, the front and side usually being about 2" from top.
2. It enables the hardener and his helper to take die from platform or plate in front of furnace and place over water spray in tank with least possible delay which is very essential. Furnace and tank rest should be as near as possible of the same height.
3. It enables the hammer man to either put pins in the holes for crane operation and sling in placing dies in hammer, or by using bars in front and back, he can slide it from truck to hammer. This system of holes is also advantageous in taking to and from the die storage by using pins and sling chain with crane.

The writer cannot understand why it is necessary to place the tang down in the water first until it cools below a red heat, subjecting and inducing the die to warp, not to speak of exposing the important and vital portion of the die to the air unnecessarily, having the trouble and delay of turning the die face down in the water in exact position of impression over spray.

The writer's method was to place the die face down, impressing over the spray as soon as possible, then pour water on the tang either with a hose or two pails in the stands of the hardener and his helper, alternating so as to keep a steady and continuous flow until satisfied that sufficient water has been poured on tang for two reasons.

1. To counteract as much as possible warpage, owing to the shrinkage that is taking place on the face of the die. The heat that is in the centre of the die will draw up through the tang thereby keeping it soft, at the same time helping to relieve the enormous strain that is passing through the steel.

We never allowed a die to cool off entirely in the water. If it was a small die we would drop it in the oil until nearly cold after it came from the water tank. On large drop dies we found it good practice to place our hand under the water and feel the impression. Before the heat had entirely left the bottom of impression it was taken out and placed on a board or hot plate, according to the thickness of die or the heat that was still in the centre.

As soon as possible after this was done, we cleaned off face with emery wrapped around suitable sticks of wood or sand stone. We then watched the face and impressions and according to quality of steel allowed the color (usually a very light straw) to come up. This at the same time was relieving the die of hardening strains, and by following the above method we were enabled to forge intricate drop forgings 10" or 12" long with sharp projections and limited flash up to 80,000 to 90,000 pieces to standard specifications and finish before the dies were taken to the tool room to be tanked up or recut.

My hardener had in addition to the muffler furnace, for dies, etc., a lead pot, and a carbonizing furnace generally filled with pots containing thousands of small pieces. Projecting from the muffler furnace at one side, we had a hollow box shape chute about 10" wide, 6" deep, and 30" long, with a vertical gas pipe in outer end to take off the gases. On the top of this chute we draw tempered all our punches, which were piled up on one end and rolled along top until the necessary color showed. This of course was after they had been hardened and polished on a spindle with suitable chuck. Punches of all diameters came by the box full, consequently wholesale methods for hardening and tempering had to be adopted.

Showing Method Adopted

The sketch showing method of hardening drop dies will illustrate that the die is supported by two adjustable braces across the tank which are of sufficient depth to allow the impressions on the face of the die to be well covered with water. The depth of water for die is governed by the depth of the impressions or irregular shape of the face of die.

The overflow pipe, as will be seen, is an ordinary pipe with a standard elbow from the horizontal pipe leading to the outlet in tank to the adjustable overflow or vertical pipe for regulating the depth of water in the tank. No extra work or expense is required to make an overflow. As far as the adjustable feature is concerned, the elbow can be made an easy or loose fit, and any kind of small chain attached to the top of overflow. A nail driven in the tank at a convenient place will enable you to obtain any depth of water required, as you can swing the joint one way or the other.

The supply pipe is provided with tee joint, and the cross pipe can be made to suit your longest dies. When hardening shorter dies the holes in sprayer can be plugged temporarily to suit the length of the impression of the die.

The Flexible Steel-Lacing Co., published a book on "Short Cuts to Power Transmission," which is said to contain hints on belting, also varied transmission data.

Speeding Up Inspection

TO MAKE the inspection of small parts a task which could be done quickly, accurately and without undue fatigue, the Amphion Piano Player Company has constructed special tables which it has found most satisfactory. Some of the ideas incorporated in these tables are well worth the consideration of factory men.

In the first place, comments H. R. Hampton in "Factory," the feed chute is equipped with a sliding door to retard the flow of parts to the table. Then guide strips fixed on the surface keep the parts from falling off the table and also keep them within easy reach of the inspector.

Two chutes are used, one leading to a tote box underneath the table, which is for acceptable parts. The other chute is provided for those parts which, though faulty, can be put in acceptable condition by the repair man. All parts rejected are thrown into the table-high boxes on the right of the inspector. Work may be rejected for several reasons, and it is necessary to the best production methods to know what proportion of rejects are traceable to each fault in manufacture.

The height of the table and the position of the chutes are designed to reduce to a minimum the fatiguing effect of the work. Another table in the same plant takes care of this need quite easily. To especially equip it for sorting, holes were cut through the top and a small flare-top chimney or chute fitted in each hole. The top of each chute extends a few inches above the table surface and prevents the material from dropping into the holes accidentally. As the inspector works, she passes rejected pieces into one or the other of the little chimneys, according to the nature of the fault. The flaring top on the chute facilitates dropping rejected parts into it.

Each chute leads into an open box beneath the table. The several boxes which catch the rejected pieces are of a standard size, similar to a tall wicker waste-basket—just high enough to be slid under the table. Built of birch, they are substantial and at the same time of a shape that is easy to handle. At the end of any period of inspection, the pieces in each box are counted and the results recorded. Some of the boxes are for pieces which have certain repairable flaws. These boxes are sent on to the repair men. These men can work fast because all the pieces in one box have the same flaw, and they become quite expert in repairing the flaw.

The Bristol Co., Waterbury, Conn., have forwarded us several catalogues covering their line of safety set screws, pyrometer and heating treatment equipment, belt fasteners, etc.

Canadian Machinery Drafting Course Part III.

Surfaces—Plane Figures — Triangles—Quadrilaterals—Circles—Solids, etc. Each Section Is Taken Up in Detail—Two Plates Have To Be Prepared—Careful Workmanship Is Very Essential

By J. H. MOORE

IN Part 2 of this series, which appeared in the June 9 issue of Canadian Machinery, we reached the point where an obtuse angle was defined. Next let us go further into the subject of geometrical terms.

Leaving the angles, we come to the subject of surfaces, which prompts the question, "What is a surface?"

A surface is produced by the motion of any line. It always had two dimensions, namely length and breadth.

There is another type of figure termed the plane figure. This could be explained as follows:

A plane figure is a plane bounded on all sides by lines, the space included within these lines (that is, taking it for granted that they are straight lines) is called a polygon, os as sometimes termed, a rectilinear figure.

Twice we have come to polygons, let us see what types we find.

A polygon proper is a plane figure which is bounded on all sides by straight lines, these lines being called sides, the sum of the sides being termed the perimeter, which of course means all the way around. These polygons are classed according to the number of sides they have and are as follows:

A triangle is a polygon with three sides; a quadrilateral is a polygon with four sides, a pentagon, with five; a hexagon, with six; a heptagon, with seven; an octagon, with eight; a decagon, with ten; a dodecagon, with twelve; an equilateral is a polygon whose sides are all equal, while a regular polygon is one all of whose angles and sides are equal.

These definitions describe in full the various types of plane figure met with in geometrical problems, in fact some of those mentioned in the list very seldom appear, but for the student's benefit have been spoken of in order that he may familiarize himself with the names.

Polygons can again be classified into various headings, in fact such is necessary, so briefly we will discuss some of the general headings. First we come to triangles, namely the polygon with three sides. The angles of a triangle are of course the angles formed by sides. Figs. 1 to 6 in chart No. 1 ilustrate the different type of triangles met with. At Fig. 1 we see the right-angled triangle, or as it is commonly termed, the right angle. The longest side of this angle, that is the side opposite the right angle, is called the hypotenuse, the other sides are simply termed sides, or, as some prefer to say, legs.

Fig. 2, the obtuse angled triangle, is one that has an obtuse angle as shown.

Fig. 3, the acute angled triangle, is one which has all its angles acute.

Fig. 4, the equilateral triangle, is one (as the name denotes) having all its sides equal.

Fig. 5, the isosceles triangle, is a polygon, two of whose sides are equal.

The altitude of a triangle is the perpendicular drawn from the vertex to the base, see line A on Fig. 5.

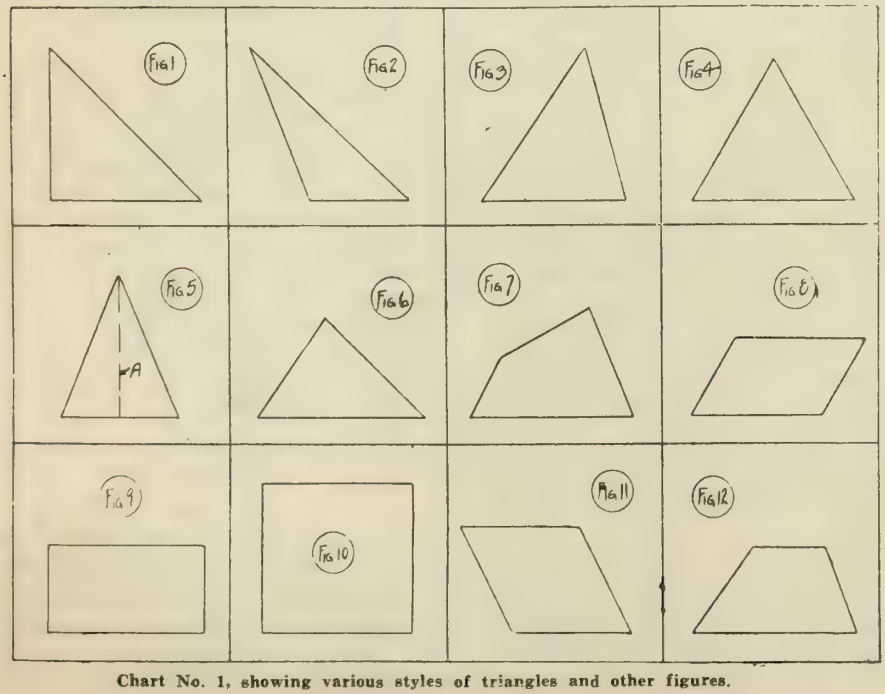


Chart No. 1, showing various styles of triangles and other figures.

Fig. 6 illustrates the scalene triangle. This triangle has no two sides equal.

The lowest side of a triangle is always called the base. Any side may of course be taken as the base, but usually the side upon which the triangle is supposed to stand is generally accepted as the base.

Quadrilaterals

Polygons are again subdivided into quadrilaterals, or polygons, with four sides, of such shape and names as follows:

A quadrilateral is, to commence with, a figure bounded by four straight lines (see Fig. 7).

A parallelogram is a quadrilateral whose opposite sides are parallel (see Fig. 8).

A rectangle is a parallelogram whose angles are all right angles (see Fig. 9).

A square is a parallelogram whose sides are all equal, and whose angles are all right angles (see Fig. 10).

A rhombus is a parallelogram whose sides are equal but whose angles are not right angles(see Fig. 11).

A trapezoid is a quadrilateral having only two sides parallel (see Fig. 12).

Circles

Next let us consider the circle. A circle is a plane figure bounded by a curved line called the circumference, every point of which is equidistant from a point within commonly called the centre of the circle.

A circle in turn has other lines which can run through it, each having their proper name. Let us consider a few of these.

Referring to the chart No. 2, at Fig. 1, we first see the circle itself, O being the centre point. Fig. 2 shows certain added lines to the circle, each having their proper name, A being the diameter, B the radius, and C the tangent to the circle. From this we gather that—

The diameter of a circle is a straight line drawn through the centre, terminating at both ends in the circumference.

The radius is a straight line joining the centre with the circumference.

The tangent is a straight line which touches the circumference at only one point, called the point of contact.

Fig. 3 carries us still further. Here we see a line A passing through two points on the circumference. This is known as a secant. The line B represents a chord of a circle, or a straight line which joins the extremities of an arc, but does not pass through the centre of the circle. The space, or area C included between the arc and the chord line B, is called a segment of a circle.

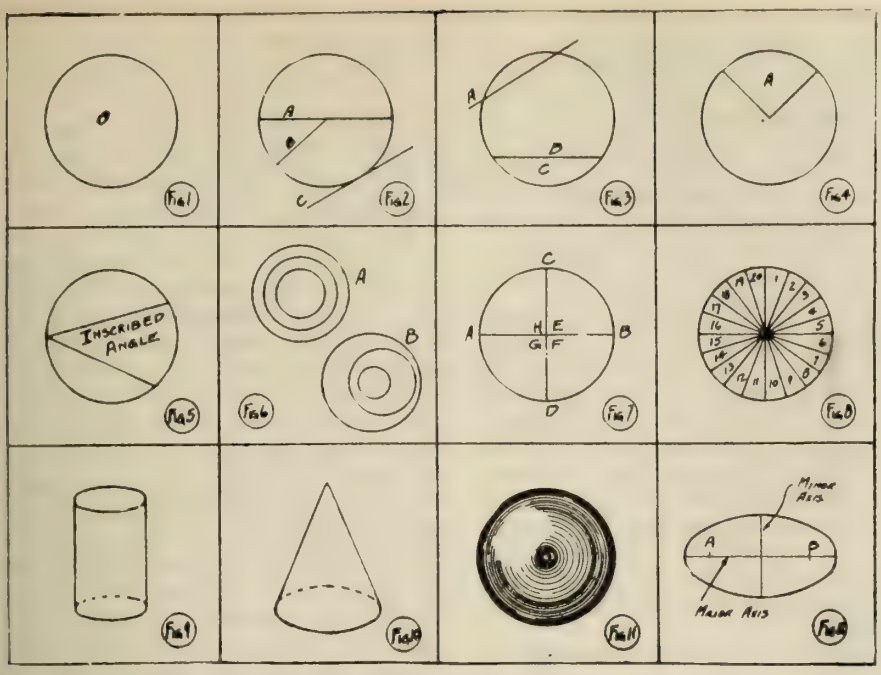


Chart No. 2—Showing the circle and other necessary figures.

Fig. 4 again shows some further terms. The space or area A is called a sector, that is, the area included between an arc and two radii drawn to the extremities of the arc.

Fig. 5 illustrates what is termed an inscribed angle, that is, an angle whose vertex lies in the circumference, and whose sides are chords of a circle. Fig. 6 at A shows concentric circles, while at B are shown eccentric circles, the meaning of each term being self-apparent, namely, that concentric means having a common centre, while eccentric means the very opposite.

The Measurement of Angles

If we construct a circle as at Fig. 7, and draw diameter lines AB and CD at right angles, that we obtain the angles E, F, G and H, each equal in turn to 90°; four times 90, or 360 degrees for the complete circle.

Having established this point clearly, let us pass to Fig. 8. Here we see a circle divided into 20 parts. Each of these parts is equal; therefore we can take 360 and divide it by 20, which shows us that the angle in each separate sector is 18 degrees. We point out this illustration to start the germ of the idea of angles into students' minds, for it is something which will very soon crop up in this course, when naturally we will go into the matter deeper. In the meantime students should remember that a circle has always 360 degrees, a semi-circle (or half a circle) 180 degrees, and that the sum of the angles on any triangle must always equal 180 degrees.

Solids

We shall next consider solids. First what is a solid?

A solid has three dimensions—length, breadth and thickness. (Readers will remember that plane figures had only two dimensions—length and breadth.) Solids are subdivided into classes, the more generally used of which are cylinders, cones and spheres. Fig. 9 depicts a cylinder, Fig. 10 a cone, and Fig. 11 a sphere.

A cylinder is a solid having two equal parallel surfaces as bases, these being bounded by curved lines. The bases are usually circles, and such cylinders are called circular cylinders.

A right cylinder is one whose side is perpendicular to its bases. Fig. 9 illustrates a cylinder of this type.

A cone is a solid bounded by a conical surface and a plane which cuts the conical surface. The plane is called the base, the point which it tapers up to is called the vertex. The altitude of a cone is the perpendicular distance from the vertex to the base.

A sphere is a solid bounded entirely by a curved surface, every point of which is equidistant from the centre of the circle. A ball is a sphere, provided it is entirely round. Fig. 11 represents clearly the construction of a sphere. The shading on this view is given merely to create the appearance of the ball being round.

An ellipse (illustrated at Fig. 12) may be defined as follows.

An ellipse is a curve generated by a point moving in a plane, and in such a manner that the sum of the distances from the point to two fixed points shall always be constant.

The two fixed points are called foci (see Fig. 12 at A and B) and lie on the longest line that can be drawn through the ellipse. This line is called the major axis. The shortest line is called the minor axis, and is perpendicular to the major axis, at its centre or middle point. An ellipse can be easily constructed if its major and minor axis be known.

In order to check up on the foregoing instructions and definitions, students are advised to draw carefully the two practice plates shown at Figs. 2 and 3. In commencing, make your sheet 8 x 13 to the border line, divide this space up into six equal portions as shown, then start on Problem 1.

Problems 1 to 6

Problem 1.—To construct an equilateral triangle, one side being given.

Draw A B 2¾ in. long. With A B as a radius, and A and B as centres, describe two arcs intersecting at C; join CA and CB. The result being an equilateral triangle.

Problem 2.—To construct a parallelogram when the sides and one of the angles are given:

Suppose AB and CD to be the given side, AB 2¼. in. long, CD 1¾ in. long. Let E be the given angle. Draw FG equal to AB and draw GH, making the angle with FG similar to the angle E.

Make line GH equal in length to CD. With H as a centre and a radius equal to AB, describe an arc at I. With F as

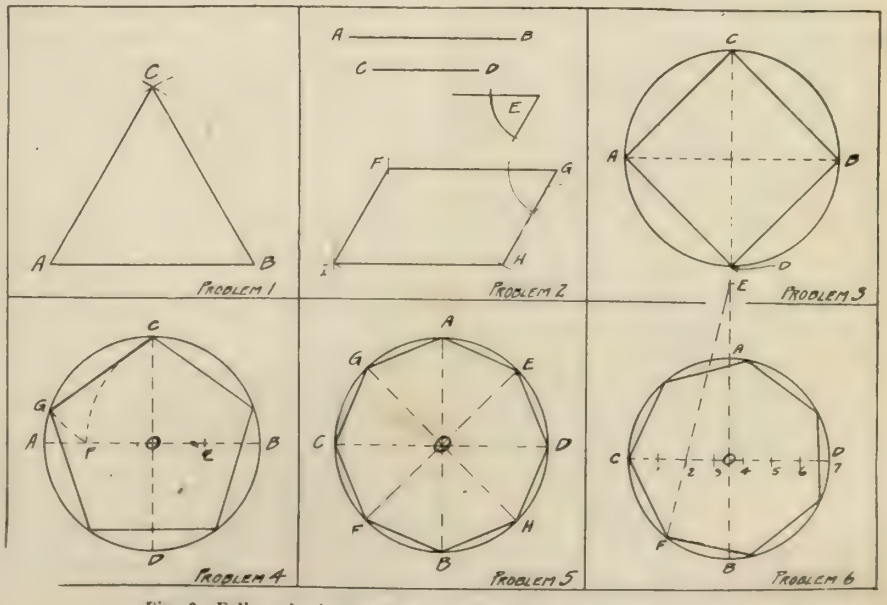


Fig. 2—Follow the instructions for this plate closely.

a centre and a radius equal to CD, describe an arc cutting at I; join FI and IH, when you have constructed your parallelogram.

Problem 3.—To inscribe a square in a circle:

Draw the circle, as shown, 3 in. diameter; draw next the two diameters AB and CD at right angles to each other; join these points of intersection with the circle, and you have a square completed as shown.

Problem 4.—To inscribe a regular pentagon in a given circle:

Draw the circle as shown 3 in. diameter; draw the two diameters AB and CD as before; consider the centre of the circle as the letter O; bisect OB as shown at E (note: your previous plate gave this problem of bisecting a line). With E as a centre and EC as a radius draw the arc CF, cutting AO at F. With C as a centre and CF as a radius, draw the arc FG, cutting the circumference of the circle at G. The chord GC is one side of the pentagon. The rest of the construction is left to the student, for it is self apparent, the one side being obtained.

Problem 5.—To describe a regular octagon in a given circle:

With O as a centre describe a circle 3 in. diameter; draw the two diameters AB and CD, bisect angle AD at E, and sides as shown at 1, 2, 3, 4, 5, 6 and 7. (Of course this can be any number). Now draw a line through points E and 2, cutting the circle at F; draw the chord CF; this is one of the sides of the polygon. Of course the others are easily obtained by spacing off around the circumference.

The Second Plate

Th same instructions hold good in the laying out of the plate shown at Fig. 3, and Problem 1:—To draw a line tangent to a circle at a given point on the circumference is started as follows:—

With O as a centre, draw a circle 2½ in. diameter. Assume a point B on the circumference, and join B with O. Now construct a perpendicular to BO in the following manner: Produce the line BO to C. Choose any centre D and describe a circle of such radius that it will cut through point B. Where this circle intersects with the line BOC call by the letter E. Join E and D, producing it out to F. From F draw a line to B, and produce the same out beyond the circle as shown. This line will be tangent to the circle first made.

Problem 2: To construct an egg-shaped oval: From a centre O, with a radius of 1½ in., describe a circle. Through the centre O draw AOB, also a line OC perpendicular to AOB, cutting the circumference of circle at C. Draw the straight lines AD at BE. With A and B as centres, and the distance AB as a radius, describe arcs terminating at F and G. With C as a centre, and CF as a radius, describe the arc FG, when you now have the egg-shaped oval complete.

Problem 3: To draw an ellipse by circular arcs.

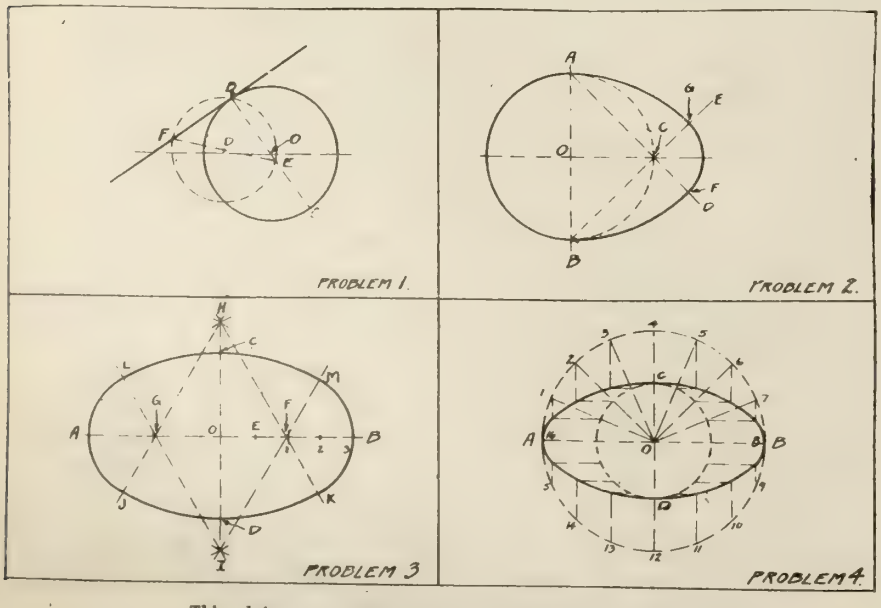
Such an ellipse is not a true ellipse, but suitable for many purposes.

Draw AB 4½ in. long, CD 3 in. long. On the major axis AB, make AE equal to CD, then divide EB into three equal parts. With O as a centre and a radius equal to two of these divided parts, describe arcs cutting at F and G. With FG as a side, construct two equilateral trinagles FGH and FGI, and continue these lines as shown. With H as a centre, and a radius HD, describe the arc, cutting at J and K. Then with the same radius, but with I as a centre, describe a similar arc, cutting at L and M. With A and B as centres, and a radius equal to the chord of the arcs AJ or BK, describe arcs, cutting AB near the points F and G. From these new points of intersection as centres, and with the same radius, describe the arcs JAL and KBM. Your ellipse is now complete, although, as said before, not absolutely accurate.

Problem 4: To construct an ellipse by the exact method, the diameters being given.

Let AB be the major axis 3½ in. long, CD the minor axis 2¾ in. long. With O as a centre and OD as a radius, describe a circle. With O as a centre, and OA as the radius, describe another circle. Divide each circle into a smaller number of parts, the more parts, the more accurate the ellipse. For our purpose we will say 16. This is best done by dividing the larger circle into 16 parts, then drawing radial lines into the centre as shown on the top portion of the drawing. Through these points of division on the inner circle draw horizontal lines and through the points of division on the larger circle draw vertical lines, the points of intersection being the points on the ellipse. Trace a curve through these points, placing an irregular curve on them in such a manner that its bounding points will pass through at least three intersection points. Be careful not to make your curve too flat. Then adjust your curve from time to time until the figure is completed. It requires considerable practice to draw a good curved line by this method, and readers would do well to practice this problem on a separate piece of paper before putting it on the plate. The neater the work, the better looking the curve, and a great deal depends on the student's taste and accuracy of eye.

This is as far as we need go in geometrical drawing for the purpose of our course, and the next part, which will appear two weeks from present date, will be on an entirely different subject, so keep your eyes open, and be ready to continue the study of mechanical drawing.



This plate may seem easy, but remember that accuracy counts.

Japanese Coal Production

The coal market in Japan remains inactive and there is little or no hope of a revival in the near future. Quotations at present show a decline of about 30 per cent as compared with the average price of last year. The total quantity of coal brought over from last year was 1,478,000 tons, and in April an agreement was reached among mine owners of Kiushu, Hokaido, and the Joban district to restrict the output. The average monthly output in the country last year was 2,250,000 tons, while during the first four months of this year it was 2,128,000 tons. The total output during 1920 was 27,020,080 tons, the figures showing a decline of 4,234,000 tons as compared with the preceding year. In 1919, when the market experienced a boom unprecedented in history, the output amounted to 31,271,000 tons, this being a record for 30 years.

The Imperial Oil Co's plant at Imperoval, near Halifax, caused great excitement a few days ago when several explosions occurred. Some expected a repetition of the disaster in 1917, but it was found to be some pressure stills which caused the trouble. The loss will be about $40,000.

How to Make the Most out of High Speed Steel

Steel Must Be Heated Uniformly—Tools Should Not be Hardened Direct from the Forging Operation—Should be Annealed—Preheating is Important—Tools Must be Properly Ground

By A. J. WILSON

HIGH speed steel is of vital importance to all lines of manufacture, for there is no manufacturing concern that is not more or less interested in the use and conservation of tools and tool steel. This applies more especially to the automobile or automobile parts manufacturers whose tools, particularly high speed tools, are a very large item of expense.

During the war when the price of high speed steel was very high, we were awakened rudely to the fact that we were using this material in an extravagant manner. As production of war material was the important demand at that time, the only alternative was to buy more steel as needed. But we also got busy to find some means of making this high priced steel stay on the job longer and to do more work while it was on the job.

As it was necessary to have a starting point, this was made at the blacksmith forge. Due care was taken that heats were satisfactory when the forging was done. One point that the forge man must make certain is that his steel is heated through uniformly. The outside may be up to forging heat and the inside many degrees cooler. The effect of this can be appreciated readily if a piece of steel in this condition were to be put under the hammer. The outside being softer than the center would prevent the hammer blows from displacing the metal in the center of the piece, therefore it would cause a number of small ruptures which undoubtedly would cause trouble in hardening.

No tools should be hardened direct from the forging operation, but should be annealed before hardening. To save time this may be done by heating them to about 1650 degrees Fahr. in the forge fire and then burying them in ground mica which for convenience can be kept in a cast iron box near the forge. Air slacked lime also will answer the same purpose.

Preheating

After being annealed the tools are ground before hardening, so as to have the least possible amount of stock to remove after the hardening operation. In hardening high speed steel the advantages derived from proper preheating cannot be overestimated. Preheating to 1450 to 1550 degrees Fahr. in a slow furnace and then bringing the heat up quickly to 2250 to 2300 degrees Fahr. in another furnace generally gives satisfactory results. Although in the case of an intricate tool which is liable to crack, better results may be obtained by two preheats, one about 1450 degrees, another about 1750 degrees Fahr., and from this placing the tool into the hardening furnace. Handling the tool in this manner, the shock of being transferred to hardening temperature is not so great and aids by not causing quick expansion of the thinner sections which naturally heat the more rapidly.

The supposition that any fire is good enough for a preheat is erroneous, because the same care must be exercised in running a furnace for preheating as for final heating if best results are to be obtained and the tool is to come out free from scale. Tools must not be allowed to soak in the preheating furnace.

As a quenching medium, fish oil, a standard soluble quenching oil or coal oil will give good results. Coal oil is a little more drastic and it must be used with some caution on account of its inflammable nature. For turning tools, boring tools and the like, where points only are hardened and a little scale does not matter, an air blast will be found satisfactory provided that the air is free from moisture.

During the past few years much experimenting has been done in tempering or drawing back of high speed steel tools and it is along this line that the most improvement has been made. Drawing back has been a common practice for years but not to the extent that it is now carried on. It has been found that steel of standard make when properly hardened, using as high a heat as can be used safely, then drawing back to 1050 or 1100 degrees Fahr., will give its best service. This applies more directly to tools doing extremely heavy work and those required to remove a large amount of metal. The tool is tougher and stronger, still retaining its original hardness, and is not given to crumbling on the cutting edge.

With tools required to give a smooth finish and take a light cut, drawing at so high a temperature is not recommended but a draw of approximately 425 degrees Fahr. in oil has been found to give satisfactory results. A tool drawn at this temperature will retain a keener cutting edge on light work than one drawn at 1000 degrees Fahr. Drawing through the intermediate temperatures, that is between 425 and 1000 degrees Fahr. has not, to the writer's knowledge, ever been productive of any marked degree of success. In fact if it were found necessary to draw a tool made of high speed steel beyond 500 degrees Fahr., it is preferable to jump to the upper range. A chart put out by a well known maker of steel gives some very valuable information in regard to high temperature drawing. This chart gives 800 degrees Fahr. as the point at which the greatest softness occurs.

Before being put to work tools must be properly ground, care being taken to avoid drawing temper or checking. It is customary to use a dry wheel which should be free cutting and true. If water is used sufficient must be used to keep the tool cool as alternate heating and cooling is very conducive to cracks or small checks which will cause trouble later on.

An occasional bar of steel will contain a pipe or seam. This can be determined easily by the appearance of the crack in the hardened tool and if the bar of steel from which this tool was made is examined, the seam or pipe generally can be discovered without much difficulty. Such a bar is practically worthless, but such cases are rare and most of the failures in tools can be laid at the door of the men who handle the steel after it is in the manufacturing plant. In other words, there is much more trouble due to faulty methods of handling than to defective steel.

Getting the Most Out of the Tool

Now that the tool is ready for use how can we get the most out of this tool? In using the term tools we are referring to tools for removing metal such as are used in turret lathes, screw machines, engine lathes, etc. In the writer's company there is employed a man whose title is "Turning Tool Supervisor," his duty being that of providing the workmen with proper turning tools.

It might be well to mention at this time that 90 per cent. of the work is performed under what is known as the straight piece-rate system. Any one

THE VALUE OF STEEL

Without steel, especially high speed steel, the present rates of high production could never have been attained.

Steel, however, requires careful treatment if the greatest good is to be secured from it, so that the hints contained in the present article should be of interest.

In welding high speed steel and carbon steel, one peculiarity arises which must be overcome. The tendency is for one to heat faster than the other owing to the difference in resistance. By allowing one to project further from the holding die than the other until they seem to heat evenly, this difficulty can be overcome.

connected with manufacturing where a bonus or straight piece rate is in effect, knows from experience how essential it is to keep workmen supplied with proper tools. The average man working straight day rate will find little fault with his tools if they are not of proper shape and right hardness. He will probably reduce his feed and speed to the point where they will stand. Put this same man under one of the above mentioned methods and if tools do not stand up he will soon be heard from.

Some time back, this problem confronted our company and after consideration it was decided to appoint some one man whose duty it would be to furnish the workmen with tools properly forged, hardened and ground. By this arrangement a saving on tools was effected and production was increased between 15 and 20 per cent. One of the foremen was selected for this new position and he had a man's size job, for in a shop where this method has never been tried it cannot be accomplished over night. One of his first problems was to gain the confidence of the workmen. Second, he was compelled to sell them the idea that a certain new shaped tool would do the work as well or a little better than a certain shape of their own pet idea. It is also a well known fact that no two workmen will grind a tool alike but this was overcome by using a mechanical tool grinder.

For tools larger than ¾ x 1 x 8 inches it is advisable to use shanks of higher carbon. Our experience in welding heavier tools has been quite limited, but we have been informed by good authority that steel containing 50 to 60 per cent. carbon is satisfactory for welding onto heavier tools up to 2 inches square, such as tools used on large planers, boring mills, wheel lathes, etc.

The value of a solid high speed steel tool of the size just stated, is as follows. One piece ¾ x 1 x 8 inches weighs approximately 1.7 pounds and costs about $1.00 per pound or $1.70. To this we add cost of labor plus 50 per cent overhead as follows:

Forging	$0.10	
Grinding	.05	
Hardening	.04	
Total labor		.19
Overhead		.095
Price of steel		1.70
Total cost of tool		$1.985

This is practically $2.00 for a small tool ready to be put to use. Of course the labor figures are only approximate, but will come very close to actual cost, and the overhead will vary in different plants.

Now let us find the cost of a tool of the same size, one half high speed steel and one half carbon steel. One piece of the high speed steel ¾ x 1 x 4 inches weighs 0.85 pounds which at $1.00 per pound represents $0.85. One piece of carbon steel of the same size, weighing about 0.80 pounds at $0.07 per pound represents $0.056. Further costs are as follows:

Cutting off carbon steel from bar	$0.01	
Welding	.015	
Annealing	.03	
Forging, hardening and grinding	.19	
Total labor		.245
Overhead		.12
High speed steel cost		.85
Carbon steel cost		.056
Total cost of tool		$1.271

From these figures we find that whereas our tools of solid high speed steel cost $1.985, we can produce a tool of one half high speed steel and one half carbon steel welded on which answers the same purpose for $1.271 with a net saving of $0.714.

Now let us see how cheaply we can produce a first-class tool from scrap formerly sold at $0.10 per pound, that is a tool of the same size worn down to 4 inches in length or too short to hold in a tool post. The cost is as follows:

Cutting off forged end of worn tool	$0.015	
Grinding end square	.01	
Electric welding	.015	
Annealing	.03	
Cutting off carbon shank	.01	
Forging, hardening and grinding	.19	
Total labor		.270
Overhead		.135
Cost of 0.85 pounds high speed steel at $0.10 per pound		0.85
Cost of 0.80 pounds of carbon steel shank at $0.07 per pound		.056
Total cost of tool		$0.546

Thus we find that we have the following results:

Tool made from high speed steel	$1.985
Tool made from one half high speed steel and one half carbon steel	1.271
Saving	$0.714

Now we have produced a tool by salvaging for $0.546 with a direct saving of $1.439 over a solid tool of high speed steel, also a saving of $0.725 over a tool welded up from a piece of steel representing 100 per cent. value.

One peculiarity arises in welding high speed steel and carbon steel, that must be overcome, and that is; one will heat faster than the other owing to the difference in resistance. This will occur in any two pieces of metal that are of different composition. This is overcome by allowing one to project further from the holding dies than the other until they seem to heat evenly to a plastic heat, then they are pressed together. The amount that they must differ in length to get proper heat at welding points can only be determined by experimenting.

As soon as the welding is accomplished they must be annealed. This is best accomplished by placing them in a hot furnace, holding them at a good annealing heat for an hour or more, then letting them cool down slowly in the furnace. If a piece of high speed steel and carbon steel when welded together is allowed to cool in the air, one will cool quicker than the other, and as contraction takes place during cooling it is bound to set up a strain in the weld which will cause it to crack. This will be true five times out of ten, thus it does not pay to take any chances. Tools properly welded and annealed can be forged successfully and it is our experience that less than 0.5 per cent. break in forging.

In placing these tools in service, precaution should be taken to see that the bed of the tool post is level and smoothed where the tool is clamped down or it may be broken in this way. This is equally true of any high speed steel tool that has been hardened all over.

The habit of workmen in striking a tool with a hammer when it is necessary to move it cannot be condemned too strongly. It is much better to take a little longer, relieve the tool and reset it, as a broken tool costs money and time and produces nothing but waste.

In conclusion, the price of success is eternal vigilance. Workmen, as a rule, do not take interest in the use of tools, and the practice of economy as that shown by the man who is responsible for the success of the department or the man who pays the bills, but much can be done along the line of educating machine operators in lines of careful handling of tools. They must be taught that every direct loss sustained by the company is an indirect loss to every individual.

LARGE DOCK

The extension recently completed to the Royal Albert Dock on the Thames forms the most costly single work ever undertaken to improve the facilities of the port of London. Over four and a half millions were spent on the extension, which adds a water area of about 64 acres and provides about two and a half more miles of quay. Construction was begun in the year 1912, and was maintained on a limited scale throughout the war. The working depth in the dock is 38 feet so that the largest class of vessel using the port can be accommodated. A prominent feature of the dock is a double bascule bridge carrying a roadway. Each leaf weighs 368 tons and the bridge opens in sixty seconds. An elaborate equipment of electric cranes has been provided, together with every facility for the rapid loading and unloading of vessels. Since its opening by the King and Queen this dock is known as the King George Dock.

The Oliver Machinery Co., Grand Rapids, Mich., have issued a "Manual Training" bulletin. It shows machines often used in various schools throughout the country, and illustrations of such manual training departments are shown.



WHAT OUR READERS THINK AND DO



GOVERNMENT WORK

By H. T. Osborn

In the September 8 issue of Canadian Machinery appeared a letter and editorial on the subject of "Government work." Mr. Osborn, another of our readers, feels he should get into the controversy, and here is what he says.

"Regarding Mr. Homewood's letter and your editorial; The point at issue seems to be whether a man should be penalized for the offence. As the practice is a dishonest one, there can be no justifying it, but at the same time, who is to condemn? Is there anybody without sin who shall cast the first stone?

In my own experience of shop life I do not remember meeting the man, be he manager, superintendent, foreman, or other employee, who could convince me that he has never acquired something, however small, at the unwilling or unconscious expense of somebody else. That he has never "knocked out" a job for himself, or would not succumb to the temptation to do so if in need of said job with the opportunity at hand.

To my mind this applies to the employer who in most cases rose from the ranks of labor or inherited his position from somebody who did. "Government work" is only one branch of the crime of disloyalty to one's employer. There are other branches more or less paltry in themselves, but still having the same effect to a certain extent. It is no unusual occurrence in most shops for the manager to show personal friends round during business hours. To the man in the shop the real business men can usually be picked out from sightseers. It this a special privilege, or is the manager wasting the company's time? In a shop I would like to speak of, it is strictly prohibited for any outsider to enter the place for any other purpose than business. Yet we often had the pleasure of seeing the lady friends of the management around.

The superintendent of this particular concern has a motor cycle which would cost him a ruinous sum, annually, for repairs were it not so convenient to bring in an odd part frequently. Many are the "Government jobs" I have been called upon to do in this way, and they were usually too small to charge time on. The foreman got away with more of this stuff than I ever saw anybody do, spending hours at a time at it, and would think he had a perfect right to take a man off a machine to use it himself, thereby stealing two men's time. I could truthfully cite many instances of dishonesty along these lines, but it is needless to do so. This person I speak of, however, was always on the lookout to see that none of the men did other than their duty. He was very considerate of the firm in this respect. How in such circumstances can anybody condemn the man in the shop. Not that it can be justified, as two wrongs cannot make one right.

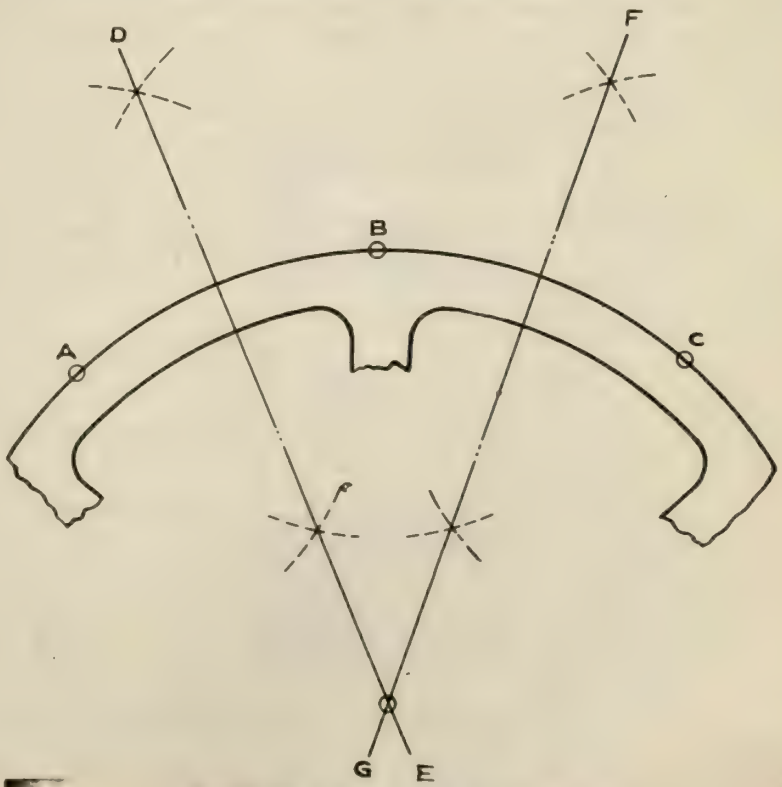
The evil seems to be universal. Even the writer of the editorial admitted his guilt. The evil cannot be abolished by making an example of somebody. An easy way of avoiding the loss, however, would be to allow employees a certain amount of freedom to do their odd jobs in their own time, making a rule, say, as follows:—"Any employee wishing to use the machinery for a short time after working hours, may obtain permission from the foreman. Cost of power, and any material used to be paid by user." With a rule such as this, there are few men who would bother with any private job in working hours, when they could do it in a convenient and honest way. Then with a virtuous example set by those in authority plus the above scheme, the employer who is robbed is indeed a martyr.

BROKEN SECTIONS

By John Hope

I noted with interest the article in July 7th issue of Canadian Machinery, which gave in panel form, a formula for finding the diameter of any broken section. The sketch attached shows another method which has found favor, and is very easily remembered.

Place the broken radius section on marking table having it rest on a sheet of paper. Define a clear line of the broken part, after which select three points A. B. and C. as shown. Describe arcs from these making them cut each other. Where they intersect draw the lines D. E. and F. G. Where these lines meet will be the center of the circle, that is, relative to the broken section. For shop purposes this method is found to be close enough except where the broken section is very short, not allowing enough space between the three trial points.



Showing the author's method of figuring section.

TWO TAP HOLDERS

By Harry Moore

An engine lathe tailstock is anything but an ideal device for tapping, yet in the smaller shops there are occasions where it must be used. The difficulty is the following up of the tap when started. Following are shown two methods which I have adopted with good success.

At Fig. 1 is shown a solid holder which is turned on the shank to fit the spindle taper, and is bored at the front to take the sleeve B. The holder is slotted as shown at Fig. 2. When the tap is held in B, it is tightened with the screw C, this screw extending up to the top of slot A. When the tap begins to travel forward the sleeve B slides forward in A, and if the thread is short enough the tailstock spindle need not be advanced at all.

In Fig. 3 the holder fits over the centre and is better adapted for work that requires the use of the centre at some point of the operation. The piece A is bored out to fit the centre, a pointed screw is used. A hardened screw with a flat end threads into the front of A, this tightening on a flat ground on the tap shank. When the tap is in the holder the short screw is adjusted close to the flat, not tight, but leaving it free to slide back and forth. A second short screw is then tightened on the hardened one, locking it in position.

HARDENING AND TEMPERING

By George Russell

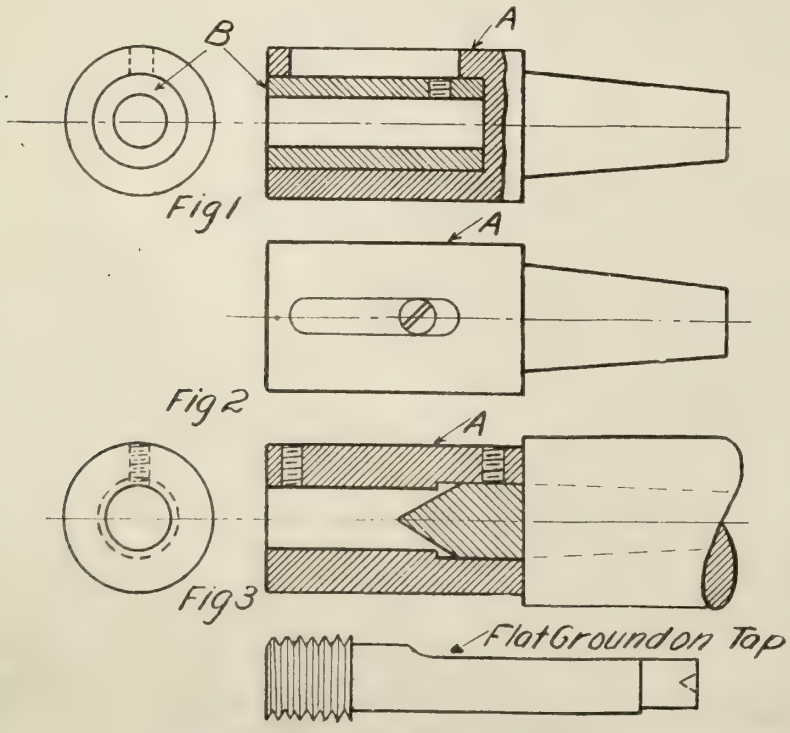
Although some people still claim that the process of hardening and tempering of tools is a trade secret the machinist is often called upon to understand such work. Some mechanics have the idea that the art of hardening is just a matter of heating a piece of steel to a cherry red and plunging in water, but, it is far more important than that. We take a piece of steel and put it through a process of careful machining and finishing, then bring it to the last and most important operation of all, and one on which the success and value of all the other operations entirely rests. To be successful in hardening the mechanic should use good judgment and should find out what particular quality is needed in the piece to be hardened, whether toughness, extreme hardness, elasticity, or a combination of these is needed.

He must know the methods to use to produce the required results. He must take into consideration the shape of the piece, the nature of the steel, and the use the article is to be put to. He should avoid heating the piece hotter than is necessary, and if compelled to use a blacksmith's forge, and the piece is larger, he should use a high fire keeping the piece well from the blast inlet, using only blast enough to keep the fire lively and to bring the piece to the proper heat. The part should be buried well into the fire to keep it away from the air. The strain should be taken out by reheating as soon as possible after immersion in the bath.

Any steel to be tempered should first be machined or ground as the skin gives false colors. Let us consider a few articles to be hardened in the blacksmith's forge. If a counterbore tap, or other similar article is to be hardened it is best to heat in a tube. A tap is required to be softer on the shank than on the teeth to avoid breaking off when in use, so that after the tap is hardened, obtain a pair of round tongs long enough to grip the whole of the shank, and a piece of iron pipe a little larger than the tap. Heat the tongs to a bright red and use them to bring the color down. In the meantime the pipe is heated to a cherry red, and as soon as a straw color appears on the shank from the heat off the tongs, the tap is placed in the pipe up to the ends of the thread. This will keep the color back on the threaded part and the shank will be a dark blue by the time the threads have reached a dark straw, then plunge into the water.

In hardening bushings for jigs, etc., never hurry the work. Heat evenly to a cherry red and plunge in water which has the chill removed; then reheat until it will snap to the moistened finger. From then on leave in the air to cool.

In hardening counterbores, or such tools where a pin or teat is employed as a guide in the hole, it is necessary that the pin or teat working in the hole should be much harder than the cutting surface. First harden the tool, being careful when dipping to avoid cracking. In tempering, heat the tool on a piece of red hot iron, and as soon as a pale straw color has come down to the pin, keep it in that place by pouring a stream of oil upon it while the color comes down on the main part of the tool. When the color has reached the desired shade then plunge in water.



Showing the style of tap holders.

PAINT SPRAYING MACHINES

Tests carried out on paint-spraying machines have shown that spraying requires approximately 10% more paint than brushing when the surface being treated is an iron roof, while brushing requires approximately 200% more labor than spraying. Exterior brick wall spraying requires 7% more paint than brushing, while brushing requires 109% more labor than spraying. On interior ceilings and walls of plaster spraying requires 40% more paint than brushing, but gives a better hiding in one coat. On similar work brushing requires 160% more labor than spraying, and gives a poorer hiding in one coat. Although it has not been possible as yet to arrive at a definite conclusion confirming the relative durability of spraying as compared with hand painting, it is claimed that the investigations so far made tend to support the belief that the spraying work will last longer. —Mechanical World.

CONCRETE MASTS

The Japanese Government is building a powerful radio station at Tokio. A feature of this installation is the reinforced concrete tower for supporting the aerial. The tower is 672 feet high, and of a round, tapering form. It measures about 50 feet in diameter at the base, and about four feet at the top. The structure is hollow, of course, with reinforcing bars throughout. The center hollow of the concrete tower is occupied by a steel stairway, which gives access to a balcony near the top, and to four other balconies. The tower was cast by means of a central framework of wood and outside wooden molds, which were shifted upward as the casting progressed.



Saving the Steel Stack

THE CONSERVATION of self-supporting steel stacks which have corroded to the danger point, by incasing them with concrete, has become a well established practice. "Scientific American" tells of a firm in Chicago who could not afford to shut down their plant, although the steel stack in place was in very bad shape, so it was decided to use the cement-gun in reconstructing the stack. By coating the outside with reinforced cement-gun concrete, a new self-supporting stack has now been built upon the existing foundation.

This steel stack was 175 feet high by 9 feet diameter. A reinforcing network of sufficient strength to make the new stack self-supporting without any help from the existing stack was built up of rods and wire mesh and secured to the existing foundation bolts. A cement-gun was then used to shoot gun-crete or gunite, as it is variously called, through the reinforcing mesh against the existing steel shell to the required thickness. A mixture of sand and cement hydrated in the nozzle was applied with an air pressure of about 35 pounds. The gun-crete is 18 inches thick at the base, tapers rapidly to 6 inches just above the bell base and then gradually decreases to 4 inches at the top.

The cement-gun remained on the ground. The dry mixture of sand and cement was blown through the hose by air from a compressor working at about 50 pounds pressure. Water was forced through the water hose of relatively small size but considerable length and at a pressure great enough to give a pressure at the nozzle in excess of the air pressure. The operator worked upward from the bottom, finishing as he went, so that at the end he was 175 feet above the gun and material was forced up to him at the nozzle at that point.

All the work was done without interrupting the use of the stack. The gun-crete was applied when the stack was too hot to permit holding the hand against it. The breeching extending from the side of the boiler house to the stack was also encased with 3 inches of gun-crete while it was so hot that water thrown against it boiled. The gun-crete was kept thoroughly sprinkled until set. The effect of the hot stack seemed to be that of steam curing and after being in use for nearly 3 years the gun-crete is everywhere sound and shows no cracks.

* * * * *

A Grinding Incident of Note

A HARDENED steel ring, gauge 1 in. long, was recently ground and lapped out at the National Physical Laboratory in England until the internal diameter, was 1.0000 in. The outside diameter, which was 20-in., was ground true. A plug gauge was ground and lapped down until it could be inserted into the ring, using ordinary hand pressure, and with both gauges clean and free from any trace of grease. The size of this plug was found on measurement to be 1.0000-in. A second plug was then made whose diameter was 1.0002-in. This plug refused to enter the ring so long as the surfaces were kept dry and free from grease, but when lubricated with vaseline it was found possible to assemble the two gauges by ordinary hand pressure. By measuring over its outside diameter both before and after the plug had been inserted, it was definitely proved that the ring had been stretched in the process of inserting the gauge.

An Amphibious Vessel

A STRANGE vehicle has been designed by M.Leon Foenguinos, in Marseilles, France. Speaking about this new invention "The Managing Engineer" says that the hull is of an unusual shape and armoured. The method of propulsion on land is by caterpillar wheels of a new type, which enable the vessel to manoeuvre in deep mud and thick sand, such as are found on river banks and on the seashore. The hull is everywhere water-tight, and at the stern is a three-bladed screw with an average speed of 800 revolutions. Both caterpillar wheels and screw are driven by a 30 horse-power motor in the interior of the vessel.

On land the vessel is guided by a steering wheel as if it were a motor car; it is, moreover, fitted with a three-speed gear, and can be driven backwards. On the water it is steered by means of a rudder, the wheel of which is placed near the pilot. It is thus very easy to drive, as to leave the land all that is necessary is to steer the vessel towards the shore where, advancing into the water by means of the caterpillar wheels, it floats as soon as its displacement is equal to its total weight. The amphibious vessel has been designed to fill many uses. As a means of transport across tracts of wild country where rivers and swamps are to be crossed, it would prove useful.

Its inventor also believes that it might be used as a lifeboat on board ship, as it cannot be swamped. An armoured type can be made to serve as a land and water tank for attacking purposes. The inventor, we are told, hopes shortly to be able to introduce a modification which will enable his vessel to navigate a few feet below the surface of the water as well as on the surface.

* * * * *

Protecting Against Fire

AFTER having several accidents resulting from the use of gasoline in open containers, the Bosch Magneto Corp. decided to develop and use a gasoline washstand that would be perfectly safe. The result of their research work is told in a recent issue of "Factory."

The stand is built up of angle iron with a sand box on top and a compartment for gasoline and kerosene cans at the bottom. The working space is in the centre, about the same height as the average work bench from the floor up. The upper compartment is filled with sand, which is held arrested by two trap-doors supported by a lever on each side immediately underneath the trap-doors. The long ends of the levers are connected with a string of gun-cotton. Should the gasoline become ignited through some accident, the gun-cotton string will immediately burn through, thus releasing the two levers and opening both trap-doors, releasing the sand and smothering the flame. At the same time the sliding door in front will move upward, confining the flames inside of the compartment. The adoption of these stands has reduced insurance rates, and they have been a subject of much praise from insurance underwriters and state inspectors who have had occasion to visit the factory.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Eighteen readers submitted correct lists for the Sept. 8th contest. We were simply swamped with lists of answers, and after the elimination test, Lewis W. Munsie, New Glasgow, N. S., and Jas. Hunter, Hamilton, Ont., were the lucky ones. Mr. Munsie is engineer with the Eastern Car Co. while Mr. Hunter is superintendent at the Hamilton Bridge Works. In another portion of this issue are the names of those who also sent in correct lists, but unfortunately did not win out in the elimination.

CONTEST FOR SEPT. 29TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1 A large item in labor cost. How to save money.
2 Something Canadian which is exclusive.
3 How to lift a load in half the usual time.
4 Something that is convincing.
5 How to overcome boiler and engine room repairs.
6 A product that is not limited to work of special nature.
7 A case where everything is tested.
8—How to prolong the life of your machinery.
9—Something that is raised and lowered by power.
10—How to avoid loss of power.
11—Something that started in 1856.
12—Two important things to consider.

These are Correct Answers for List from September 8th Issue.

1—Pratt & Whitney Co. of Canada.
2—The National Acme Co
3—Dominion Engineering Works.
4—Taylor Instrument Co.
5—Canadian National Carbon Co.
6—Armstrong Bros. Tool Co.
7—Wallace Barnes Co.
8—Brown & Sharpe Mfg. Co.
9—Dennis Wire & Iron Works Co.
10—The National Acme Co.
11—Roelofson Machine & Tool Co.
12—Dominion Oxygen Co.

Closing Date for This Contest is October 20th



DEVELOPMENTS IN SHOP EQUIPMENT



COMBINATION MACHINE

The Dalton Mfg., Co., Sound Beach, Conn. have brought into the market a combination machine which is primarily intended for use in garages, on shipboard, and in other places where a rather complete equipment is required and floor space is at a premium. The machine can be used as a lathe, drilling, or milling machine, and a single hollow spindle serves both the lathe and the milling machine. It has a No. 10 B. & C. taper hole in the lathe end. The lathe swings 13 in. over the shears, and will take 37 in. between the centers. By removing a section of the shears next the headstock, it becomes a gap lathe, capable of handling faceplate work 18½ in. in diameter by 6½ in. long. The block is held in place by a tapered dowel bolt, and may quickly be removed or replaced.

The cross-slide has a travel of 12 in., and is fitted with a compound rest. The head has a three-step cone, and is provided with a single back gear, giving a speed range from 20 to 441 revolutions per minute. The lead screw is 1 in. in diameter, and has an 8-pitch Acme thread. Change gears are provided to cut all standard threads, including 11½, from 3 to 56 per inch. Gears for metric threads can be supplied.

The milling machine table has a working surface of 24 by 7½ in., and a longitudinal feed in either direction of 15 in. The transverse movement is 6¼ in., and the knee can be adjusted vertically through a distance of 13¼ in. A telescopic elevating screw obviates the necessity for boring a hole in the floor.

The drill press can be used only by removing the overarm of the milling machine. A round table is furnished, to be attached to the table of the milling machine. The machine will drill to the center of a 16-in. circle, and the spindle has a vertical travel of 9 in. The maximum distance from the end of the spindle to the milling machine table is 23 in. With the round table in use this distance is 18 in. The spindle can be locked rigidly in any position of its vertical travel, and it then becomes a vertical milling machine, having all the movements of a standard machine.

While the lathe and milling machine, or the lathe or drill press, may be used simultaneously, the tool is intended as a one-man machine. It can be set up on a floor space of 40 sq. ft., including the room necessary for the operator to get around it.

NEW SERIES OF VISES

The Chas. Parker Co., Meriden, Conn., placed on the market a short time ago a new series of vises. The new line embraces seven sizes in both the stationary and swivel types, ranging from 3¼" to 7" jaws. The castings used are of increased strength and are made from semi-steel, and the solid steel bar slide strengthener embodied in these vises is a patented feature which is said to strengthen the weakest part. They have also a patented swivel base which is well worth attention, together with various other features.

NEW TYPE DRILLING MACHINE

A gantry type of drilling machine has been developed and marketed by W. K. Stanets, Jenkins' Arcade Building, Pittsburgh, Pa. This machine is said to be very useful to those building tanks, steel cars, etc., in fact, where it is required to drill holes near the centre of large steel plates.. There is not a sufficient demand for machines of this type to justify the making of any standard size or style, but it is stated that the design of this machine lends itself to the uses intended of it, and it is the practice to build each machine to meet the requirements of the shop in which it is to be used.

TOOL FOR MEASURING SPEEDS

An instrument devised for measuring the cutting speeds of machine tools of all kinds has been placed on the market by a New York concern. This instrument gives direct readings without any timing or calculating, on a dial, which is graduated to record all high or low cutting speeds of lathes, milling machines, planers, and drills. In operation, the instrument is held by a handle so that a friction wheel at right angles to the handle is pressed against the object whose motion is to be measured, and the dial, which is at the end of the handle, faces the operator. The friction wheel can be replaced by a pointer, such as is used on all tachometers, and the instrument then records revolutions per minute. The device is also used for recording the speed of rolls, belts, ropes, etc.

SOME LEADING ARTICLES IN THIS ISSUE

Need of Gauges for Modern Manufacturing 25

Modern gauges are very necessary if production and accuracy are to be obtained—Definite Limits Should be set, these depending upon the nature of the work.

Sixteen Years' Experience in Drop Forging 30

How long should a die be kept in a furnace?—Proper method of hardening drop dies—Round corners save many a break—Counteracting warpage.

Canadian Machinery Drafting Course, Part III..... 32

Surfaces—Plane figures — Triangles — Quadrilaterals — Circles — Solids, etc. — Each section is taken up in detail—Two plates have to be prepared.

Making the Most of High Speed Steel 35

Preheating of steel important—Proper quenching Medium—Tempering and Drawing—Importance of proper grinding—Getting the most out of the tool, etc.

What Our Readers Think and Do 37

Government Work—An answer to a previous letter—Broken sections—How to Figure them—Two tap holders.

Weekly Engineering Digest 39

Saving the steel stack—Hardening a ring gauge and the result—A strange amphibious vessel, and a method of protection against gasoline fires.

Canadian Machinery Weekly Contest 40

We still receive many replies, but few correct lists. The questions are not exceedingly difficult, and all that is required is a little further study of each question. Try this week and make up your mind to have all questions correct.

CANADIAN MACHINERY
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Where The Remedy Lies

IN ANOTHER portion of the present issue appears a letter on the subject of "Government Work." Mr. Osborn, who is the author of the letter, brings out some interesting points, but unfortunately he seems to have missed the message in our last editorial, viz., that the only way to stamp out this evil is for the workers themselves to discourage any attempts at it. Mr. Homewood complained of hounding a man for such an offence, while Mr. Osborn uses the term penalizing. There is a vast difference between the two words. To hound a man is absolutely unfair, but to penalize him is quite within an employer's right.

Take for example the superintendent with the motor cycle which Mr. Osborn speaks of in his letter. First of all we will grant that such a case is not unusual, but does that make the offence any lighter. Of course not, and in such a shop we could hardly blame men for trying their hand at odd jobs for themselves, yet the fact remains the same that many wrongs do not make a right. If the management of the firm which Mr. Osborn speaks of, was on the job, such a foreman would have to find a position elsewhere. It matters not whether the "Government Worker" be foreman or ordinary employee. If he is working for himself in his master's time, it makes the offence the same. The fact that this particular foreman watched, and refused to allow his men the same privilege as himself, showed that he knew it was wrong, and his selfish and one sided conscience was the only thing that saved him.

As far as Mr. Osborn's point of showing personal friends through the shop is concerned, this is something that should be avoided as far as possible. There come occasions however when the showing of friends through a plant is quite permissible. Suppose they have come quite a distance, and wishing to show them the business he is building up, the owner proudly pilots them around. Whose business is it but his own? So long as he does not interfere with the shop production it matters not whether any of the sightseers ever visited such a plant before. Although we do not believe in the habit, as a habit, we at the same time admit it is the owner's own business.

Then again, how can the average workman feel sure that the so termed sightseer is not someone who is vitally interested in the business of the company. He may be a silent partner, or perhaps a gentleman about to place an order of large proportions and who wishes to see the facilities of the plant before finally closing the deal. The situation takes on so many different angles that it behooves one to think carefully before criticizing.

The last suggestion of Mr. Osborn's, to our mind, does not hold water. He suggests the setting apart of a certain time for employees to do their odd jobs in their own time, charging them up for cost of power, material used and so on. How many plants could afford to do this, and how many men would honestly turn in an account of material used, power consumed, depreciation of machinery, etc., etc.? Even conceding the fact that every man would act honestly, what would the article cost when actually completed? Would it be more than the workman could purchase it for? Frankly we believe the latter condition would hold true.

Another point and we close. Suppose a man is making a square, a surface gauge a set of vee blocks, or in fact any small tool. Does he realize that when he is doing so, he is actually taking trade away from brother mechanics who are engaged on such work daily, and who, with the facilities on hand, can make such tools cheaper and more accurately? This is a side of the question seldom considered.

However we must not get away from the main point of the editorial "Government Work," and its danger. Again we repeat that the solution lies in the hands of the employees themselves, and while we do not expect any world wide movement to stamp out the evil, the fact remains that the moment workers stop such a practice, the danger ceases to exist. Human nature seems to be such, that the temptation to do a job for oneself in someone else's time is too strong to resist, so that we can reasonably expect that, like the poor, the government worker will be always with us.

* * * * *

Good Judgment

SPEAKING of the value of education to engineers, Knox Taylor, C.S.C.,president of the Taylor-Wharton Iron & Steel Co., says that an engineer should be educated to know a great deal about a few things and a little about a great many things. Where should the line be drawn? That is the great question. To draw it properly is a matter of judgment, and good judgment is so rare. How much time, money, and even life, is wasted through poor judgment? Too much emphasis cannot be placed on educating to develop good, sound judgment, for without it nothing else avails.



It wouldn't be a bad idea to try the other key.



MARKET DEVELOPMENTS



Market Continues to Show Upward Trend

Steel Business Picks Up Steadily—Machine Tools Are Moving At a Fair Speed—Reductions Are Announced In Two Lines—Scrap Market Still Remains Very Dull

MARKET conditions continue to improve. From all quarters comes a note of optimism. The steel demand is much better this week and business is broadening until at present practically all classes of buyers are into the market. There is a very hopeful tone throughout the iron and steel trade among producers, distributors and consumers. No spectacular improvement is expected, but the feeling is that from now, the improvement will be gradual but steady.

One Canadian manufacturer has announced a 10 per cent reduction on milling and grinding machines, this coming into effect Sept. 23rd. Lower cost of materials and slightly lower wages are the reasons given for the reduction. Machine tools generally are moving, but not rapidly. There are quite a number of enquiries floating around, some of which look like real live orders.

Structural shapes, bars, hoops and items of such nature show a seasonal improvement. Prices are holding steady in these lines. Next week we expect to announce a slight reduction in the price of boiler tubes.

The small tool market still goes along in steady fashion, there being neither change in prices nor a difference in the demand. Scrap metal remains dull as one could possibly imagine. Nobody shows an inclination to buy, and dealers of course refuse to stock up further. With the exception of the scrap metal market, all other lines show increased activity.

STEEL DEMAND IS NOW MUCH BETTER GENERAL IMPROVEMENT IN BUSINESS

Special to CANADIAN MACHINERY.

PITTSBURGH, September 29.—Price movements interfere with an exact study of trend in the volume of orders for steel products. Both wire products and sheets have been advanced in the past week, while tubular goods have been reduced. In wire products and sheets, one cannot tell precisely how much of the improvement in demand was a cause of the price advance and how much of it was caused by the price advance. In each case there were heavy bookings before the advances were made effective, buyers being given notice of prospective advances and an opportunity to cover.

In the case of tubular goods, manufacturers state that the reduction has not had any important effect upon bookings, which have been increasing right along. However, the reduction was not a plain reduction by any means. In the first place, the reduction is computed from the lists of July 7, which were being shaded more or less, so that the actual decline in the market is much less than the announced reduction. In the second place, there were many price guarantees out on pipe, running from two weeks to longer periods, and in such cases there is no instant reduction, the reduction really dating back.

Steel Demand is Better

However, whether one can analyse the steel demand in detail or not, there is no question that demand is increasing in general, as it has been increasing since the middle of July. Business is broadening, with practically all classes of buyers in the market to a greater or less extent, and in their contact with the producers the buyers show that they rate the prospects in their several lines of business much better than they did two months ago. There is now a very hopeful tone throughout the iron and steel trade, among producers, distributors and consumers. The expectation is for a continuous and gradual improvement, not for anything spectacular.

Usually the tonnage of steel ingot production is a good gauge of the demand for steel products in general. At this time it is not as good an index as usual, because the improvement in demand has been chiefly in the lighter and more highly finished products, sheets, tubular goods, wire products and tin plate, while the heavy lines, bars, shapes, plates and rails show little improvement. Accordingly there is not so much improvement in the tonnage of ingots. The rate of ingot production now is about 35 per cent of capacity. This looks like a very low rate, even though it is nearly double the minimum rate, in the fore part of July. In tonnage, the rate of steel ingot production, in round figures, has increased from about 10,000,000 tons to 18,000,000 tons per annum, capacity being about 52,500,000 tons, while during the first nine months of 1920, when demand appeared to be almost unlimited, output averaged a rate of 42,000,000 tons a year, there being restrictions to operation by fuel shortage, labor inefficiency and great transportation difficulties.

Steel Price Movements

The wire advance, reported a fortnight ago, and effective September 12, was $2 a ton on plain wire and cement coated nails and $3 a ton on barb wire, and wire nails, making prices as follows: Plain wire, $2.60; galvanized wire, $3.10; cement coated nails, $2.45; wire nails, $2.90; painted barb wire, $3.05; galvanized barb wire, $3.55.

The advance in sheets, which started with advances by various independents and was completed by the American Sheet and Tin Plate Company (Steel Corporation adopting the new figures, effective at the opening of business September 22) is $5 per net ton, making blue annealed sheets 2.50c., black sheets 3c and galvanized sheets 4c. The new list prices on tubular goods, by the lists dated September 16, 1921, and referred to in last report, are: Standard steel pipe, basing discount, 1 to 3-inch butt weld, black, 68½ per cent., galvanized, 56 per cent; steel boiler tubes, less car loads, 53 per cent basing discount, on sizes 3 ¼ to 13-inch; line pipe, basing discount, 67 ½ per cent, on 2 ½ and 3-inch butt weld.

With two market advances, in wire products and sheets, and one decline, in

pipe, still fresh, there has been practically a stationary market in bars, shapes and plates. One can no longer say that the steel market is declining, and it certainly does not look stationary. It is a serious question, however, whether a general and prolonged advance has begun. The real decline, which was decidedly sharp, practically ended towards the close of July. After that what occurred by way of declines was no more than a gentle sagging here and there. The sheet mills insist that the advanced prices are being strictly held, and that is probably correct, but it is not so certain that, as claimed by some, the market will have another advance. It is pointed out that costs in August were far above even the present advanced prices, but one must bear in mind that costs are lower now. By the bi-monthly adjustment, tonnage wages are down by an average of about $2 a ton, and by the present heavier operation costs are also reduced.

General Business

There is no doubt that there is improvement in business generally. That is important as to the steel market's future and promises further improvement in steel demand, but it is not an explanation of the improvement in steel that has occurred up to date. since that improvement represents simply progress towards a normal relation with general business. Steel demand had been subnormal, on acocunt of stocks that had to be liquidated. With no improvement at all in general business steel demand was bound to improve from the absurdly low level of June and July. In other words, it seems perfectly safe to assert that matter what might happen to general business steel could not go back to its position of last June and July.

Pig Iron and Coke

Inquiry for pig iron has been very light, but a resumption of buying in a moderate way must come soon, as recent purchases were only for very early delivery and practically all classes of buyers are consuming iron at a great rate. Merchant furnaces are gradually resuming operations. Prices show a stiffening tendency, though there have been no actual advances in the past week, the local market remaining quotable at $20 for Bessemer, $19 to $20 for basic and $21 for foundary, f. o. b. valley furnaces.

Connellsville coke, which recently scored an advance of fully 25 cents, supported by the wage advance of the indepednents to the Frick scale of August 1, shows rather mixed conditions. There is an improvement in demand, but on the other hand the Connellsville region has failed to get some business that would normally come to it, because steel works having idle by-product coking capacity underbid the beehive ovens. Furnace coke is $3.25 to $3.50. Ordinary brands of foundary coke are strong at $4.25, while a few weeks ago they were easily obtainable at $4.00. At least two favorite brands have been marked up in the past week from $4.50 to $4.75, making the market range $4.25 to $4.75, against $4.00 to $4.50 quotable during July and August.

POINTS IN WEEK'S MARKETING NOTES

Business men generally welcome the present market improvement as the beginning of a permanent business revival.

The railways of the U. S. are to get half a billion dallors for the purpose of improving their service. This grant will be followed by others and will no doubt bring businees to other lines.

The Canadian government is being asked by Sydney, N.S., representatives to place orders for steel rails with the mills in that vicinity, so that the rumored shut down owing to lack of orders will not take place.

The volume of sales in pig iron has fallen off during the last week. Present prices however are likely to prevail until the demand increases. Some say that when this occurs there is likely to be an upward revision in prices.

The demand on steel is increasing Business is broadening and practically all classes of buyers are now in the market to some extent. A hopeful tone is very evident throughout the iron and steel trade. The expectation is for a continuous and gradual improvement.

Furnace coke is selling at $3.25 to $3.50, according to Pittsburgh reports, while ordinary brands of foundry coke are strong at $4.25, while a few weeks ago they were easily obtainable at $4.00.

A reduction of 10 in a certain line of milling and grinding machinery has been announced. This took place on September 23rd and is effective from that date.

The demand for machine tools, while not heavy, is steady. Enquiries continue to come in and several ordefs seem to be almost at hand. Dealers in this branch of the market are not complaining.

According to reports a new method of extracting aluminum from a mineral has been discovered in Japan. If present plans go through a refining plant driven by electric power will be established at Yoyogi. A project is under contemplation to establish a semi-governmental company for the manufacture of aluminum by the new method, which consists in the electrical treatment of ore and enables the production of aluminum to be increased.

PRICE REDUCTIONS IN SOME LINES

TORONTO, September 29.—Business generally continues ti improve. Everyone not only feels better but looks better these days. The steel men say that the demand in their market keeps on improving steadily. The change may not amount to much week by week, but in the aggregate it is well worth while For example one dealer told Canadian Machinery that last week he sold 50,000 tons of miscellaneous material on one order alone. This same party said that the month of August showed an improvement of 50 per cent over and above the amount sold in July, and September would in turn prove to be much in advance of August. This of course does not infer that the demand existent is anything like normal. It must be remembered that the steel market took a terrible drop some time ago, and that it will be quite a time yet before normal business can be looked for. It causes considerable optimism, however, when week after week, the figures show an increased demand. Hoops and bars are active, also regular building material, that is the steel used in construction work. The latter of course could well be called seasonable improvement. A point of interest to be noted in this market is the return of the buyer who is purchasing for stock. One dealer mentioned to Canadian Machinery that during the past week two or three shrewd buyers bought a considerable amount of material for stock purposes. When men like the ones described decide to enter the market with confidence, the future is pretty well assured. Although we cannot announce anything definite this week regarding boiler tubes we fully expect that a slight reduction will be in force next week. However we shall secure more details by that time.

Machine Tools

The machine tool dealers have no special complaint to make. Although there is no sensational rush on the part of manufacturers to buy, they at least are showing interest by making enquiries. Several small orders have been closed, and one dealer mentioned that within a few days, or perhaps a little more than a week, he expected to land four orders of good proportions. This would clearly show that the market is not confined to enquiries only.

A peculiar point came up with one of the machine tool dealers when Canadian Machinery asked him how many of the orders received were of the hand to mouth variety. "That's just the trouble," remarked this gentleman. "Everybody seems to hang off until the last moment. For example, one concern ordered from us about $1,500 of small tools. Many of these were special, so that it was impossible to deliver from stock. We explained our position, as they had requested immediate delivery, and imagine our surprise when we found out that they had known, nearly six

months, ago that they would require these goods not later than September. Eventually we got the business, but the delay to them meant real money lost."

A 10% reduction has been made by a Canadian concern on both their milling and grinding machines. This reduction came into effect September 23rd and the reasons given for the change in price are the lower prices paid for material, also a slightly lower wage rate. This reduction applies to all sizes of these two lines. What effect this will have on the demand of these tools remains to be seen, as the change is so recent, that one cannot judge at present.

SEASONAL IMPROVEMENT EXISTS IN SOME LINES—MACHINE TOOLS QUIET

Special to CANADIAN MACHINERY.

MONTREAL, September 29.—From practically all quarters the general improvement in business, noted in the last few weeks, still seems to be evident. There is a certain amount of seasonable stimulation in certain lines, while other lines of business seem to beimproving from the fact that a legitimate demand has been created. Most business men welcome the present improvement as the beginning of a permanent business revival. The future is a closed book to everyone, but one cannot fail to see that our whole realm of business is so interlocked with international affairs that, until, the European disturbances approach something in the nature of a settlement, and near-normal conditions prevail, we in Canada cannot expect our business conditions to be finally adjusted.

Conditions in the United States are so unfailingly reflected here in Canadian business that we cannot afford to ignore them. During the progress of the European war, the United States developed all her manufacturing industries to a point that is far beyond that of her present requirements. The result is that if her plants work to anything like capacity she will have large surpluses of all commodities for export. But her exporting facilities have been badly crippled by an unsuccessful attempt to inaugurate a National Merchant Marine. Her railways have been badly handicapped by financial troubles and during the time that they were operated by the government they were allowed to deteriorate badly. Thus shipping conditions have ruined her chances of an export business. At present she has an abundant supply of manufactured goods with no market in which to dispose of them. Her war transactions have made nearly all the important countries her debtor and to further discourage exporting, a high and really fictitious rate of exchange prevails. Her factories at present are either idle, or working on very short time,

Canada is dependent on the States for a great deal of material, and the interests of the Canadian industries are more or less interlocked with those of the States, and in this way the condition across the line is reflected to some extent in our own country.

But to a certain extent Canada and the United States are in a position to adjust their own peculiar problems of reconstruction, independent of the rest of the World. At the same time we are not by any means independent of world affairs in general. Perhaps in Canada we are not suffering from poor business conditions quite as badly as our neighbors across the border as our basic industry of agriculture shapes our business affairs to a greater extent than it does with our U. S. cousins, and manufacturing, although very important with us, is not quite so great a factor as with them. Prospects of a good crop in the Canadian West this year will put a large sum of money into circulation and will have its effect on reviving business in Canada. In passing through these trying times we see more than ever the importance of developing all our natural resources as far as possible and these in turn will help to develop our manufacturing to a point where we approach the position of being self-sustaining. If such were the condition today we would not be forced to spend so much money under the penalty of an adverse exchange rate.

The railway situation is bad in both countries. It is reported that the U. S. Government has voted half a billion dollars to the railways for the purpose of putting the road beds and rolling stock into first class condition. This grant will be followed by others and will mean a certain amount of business for machine tool dealers and machine shops all over the country. Canada will have to put her railways into first class condition and some such similar expedient will no doubt be resorted to here. This should mean more business for Canadian manufacturers. As soon as the National Railways are fully co-ordinated mediately re-conditioning the roads, and there will be more or less business imediately re-conditioning the roads, and business will no doubt be handled with greater dispatch as the present managements are working at a decided disadvantage. On the whole the Canadian situation is very favorable when compared with that of other countries. Eastern Canada is enjoying a fair trade and the prospects for business during the fall and winter are very encouraging.

The Steel Trade

The government is being approached by representatives of Sydney, N.S., in order to induce it to place orders for rails with the rolling mills in that vicinity, in order that a serious condition of unemployment is not precipatated about the first of November when it is rumored that a general shut-down will occur for lack of orders. There is no doubt but that an order will be given for winter rolling. The government recently placed an order for 40,000 tons of steel rails with the Algoma Steel Corporation for winter rolling, and this order does not represent all their requirements.

The Canadian Car and Foundry Co. are busy on their order for tank cars for the Russian Government. This firm took the order under rather peculiar conditions namely that of having secured payment in advance. This would be an idea for other firms doing business with Russia. Light steel plates continue to be in fairly good demand and sheets are moving comparatively freely yet.

Structural shapes are not in great demand but a few orders are coming along in small lots while bars are very quite. There has been no change whatever in the prices and it is the general consensus of opinion that the present scale of prices represent the low level and as soon as the demand increases the price will strengthen. Present prices really only cover the cost of production with little or no profit.

Pig Iron

Small sales of pig are reported but the volume has fallen off a little in the last ten days. The recent increases in price brought many of the foundries into the market and last month represented the largest monthly business of the present calendar year. Present prices are likely to prevail till the demand appreciably increases, then there will ikely be an upward revision of price. Jobbing foundries are doing a fair amount of business. While some of the larger foundries are operating in a small way.

Trade is very quiet in machine tools. There is practically no demand for new tools. A few sales of re-manufactured tools are reported but the volume is not large. There is a large amount of idle machine tools in the country and it is not likely that new sales will be reported unlike most of the idle machines are put to work. There is a slight tendency to reduce prices but as this action is not expected to stimulate business many manufacturers have made no reductions.

Small Tools and Supplies

The usual amount of business is being done from week to week. Of late, however, some firms which have been out of

the market for some time, have been asking for rates which have in some instances resulted in orders being placed. There is not much of a tendency to adhere to any set price list, and quotations on each order seem to be the method of doing business. The manufacturers are getting their product on the shelves of the jobber and there is a slight indication of getting back to normal, but liquidation in some quarters still continues.

In the last week nothing has occurred to change the same quiet conditions that have prevailed for some time past. Prices are still very weak and no business is offering. Until the foundries get operating again there will probably be but little to report in this connection. No changes in the price of non-ferrous metals have taken place in the last week. The little business offering is of the hand to mouth variety. Perhaps one may discern a slight improvement in the volume of business but it is very slight.

CANADA'S MINERAL PRODUCTION RICH IN COBALT, ASBESTOS AND NICKEL

ALTHOUGH not generally known, Canada produces 90 per cent of the world's cobalt, 88 per cent of its asbestos, and 85 per cent of its nickel. The industry has been somewhat hampered by inaccessibility of location, and lack of necessary capital for exploitation. In spite of these disadvantages considerable improvement has been made, for the value of Canada's mineral production in 1920 was $217,775,080, as against $176,686,390 in the previous year, or an increase of 23.3 per cent. All minerals, with the exception of lead and quartz showed an increase in the value of production over 1919, though in the actual amount produced there were decreases also in pyrites, petroleum and natural gas.

Ontario accounted for the highest mineral revenue with $787,749,178, followed by British Columbia with $38,044,915. Alberta jumped from the previous year to the third place in value, with $33,721,898; Nova Scotia was close behind with $30,187,533, whilst Quebec produced to the extent of $27,722,502. Manitoba's mineral revenue was nearly four millions: New Brunswick's two and a quarter millions; Saskatchewan's over one and a quarter millions, and the Yukon's about the same.

With a production value of more than $81,000,000 copper was Canada's most valuable mineral in 1920. Nickel was next with more than $61,000,000, and zinc third with $40,000,000. Lead was worth $33,000,000; coal $16,000,000 silver $12,000,000; lime $9,000,000; slate $6,500,000; and cement $6,500,000. Ontario accounted for 36.16 per cent of production; Nova Scotia 13.86 per cent; and Quebec 17.73 per cent.

Production in 1920

The combined mineral production value of Canada during 1920 was the highest the Dominion has ever reached, and one attained in conditions of economic depression, falling prices, and a considerable cessation of operations at points which makes the outlook all the more pleasurable for future mineral production. The metallic production which in 1918, when the pinnacle of wartime efforts was attained, was valued at $114,549,152, and fell to $73,262,793 in 1919, came back to $77,236,370 in 1920, whilst the total value of the non-metallic production which in 1918 was $96,752,745, and increased in 1919 to $103,423,507, increased again in 1920 to $140,538,710. About $23,000,000 of this increase is due to coal alone.

There is no question but that production is increasing rapidly, for in 1886 the mineral production of the whole of Canada was only $10,221,255, or $2.23 per capita. In the next five year period, or at the end of 1891, this production value had increased to $18,976,616 and $3.92 per capita. Another substantial increment had been added by 1896, when the production for the year was valued at $22,474,256, and the increase in the next half decade was remarkable, bringing the total for the year 1901 up to $65,797,911.

By 1906 the yearly output was valued at more than $79,000,000; by 1911 at $103,000,000; and in the following five year period the value nearly doubled, accounting for $177,201,534 in 1916. A war-time spurt brought it up to $193,000,000 in 1917, and this movement reached its zenith with $211,000,000 in 1918. In the first war year a depression occurred, but a recovery was made last year that was in itself a record.

BETTER TRAINING FOR MECHANICS

Philadelphia intends holding a conference to discuss methods for restoring the apprentice system of training young men in the various trades. A complaint has been made that this system has been greatly restricted by different labor organizations and that there is laxity in admitting the untrained to employments for which they are not qualified.

The result of this, according to a report in the "New York Herald," has been a deterioration in the quality of output as well as a falling off in the morale of men employed. As a consequence good, trained mechanics are scarce in proportion to industrial needs, and they are all the time growing scarcer. This is bad for the mechanics and bad for the country. High wages and prospective advancement are the rewards of skill. To the attainment of skill there is no royal road. It is acquired only by conscientious instruction.

It is the purpose of those back of the apprentice conference movement to provide ways and means for apprentice training and instruction which shall be thrown open to all, irrespective of any limitations which have been imposed by certain crafts. With more and better mechanics the country's industrial output will be larger and better. On the other hand, ill-directed, circumscribed, haphazard mechanical training of employees, from which our industries have suffered more or less, means a serious national handicap in the sharp world competition ahead.

The matter of improvement in this respect has been taken up by the industrial committee of the Philadelphia Chamber of Commerce. It has interrogated many boards of trade and it has digested a mass of data assembled by experts employed for the purpose. The conclusions reached are that a large proportion of the young men in the various industries merely drift in with wholly inadequate training; that they never acquire skill proportionate to their natural capacities; that, as a consequence, they do not prosper personally as they should and do not produce the wealth the country might expect from them. Some of the experts estimate that 60 per cent of the younger mechanics in this country are thus handicapped.

The responses which have come to the Philadelphia committee have been encouraging. There is distinct promise of valuable results from the proposed conference, and this not merely for Philadelphia but nation wide in inspiring similar efforts in all the great industrial centers.

ELECTRICAL PLANT

A new electric power development will be erected at Great Falls on the Winnipeg river, 63 miles from Winnipeg. It will have a capacity of 168,000 horsepower and will cost about $10,000,000. Announcement of the successful result of financial negotiations was made recently by A. W. McLimont, vice-president of the Winnipeg Electric Railway Company. Work on construction already is under way, with about 200 men employed, but as the work develops between 1,000 and 2,500 men will be engaged.

The undertaking will be carried out under the charter of the Manitoba Power Company, which company is taking over the plant and assets of the Winnipeg River Power Company. Sir Augustus Nanton is president of the Manitoba Power Company, and Mr. McLimont is vice-president in charge of construction and operation. The plant will be constructed in six units of 28,000 horsepower each, and work will be completed in 1924. Promotors of the development believe that the availability of a large quantity of cheap power will do much for Winnipeg's industrial promotion.

The Baldwin Steel Corporation, Ashbridge's Bay, Toronto, have had their business assessment reduced from $483,839 to $264,000, and their building assessment from $800,000 to $325,000.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago.	30 00
Standard low phos., Philadelphia.	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 00	17 50
Castings, copper	16 75	18 00
Tin	34 00	39 00
Spelter	7 00	7 50
Lead	7 50	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 9 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	8 00
Red brass turnings	7 00	7 50
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less.	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	45
Can. carbon cutters, plus	10
Standard drills, all sizes	45
3-fluted drills, plus	10
Jobbers' and letter sizes	45
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	10 to 15 off
Can. high speed cutters, net to plus 10	
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5 75	$5 25
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 50	6 00
Can. plates, all bright	7.75	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	8.00	....
Fleur-de-Lis, 28 B. W. G.	7.50	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	....
Premier, No. 28, U.S.	6 75	6 50
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30,

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	27 00
1¾ in.	29 75	24 00
2 in.	29 25	22 00
2¼ in.	33 00	25 50
2½ in.	44 75	28 00
3 in.	49 25	34 00
3¼ in.	.....	42 50
3½ in.	63 50	37 50
4 in.	85 00	48 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21	Atlas	19
Peerless	22	X Empire	15
Grand	21½	Ideal	18
Superior	21½	X Press	13½
X L C R	16½		

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	17	Dark colored	13
Mixed colored	14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard	10%	Best grades	15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



Industrial News

The Liberty Machine Tool Co., Hamilton, Ont., has built to special order, two planers for the Harrisburg Foundry and Machine Co., Harrisburg, Pa.

The B. Greening Wire Co., Hamilton, Ont., has again got back to full time working hours. For some time past the regular schedule was three days a week, but increased orders has made the full time shift possible.

The Canadian Cottons, Ltd., Hamilton, Ont., have once more started on full time schedule. Some time ago the working hours were reduced, but conditions have improved to the point where full time is again possible.

The Parker Motor Car Co., Montreal, capitalized at $10,000,000, has leased space in the works of Caron Bros. at Longue Pointe to provide for assembling cars on a large scale.

It is reported that some 350 men have been taken on again by the International Harvester Co. at Hamilton, Ont. Some time ago it was necessary to let these men out owing to over production, but now conditions have become much better.

The Anglo American Motors Ltd., have obtained a site at Trenton, Ont., on which they intend building a modern plant.

The Sapco Spring Co., Ltd., Toronto, expect to extend their plant, thus increasing their capacity. They make truck springs, and other automobile springs, etc.

The Canadian Gary Motor Truck Co., Toronto, have secured premises on Alantic Ave., and intend installing equipment at once for the manufacture of their trucks, etc.

The City Council of Montreal intend installing new boilers in their pumping station on Craig St. It is expected that these boilers will cost around $15,000. Bids will also be called shortly for four new pumps for the Rielle St. pumping station, and the latter will also cost about $15,000.

Rankin & Co's. planing mill, Toronto Ont., was damaged by fire to the extent of $20,000 on Sept. 24th. The mill, which is a two-storey structure, was gutted, while the excelsior house was slightly damaged. The remaining buildings were untouched.

Notification is made by the Director-General of Commercial Intelligence, Calcutta, that manufactured mica has been exempted by the Government of India from payment of import duty.

The Annual Fall Meeting of the American Welding Society will be held at Philadelphia, during the week commencing October 17. In addition to the technical sessions, provisions are being made for meetings of the American Bureau of Welding, and of its research committees, and of the directors of the society.

According to a statement made by A. H. Morse, managing director of the Marconi Wireless Telegraph Co., of Canada, La Prairie, Que., a little town about six miles from Montreal, will be the site of one of the most complete wireless experimental research stations in the world.

The next British Industries Fair is to be held in London and Birmingham from Feb. 27 to March 10, 1922. This fair is open to manufacturers in every part of the British Empire. It is said to afford an excellent medium for bringing manufacturers in direct contact with buyers, as only bona fide manufacturers are permitted to exhibit and buyers are admitted to these fairs by invitations only. The general public are not admitted. Full details regarding the fairs can be obtained from H. M. Trade Commissioners at 243 St. James Street, Montreal, 260 Confederation Life Building, Toronto, or 610 Electric Railway Chambers, Winnipeg.

The Georgetown Coated Paper Co., has gone back to full time, and it is expected that they will be running at full speed all winter. Another concern in the same town, The Harley Kay Co., is also expected to start on full time immediately. The Manawata Hosiery Co., Palmerston North, New Zealand, has also signed a contract with a Georgetown concern, to have the latter deliver in monthly consignments for a two year period, special automatic knitting machines. This, with other domestic trade will keep the factory spoken of running full time for the next two years.

The English Electric Co. of Canada will have a capitalization of $2,000,000 of 8 per cent preferred stock, and 30,000 shares of no par common. It is understood that control of the company will be vested in the common stock only. Of the 30,000 shares, approximately one-third or 10,000 shares will be handed over to the English Electric Company in payment for the designs, patents, and manufacturing rights which the latter is giving the Canadian concern. Well on to another third of the common stock will be absorbed by preferred shareholders in the form of the bonus of 40 per cent common stock allowed them. Something like 10,000 shares, the remainder of the common stock, will go to the principals who negotiated the deal of whom several are members of the Canadian board of directors of the company. Very little common stock is being allotted to the underwriting firm, the Canadian Debentures Corporation. As holdings of the English company, and of the Canadian principals who were instrumental in bringing the three companies together are about equal the balance of control will be with the remaining Canadian common stockholders, who subscribe to the preferred issue.

The new concern does not need to undertake any important plant extensions or alterations, inasmuch as the existing plant is adapted for a much larger and wider range of production than it is at present being utilized for. It is merely a matter of bringing out designs and patents for new electrical equipment from England, whereupon production of same on a large scale can be undertaken at the St. Catharines factory at once. A portion of the $500,000 order placed by the Toronto tranportation commission with the English company in England will be filled presently by the Canadian company.

Marine News

The new steamship Princess Louise, of the Canadian Pacific Railway Company's British Columbian Coast service, was recently launched at Victoria, B.C. She bears the distinction of being the first marine passenger vessel constructed in British Columbia. Her timbers, except for the hardwoods, were grown in this province, and her boilers and other mechanical fittings were made in British Columbia. The efforts of the builders were to make the Princess Louise an "all British Columbian" product. She is 330 feet over all, and can attain a speed of 17½ knots loaded.

As an illustration of what can be done in the port of Montreal in the quick despatching of ships, the steamer Manchester Civilian, of the Manchester Line, which arrived here light at 10.30 a.m. Monday, was scheduled to sail Wednes-

day for Rotterdam with 264.000 bushels of wheat. The steamer was passed by the port warden an hour after her arrival and commenced to load her cargo at one o'clock.

The second of the 10.500 ton ships built for the Canadian Government Merchant Marine by the Halifax shipyards, the Canadian Constructor, has been launched at Halifax. The first of these ships, the Canadian Cruiser, which was launched some weeks ago, will come into commission about the end of this month, according to a statement by Mr. R. R. Teakle, general manager of the C.G.M.M.

Following extensive investigation of tides in Baie de Chaleur and in the various harbors along the Atlantic coast, the Naval Department is issuing tide tables for the guidance of mariners for the year 1922. This work is being carried on under the supervision of Dr. W. Bell Dawson, superintendent of tidal surveys. During the summer observations of tidal actions were made at Campbelltown and Dalhousie, on Baie de Chaleur; at Gaspe, Fox River, at Seven Islands, on the St. Lawrence, and at St. John, Halifax and other ports.

Incorporations

The Wahl Co., manufacturers of eversharp pencils, fountain pens, etc., have incorporated as a Canadian company, and will manufacture their line in Toronto, having leased part of the Cowan factory building on Sterling Rd.

The Watkins Mfg. Co., Ltd., Kingston, Ont., has been incorporated with a capital stock of $15,000 by James McK. Hughes, William McA. Nickle and others to manufacture machinery, metals and to rebabbitt automobiles, marine, traction and other mechanical parts, etc.

The Duro Aluminum Ltd., has been incorporated at Hamilton, Ont., to manufacture aluminum ware, enamel ware tinware, sheet metal ware etc. The authorized capital will be $200,000, the gentlemen interested being John A. Soule, Philip M. Cross and James M. Dunn.

The North Shipping Co., and the South Shipping Co., have been incorporated under the Dominion Companies Act. The offices will be at Quebec, and the authorized capital of each company is $500,000. It is the intention of these companies to transport passengers, mail and merchandise, and do towing and wrecking, etc., in any navigable waters in and bordering on the Dominion, and to and from any foreign port. The incorporators are as follows:— A. C., and H. P., Hill. C. H. Maclaren, S. A. V. Martin and L. Mattman, Ottawa. It is said that these companies are subsidiaries of the Clark Steamsnip Co., which operates steamships on the north and south shores of the St Lawrence river.

The Taylor O. K. Mfg. Co., Ltd., Hull, Que., have recently been incorporated with a capital stock of $200,000. This concern intends manufacturing storage batteries, but at present they do not plan to erect a plant although it is thought this may be necessary next year. Officers are: President, H. A. Champaigne; secretary-treasurer, J. W. Ste. Marie and general manager, Ray Murray. Offices of the Company are at 11 Youville street, Hull, Que.

DROP IN PRICES ON FARM MACHINERY

Reductions Ranging from 15 to 30 per Cent Are Announced by Big Implement Firms in Canada— Farmers Will Benefit

The Massey Harris Co., with headquarters in Toronto, and the Cockshutt Plow Company, of Brantford, have announced reductions in prices from 15 to 30 per cent. Mr. Thomas Bradshaw, treasurer of the former company, says that the average reduction would be about 20 per cent. This applies to all finished implements stored at the headquarters here or in the different branches and is based upon an estimate of the lowered cost of production, applicable to implements hereafter to be turned out, although the implements now being offered for sale were produced under higher cost conditions.

Mr. Wedlake, general manager of the Cockshutt Plow Co., says that big cuts in inventory have made the new price possible. It means a cut on the other side of profits, according to Mr. Wedlake, and this cut will be about 25 per cent. It is expected that normal operations in this plant will gradually be arrived at.

Mr. S. B. Chadsey, general manager of the Massey-Harris plant here, says that as there are many varied lines manufactured, the cuts would run from 20 per cent. to 25 per cent. It is stated that the manufacturers in general base their new prices upon a drop in cost of material and labor of approximately 20 per cent. In some cases these cuts in wages have been made, in others, there had been no change up to the time of the closing of the factories. Mr. Chadsey said that it was not correct to say that a cut of 20 per cent. would be made in wages, but that there would be a readjustment of wages, which would approximate an average reduction of 20 per cent.

EQUIPMENT WANTED

A firm in the west desires to purchase several items of equipment including the following:—A six foot shear; a small punch press; a key seating machine, a six foot power brake; a power drill; a 14 inch lathe; a set of four foot rolls; an 8 or 10 h. p. motor. Those interested should write the Link Mfg. Co., Portage La Prairie, Manitoba.

DRAWBACK ALLOWED ON IMPORTED SHEETS

Imported Steel Sheets, When Used In The Manufacture of Stampings For Automobiles, Are Allowed Drawback

Anyone using imported sheets in the manufacture of stampings for automobiles will be interested in the following regulations which are now in force. under the provisions of sections 286 of the Customs Act:—

When imported steel sheets, hot or cold rolled, or coated with lead or a combination of lead and tin, number sixteen gauge and thinner but not thinner than number twenty-four gauge, measuring from twenty to forty-two inches in width and from fifty to one hundred and twenty inches in length, on which Customs duties have been paid, are used, after the thirty-first day of July, nineteen hundred and twenty-one and until otherwise ordered, in the manufacture of stamping for automobiles, there may be paid a drawback of ninety-nine per centum of the Customs duties paid on the steel sheets so used. Provided, however, the said drawback shall not be paid unless the duty has been paid on the steel sheets so used as aforesaid within twelve months of the manufacture of the said stampings for automobiles, subject to the following conditions, viz:—

(a) The quantity of steel sheets used and the amount of Customs duties paid thereon shall be ascertained;

(b) Satisfactory evidence shall be furnished in respect to the manufacture in Canada of the stampings for automobiles.

The claim for drawback shall be verified under oath before a Collector of Customs to the satisfaction of the Minister of Customs and Excise, in such form as he shall prescribe, within one year after the manufacture of the stampings for automobiles. The Minister may also require in any case the production of such further evidence, in addition to the usual averments, as he deems necessary to establish the bona fides of the claim. All claims for drawback under the foregoing regulations should be made on Form K. 15½.

Obituary

A. B. Petrie of Guelph, president and founder of the Petrie Mfg. Co., Hamilton, Ont., died at his home a few days ago. Mr. Petrie, who had reached the age of 80, started the Petrie Mfg. Co. some 20 years ago, the first factory being in Galt. The business was next moved to Guelph, then later brought to Hamilton about 16 years ago. This firm which manufactures cream separators, gasoline engines, and sprayers, will be carried on by the five sons, A. B. Jr. H. J.; P. S.; C. M. and G. R. Petrie, all of whom are interested in the business.

Right in the Lead

THREE PER MINUTE

OF THESE DROP-FORGED STEERING ARMS
⅞ in.—14 U.S.F., ¾ in. LONG
Threaded on a Geometric Threading Machine at a Prominent U.S. Auto Factory



Another Geometric Threading Machine was given the work of threading both ends of steel brake pull rods. Production jumped to 70 rods per hour (threaded both ends) where only 30 rods an hour had been previously threaded. The Geometric Threading Machine increased production and cut costs on the work, beside releasing the big turret lathes for other work more in their line.

The biggest recent record with a Geometric Threading Machine was in threading 4,000 Graphophone Brass Mouth Pieces in one day. Before the work was put on a Geometric Threading Machine a solid die was used, and, with the necessary backing off, only 800 pieces could be threaded in one day.

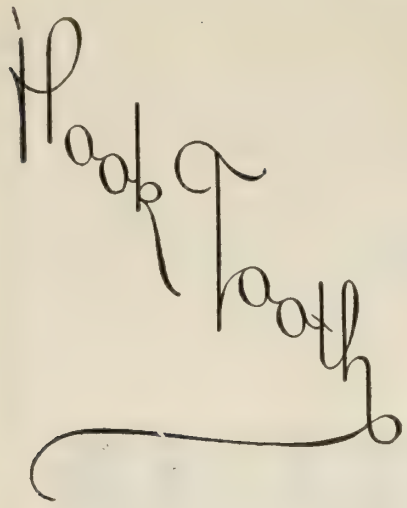
The Geometric Threading Machines produce work in quantities—rapidly, accurately, profitably—with a minimum of attention. There are three sizes—1-2 inch, 3-4 inch and 1 1-2 inch.

There are three styles—Single Spindle, Double Spindle, and Bench Threading Machine.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto.
Vancouver, B. C., St. John, N. B., and Halifax, N. S.



SOME HAVE wondered
* * *
WHAT THE hook in
* * *
HACK MEANS, but
* * *
MECHANICS KNOW at
* * *
ONCE THAT it is
* * *
THE SCIENTIFIC principle
* * *
BY WHICH the teeth
* * *
OF SIMONDS hack
* * *
SAWS ARE made, they
* * *
HAVING A slight hook
* * *
AT THE point so they
* * *
CHISEL OUT the
* * *
METAL INSTEAD of
* * *
TEARING IT out
* * *
AND CONSEQUENTLY the
* * *
BLADES DO not
* * *
WEAR OUT, but last
* * *
LONGER, HOLD their
* * *
CUTTING EDGE and do
* * *
NOT SHELL teeth.

When you need hack saws get the best—Simonds.

Simonds
Canada Saw Co.,
Limited
"The Saw Makers"
Montreal, Que. - St. John, N. B.
Vancouver, B. C.

SEMI-ARID STATES WILL BE RECLAIMED

Plans are being made for the reclamation of the semi-arid states of Brazil. A large amount of engineering and construction work is going to be accomplished, and this work, which is located in the states of Ceara and Parahyba, will include the construction of five large dams involving nearly a million cubic yards of concrete—to create storage reservoirs, some of which are to be larger than any artificial reservoirs existing elsewhere. The work is to be conducted under the direction of the Brazilian Government, and in its ultimate importance and economic value it is comparable to the irrigation work carried on since 1903 by the United States government.

In these semi-arid states of Brazil there is an average rainfall of about 30 inches, which if properly distributed as to time and volume would make, even under the tropical sun, a sufficient supply of moisture to produce moderate crops. The climate, however, consists of a dry season extending from May to December and a rainy season lasting from January to April or thereabouts. Practically all of the rainfall occurs during the rainy season months when, if the precipitation falls in heavy rains, the soil is saturated, the springs are renewed and the rivers are in flood. In the dry years, however, the rainfall, although aggregating as much as the average year, may be precipitated largely in thin showers which, under a tropical sun, are quickly evaporated, with the result that the soil does no become well moistened and the rivers carry little if any run-off. Severe droughts result which reduce the inhabitants of this section to a condition of starvation. It is to remedy this situation that this reclamation programme has been undertaken.

The region to be benefited, lying in Latitude 4 to 8 degrees south of the Equator, will have climatic possibilities similar to southern Arizona and California or the irrigated section of the west coast of Mexico. The streams which drain the region are of large volume and will furnish ample supply for reservoirs. The products of the country include cotton, sugar, skins, medicinal products, various kinds of palm and other nuts for the production of vegetable oils, citrous fruits and other products of tropical and sub-tropical agriculture. The people of the region are known as among the most energetic in Brazil and are valued all over the republic for their industry and effectiveness as workers. The work is under the direct control of the Inspectoria de Obras Contra as Seccas which is a department of the Ministry of Viacao e Obras Publicas. The Inspector General in charge of the work is Dr. Miguel Arrojado Lisboa. Dr. Pires do Rio is the Minister of Viacao e Obras Publicas. The initiation of active work at the present time is due in large measure to the interest shown by the president, Dr. Epitacio Pessoa, who has given this programme for the material betterment of a needy section of his country.

Dwight P. Robinson & Co., Inc., New York, are going to supervise a large amount of this engineering work.

Motor Transport

Motor lorry transport has developed considerably in Switzerland during the last two years, according to the former commercial secretary to H. M. Legation at Berne. This condition exists largely because a great inflow of army trucks was obtained at relatively low cost from the various belligerent countries—and the railway concerns are becoming adversely affected to a marked extent by their competition. Motor lorry transport has also been encouraged by the increase in railway rates, and seems destined to develop still greater powers of competition in the near future for internal goods traffic. Owing to the comparatively small area of Switzerland the distances to be traversed may well not warrant the expenditure entailed by cartage to the station of despatch and from the station of destination, with its attendant waste of time and labor in double registration, waiting for receipts, delivery of goods and double breaking of bulk, and the simpler and more economic method would appear to be the use of lorries from door to door for short distances.

GERMAN STEEL TRADE HAVING BOOM

Steel Trade Has Boom—Factories Booked Up to End of October—Further Orders in Sight

The German iron and steel industries are at present experiencing a boom. The various factories are booked up to the end of October, and according to reports, England, Holland and South American countries are the largest buyers.

The rush to place orders is explained in part by the low value of the mark. However, it is believed prices will advance later on. They are now lower than those quoted at the time of the industrial stagnation last spring. Higher wage scales have been agreed to between employers and labor, employers acting on the theory that this will enable them to avoid a period of strikes which would hamper many industries.

The demand for coal and pig iron is heavy and is sending prices soaring. This, it is believed, will continue until French imports again stabilize the markets. The demand for half manufactured steel for immediate delivery is greater than the mills can meet. Rails, railroad material, and, lately, locomotives and cars are much sought for. The machine works have orders, but are complaining of difficulties in meeting the higher cost of raw materials.

Engineering News

The General Motors of Canada intend going after export business in motor cars in deadly earnest. Col. R. S. McLaughlin, president of the company, says that he is confident that operations will be steady in the Oshawa plants during the coming winter. He states that much depends on export business, which is now opening up. The company now has initial specifications of 1,000 cars of all makes which are to be taken in the next few months, and as business conditions right themselves in various parts of the world this trade should assume a considerable volume. The receipt of these offers would have a steadying effect, especially at this time of the year.

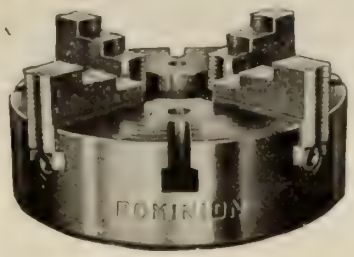
The first shipment of Canadian goods to Russia since the Bolshevik revolution will be made from Montreal in October, when the advance consignment of five hundred oil tank cars, now nearing completion in the shops of the Canada Car and Foundry Company, will be placed aboard vessels of the Canadian Government Merchant Marine for transportation to Novorossusk, a Russian port on the Black Sea. Four of the largest Government freighters will be used to carry the cars to Russia, and it is expected the final shipment will be made from Montreal before the close of navigation.

There is some talk of an assembling plant being erected in Walkerville by the Reo Motor Car Co. Although nothing official has been reported, the rumor has it that the Reo Co., hopes to begin assembling its cars in Walkerville by the beginning of next year. The Dodge Bros. Co., have also been negotiating for a site, if the talk on the streets is correct.

BETTER LUCK NEXT TIME

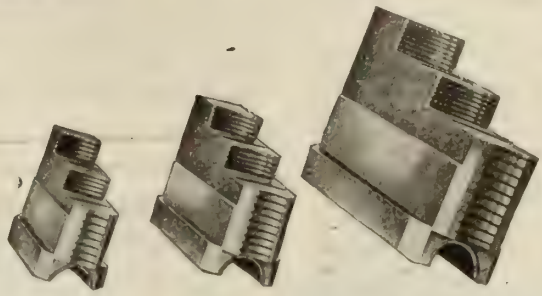
Following are the names of those who submitted correct lists for the Sept. 8th contest:—W. J. Lawrence, Montreal; E. Ergott, Toronto; George Land, Peterboro; Paul W. Lohner, Lockport, N.S.; Stanley F. Lennox, Belleville; T. Parker Lachine, Que.; A. M. Jagger, Hamilton; F. Webb, Dundas; L. T. Churchill, Calgary, Alta.; Burton H. Galbraith, St. John N. B.; John H. Wood, Toronto; G. F. Sanders, Cargill, Ont.; F. Drackley, Sault Ste. Marie; John McCampbell, Tessalon, Ont.; H. N. Bethune, Hamilton, Ont.; and Paul A. Wink, Cobalt, Ont.

The Selson Engineering Co., New York, and Coventry, England, have an interesting catalogue describing their machine tools, attachments, etc. Lathes of all kinds and sizes are shown, also shaping machines both hand and power. Radial drilling machines; mitreing and slotting machines; tool grinding machines, metal saws, tooth rounders, and many other lines are included in the 48 pages of this book.



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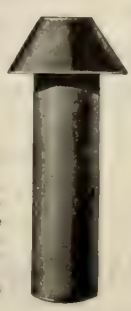
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Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
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Garlock-Walker Mchy. Co., Toronto, Ont.
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Boring Heads
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Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
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Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

Bronze
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O

Bulldozers
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, On

Calipers
Brown & Sharpe Mfg. Co., Providence, R.
Starrett Co., L. S., Athol, Mass.

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.

Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthis, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence, R.I.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont

Gages, Comparator
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Bull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia, Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co. Madison, Wis

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Clemson Bros., Hamilton, Canada
Garlock-Walker Mchy Co., Toronto, Ont
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Pars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont.

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

etal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oils
Canadian Oil Companies, Ltd., Toronto Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Imperial Oil Ltd., Toronto, Ont.
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haverhill, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ferri-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Ptess Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. B., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Teol Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.
Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal Q

Screens
Can. Wire & Iron Goods Co., Hamilton.

BUYERS' DIRECTORY

Screens, Paper
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Ferry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal. Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, [illegible]
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
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Can. Fairbanks-Morse Co., Ltd., Montreal
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Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
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Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
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Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, nt.
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can Fairbanks-Morse Ltd., Montreal Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont
Crane Ltd,. Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Lincoln Electric Co., Toronto, Ont
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

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The Canadian Fairbanks-Morse Co. Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co. Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

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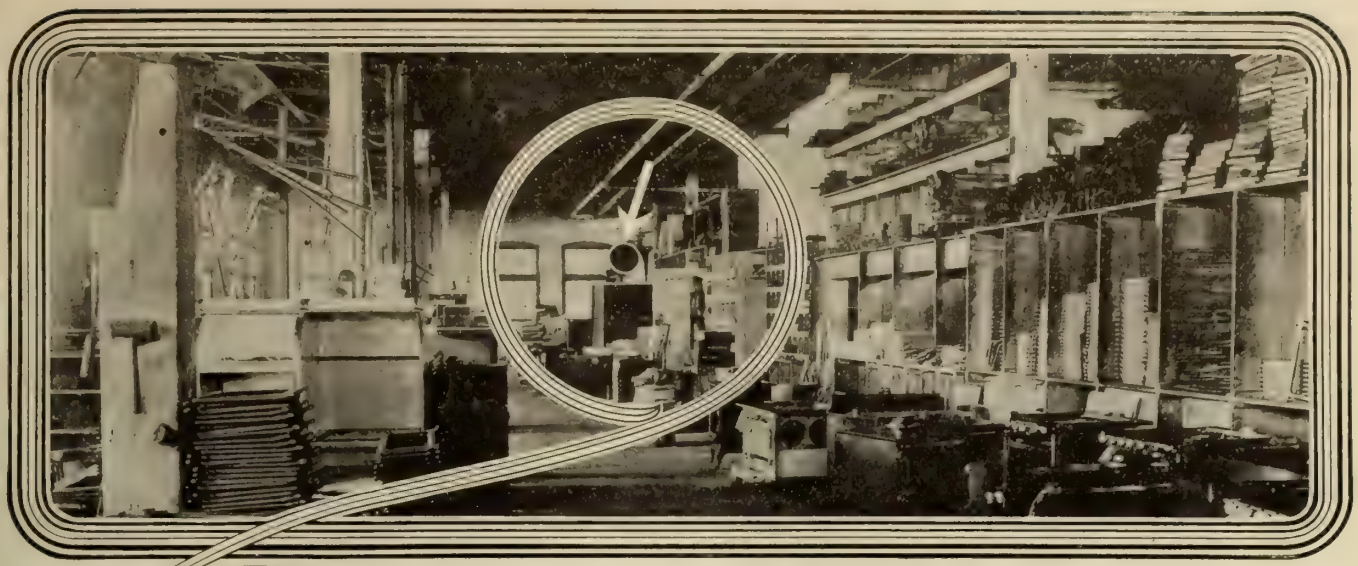
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New York.....1706 Flatiron Bldg.
Minneapolis...806 Metropolitan Life Bldg.

Skinner Bros.
Baetz Patent HEATING SYSTEM

Skinner Bros. Mfg. Co., Inc.
1438 S. Vandeventer Avenue, St. Louis, Mo.

Please send complete details on Skinner Bros. (Baetz Patent) Heaters to

Firm .....

Address .....

Building used for.....

We can / cannot use steam.

Jacobs Super Chuck

Patented 1909-1915. Other patents pending



A Look Inside

Here are the several parts—carefully designed, exactly fitted, perfectly made—that guarantee the Jacobs Super Chuck to hold a drill tight, to hold it right, and to keep on doing its work indefinitely.

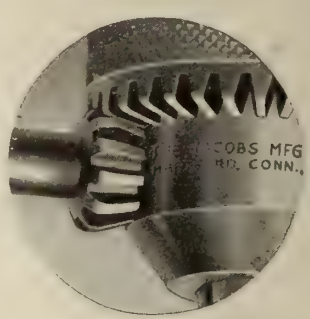


FIRST THE BODY—scientifically casehardened; size limits within .0005″, arbor hole ground on a special fixture with six gages to position it accurately in relation to the hole for the jaw.



THE SLOT FOR THE NUT, correctly located in relation to the jaw holes by means of micrometer gages, insures a properly fitting thread on the nut and jaws.

NO WEAR ON KEY HOLES because of the deeply casehardened body, result—a well fitting Gear on Sleeve and Key.



THE JAW, OF TOOL STEEL, has glass hard gripping surface; threads are tough, and all surfaces are ground on centers to within **a quarter of a thousandth** of an inch.

THE NUT, of special analysis steel, is ground after heat-treatment, in correct alignment with thread; tolerance .0005″.

THE BALL RACE comes within limits of .0001″; finest grade balls are used. An important point is the pitch of thread on nut—angle is 90 degrees to center line of jaw, so part cannot run over thread of latter.



The Jacobs Super Chuck centers a drill, **accurately,** and will continue to do so after years of use. It saves its cost time and again by preventing drill breakage. Its correct balance preserves bearings of your drilling machine—order a Super Chuck from your dealer.



The Jacobs Manufacturing Company

Hartford, Connecticut, U.S.A.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVI., No. 14 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Oct. 6, 1921 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Alloyed under the Stanley Process

Lionroyal

Babbitt



The product of over half a century's experience

BRITISH SMELTING & REFINING Co LTD

DRUMMOND BUILDING MONTREAL and 13 VICTORIA STREET LONDON S.W.1

You Need a Good Die Stock Set

If you need one at all.

Because a **GOOD** Die Stock Set embodies:

1. Accuracy in its product.
2. Adjustment for wear.
3. Free cutting qualities.
4. Provision for sharpening.
5. Ample adjustment for oversize or undersize.

P. & W. Die Stock Dies **ARE GOOD DIES.**

BETTER than most because of the interchangeable feature in their chasers. A brcken chaser in a P. & W. Die doesn't mean a new set of chasers. You can get a new chaser to replace a breakage and the new one "fits in" perfectly in your old set. That's the 6th point, **"ECONOMY IN OPERATION."**

PRATT & WHITNEY COMPANY
OF CANADA, LIMITED

Works: Dundas, Ontario

MONTREAL	TORONTO	WINNIPEG
723 Drummond Bldg.	1002 C.P.R. Bldg.	1205 McArthur Bldg.
VANCOUVER	WALKERVILLE	HALIFAX
B. C. Equipment Co.	103½ Sandwich St.	Roy Building



PRATT & WHITNEY.

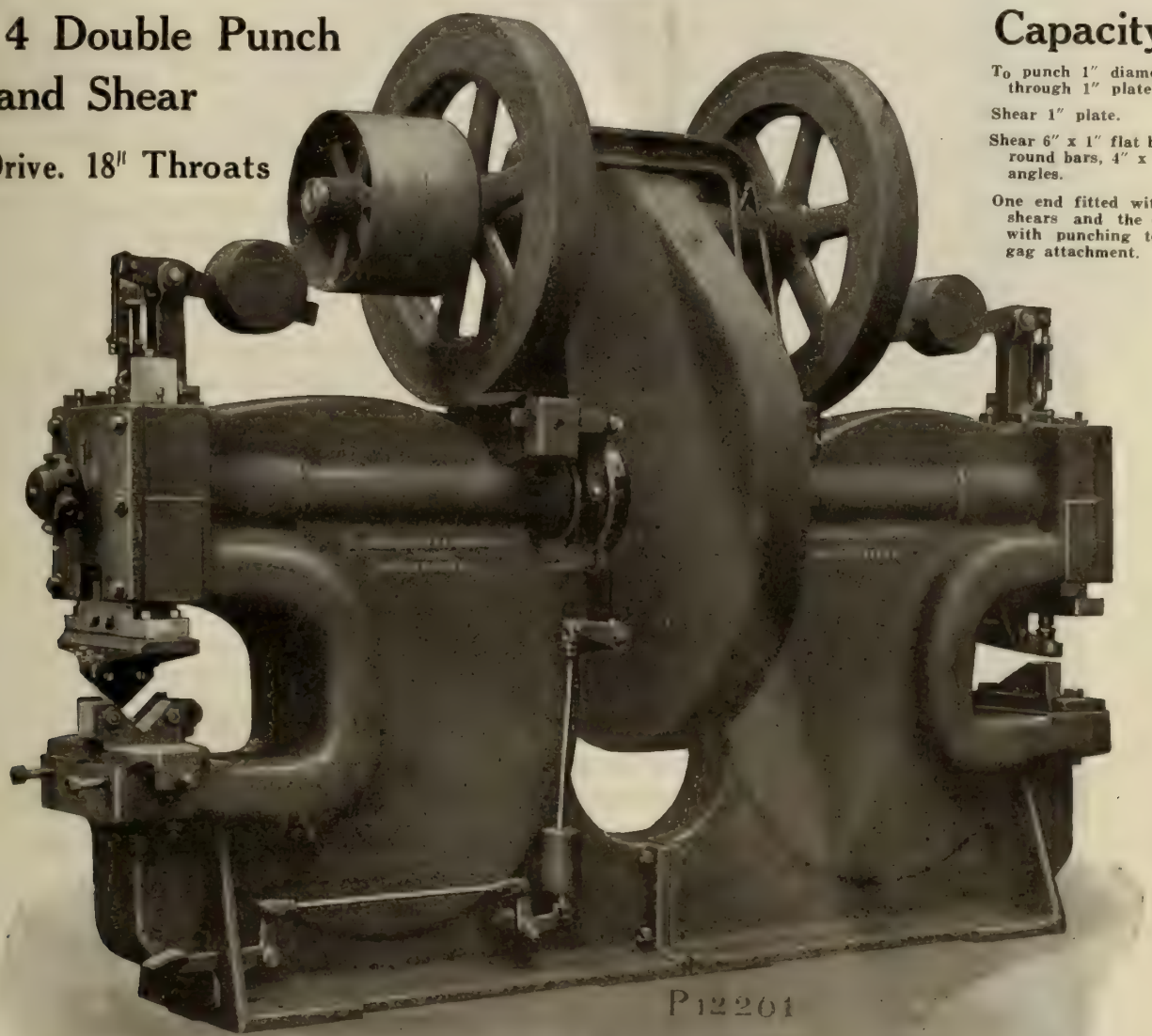
The BERTRAM Page

MACHINE TOOLS

J.B.&S.Co

No. 4 Double Punch and Shear

Belt Drive. 18" Throats



Capacity

To punch 1" diameter holes through 1" plate.

Shear 1" plate.

Shear 6" x 1" flat bars, 1¾" round bars, 4" x 4" x ⅜". angles.

One end fitted with Angle-shears and the other end with punching tools and gag attachment.

The John Bertram & Sons Co., Limited

DUNDAS - ONTARIO - CANADA

MONTREAL	TORONTO	VANCOUVER	WALKERVILLE	WINNIPEG	HALIFAX
723 Drummond Bldg.	1002 C.P.R. Bldg.	609 Bank of Ottawa Bldg.	103 1-2 Sandwich St.	1205 McArthur Bldg.	Roy Bldg.



The New Canadian-Detroit Double-D Rolled Drill

Made in Canada

PRODUCTION requirements in an ever-increasing number of plants necessitate the use of a strong, accurate drill, specially designed for hard drop forgings, steel castings, and other alloy steels equally tough and difficult to drill.

For this service we have developed a hot rolled process drill known as the Canadian-Detroit Double-D (DD) Rolled Drill. It combines the strength of the forged type drill with the accuracy and uniformity of the milled type.

The flute of the DD is formed straight from the bar stock by successive passes through specially built and patented rolls at a temperature of 1850° F. This mechanical rolling of the flutes produces a refinement and uniformity in the grain of the steel and gives additional density at the centre and at the outer edge. Each drill is rolled separately, and the rolls are so designed and operated as to produce the same uniform increase in web thickness as is obtained in high-grade drill of the milled type.

The fluted drill is reheated and twisted in a specially designed automatic machine. The twisting process is held absolutely uniform, giving the same increase in helix angle from shank to point, 27° to 32°: this standard has been adopted on our milled drills and has been proven by exhaustive experiments to be the most efficient.

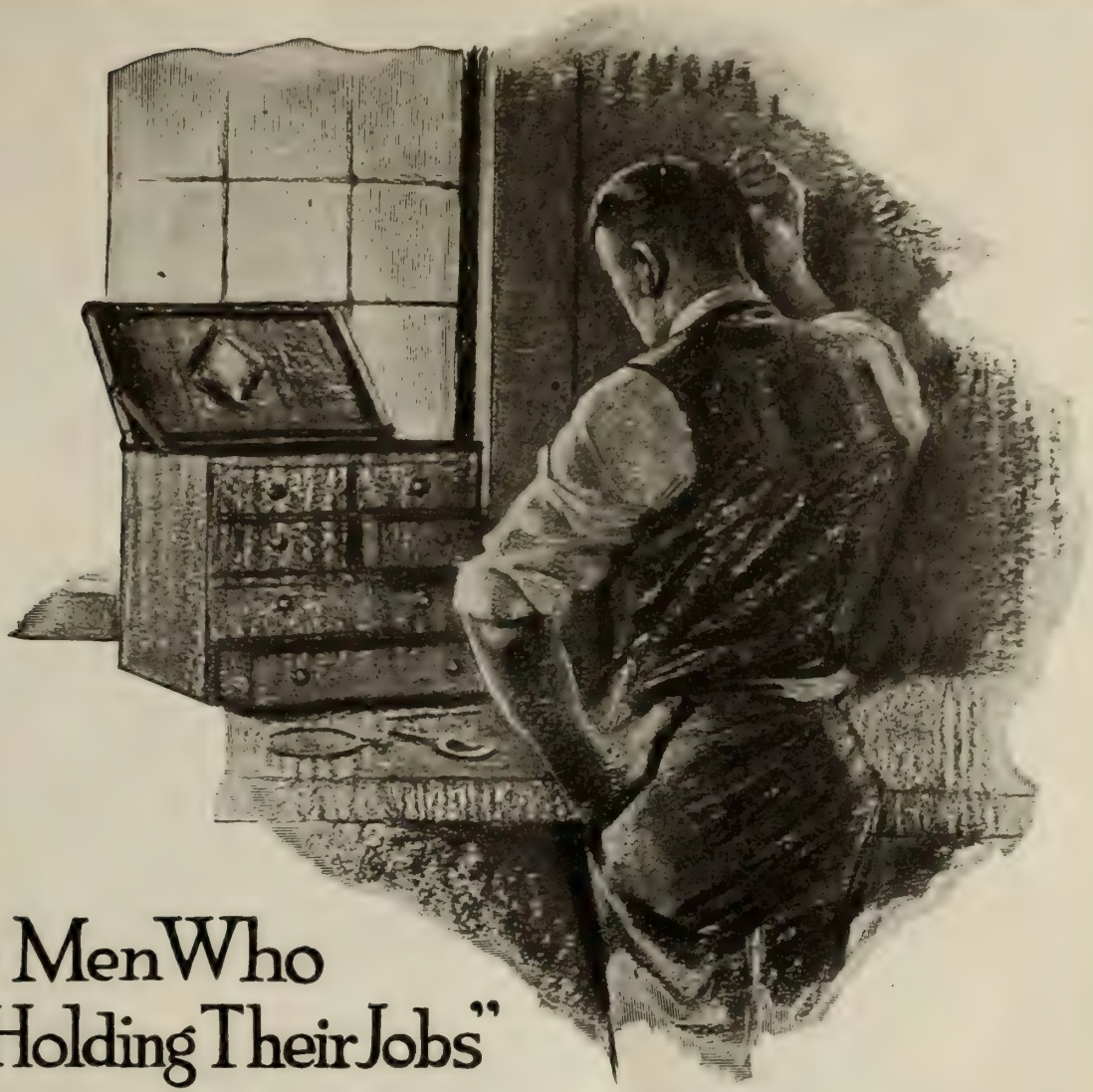
The DD has increased production and cut drilling costs in many of the finest plants in Canada. A fair test will convince you.

Manufactured and carried in stock at Walkerville in all sizes from ½ inch to 1½ inches.

We also manufacture and carry in stock all sizes and types of high speed and carbon milled drills.

CANADIAN-DETROIT TWIST DRILL COMPANY, LIMITED

Walkerville, Ontario



"The Men Who Are Holding Their Jobs"

are the men who are ready for any kind of work—whose tool kits are complete—the sort of men who have a preference for Starrett Tools.

How about *your* tool kit? Have you a complete outfit of Starrett Tools? Or are you one of the tool borrowers?

Starrett Tools help you hold your job.

Write for Catalog No. 22 "3" and visit your Starrett Tool dealer today.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

ATHOL, MASS.

42-2201



Use Starrett Tools

ALLIGATOR

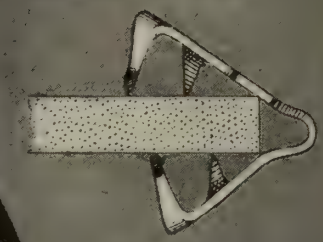
TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING

Best for Every Type of Belting

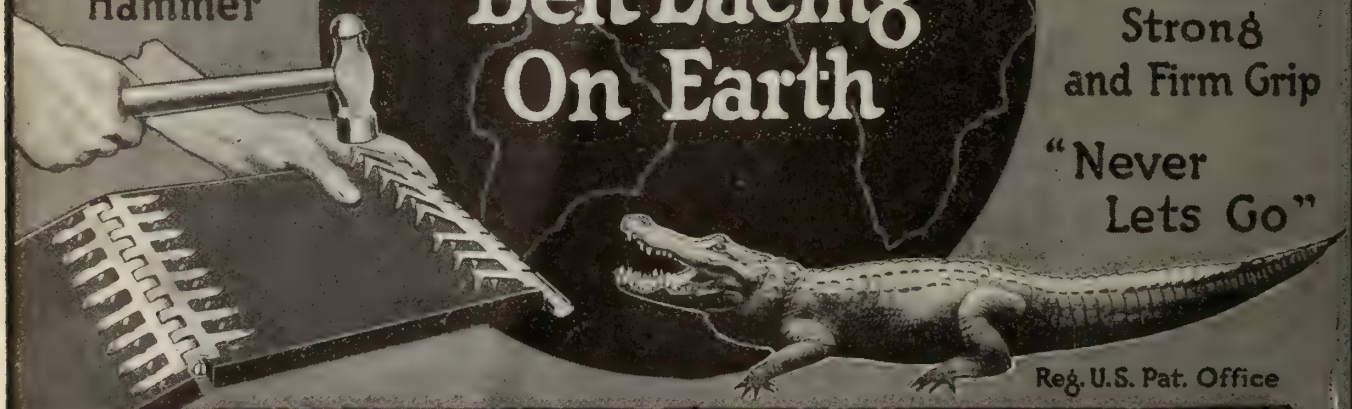
Nothing Needed But a Hammer

The Strongest Belt Lacing On Earth



Double Staggered Teeth Insures Strong and Firm Grip

"Never Lets Go"



Reg. U.S. Pat. Office

Jobbers—Dealers

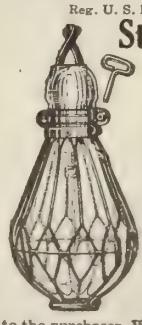
Sell Satisfaction and Economy When They Sell ALLIGATOR Steel Belt Lacing

Go over these features that make "ALLIGATOR" the best belt lacing proposition for you and for your trade.

FLEXCO-LOK

Reg. U. S. Pat. Office

Steel Lamp Guards



Protects lamps from breakage and theft—property from fire. An efficient, inexpensive security against danger, losses and delays.

Made in all styles and sizes with reflectors and handles if desired. Patent lock prevents theft. Sold at a distinct economy to the purchaser. Write on letterhead for information, prices, etc. Not in stock in London.

First: National and local advertising in carefully selected general publications, trade papers and consumer class publications interests all belt users and creates a demand that has been growing for twelve years.

Second: ALLIGATOR is preferred by Master Mechanics in every industry all over the world for its ease and facility of application, long life in operation, belt saving characteristics and economical features. The decision of hundreds of thousands of belting users should influence you to stock it.

Here are other reasons:

ALLIGATOR is the most easily and quickly applied of all belt lacings. **Only a hammer needed and three minutes average time** to lace a belt. Anyone can put it on.

Besides this important feature, this belt lacing has proven the strongest and consequently the **most efficient** in every test.

It outlasts any other type of belt lacing—and **saves the belting.** See illustration and note how the staggered teeth penetrate without injuring the belt and clinch down flat. Also note the sectional steel rocker hinge pin which makes a flexible hinge joint that hugs the pulley, is no thicker than the belt, and permits belt to be run on both surfaces.

In addition the use of ALLIGATOR Steel Belt Lacing is the most economical manner of taking up stretch on new belts and of relacing and repairing old ones. Only one end of belt need be cut off in shortening; or to lengthen, insert stub of correct length.

Can be kept handy in stockroom or tool box for immediate service thus avoiding any possible delays. Represents big saving and convenience to your customers on any kind of belting. A complete service for all thicknesses of power or conveyor belting. A size and type for every need. Write on letter head for samples and trade prices.

FLEXIBLE STEEL LACING CO.

Stocked by the best Supply Houses in Canada. **4610 Lexington St., Chicago, U.S.A. 135 Finsbury Pavement, E. C. London.**



Milled

PLAIN and CASTELLATED

Nuts

STANDARD

V. & U.S.S. Semi-Finished Nuts
V., U.S.S. & S.A.E. Cap Screws
V. & U.S.S. Set Screws
S. A. E. Plain & Castellated Nuts

SPECIAL

Screw Machine product up to 2¼" diam.—to specifications.
Hardened and ground screw product—to specifications.

THE NATIONAL ACME COMPANY

MONTREAL, P.Q.

De Courcelles G. T. R. R.

VENUS PENCILS

The largest selling quality pencil in the world.

Engineers everywhere use the perfect VENUS knowing that none other gives the same supreme service and satisfaction.

With VENUS the fine, clean lines of working drawings are put in with ease and accuracy; the shadows and high lights of sketches take form with amazing results.

The exactness and uniformity of VENUS grading is your safeguard; it insures pencil efficiency and pencil comfort.

17 Black Degrees—3 Copying

For bold heavy lines - 6B-5B 4B-3B
For writing and sketching, 2B-B-HB-F-H
For clean fine lines - 2H-3H-4H-5H-6H
For delicate thin lines - 7H 8H-9H

Plain ends, per doz., $1.50
Rubber ends, per doz., $1.75

At stationers and stores throughout the world.

American Lead Pencil Co.

238 Fifth Ave.
New York
Factory: Hoboken, U.S.A
Factory: London, Eng.



The world's most famous pencil

COLUMBIA

THE BRUSH IT NEEDS!

WHICH is the most suitable brush for any machine depends on correct analysis of all the relevant facts. That is why the Columbia Data Sheet Service improves motor and generator efficiencies. The essential facts are ascertained by Columbia Brush Specialists. These facts are carefully analyzed by the Columbia Board of Engineers. The Columbia Pyramid Brushes specified as correct for each unit are guaranteed to give satisfactory service.

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COLUMBIA Data Sheet Service Solves Your Brush Problems. Write the address below.

CANADIAN NATIONAL CARBON CO., LIMITED
TORONTO and WINNIPEG.

4920

Indicating **Tycos** Temperature Instruments Controlling
Recording

Great industries standardize on Tycos Temperature Instruments because built upon two basic factors--the dictates of science--the requirements of industry.

All problems met—Tell us yours

Repairs, now efficiently, quickly and economically handled in Canada.

Taylor Instrument Companies

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There's a *Tycos* or *Taylor* Temperature Instrument for Every Purpose

751½

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.
The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder
For Wet or Dry Drill Grinding 1/8" to 2¼". Also ⅛" to 3½" dia.

LA SALLE TOOL CO.
La Salle, Illinois, U.S.A.

Represented in Canada by
A. R. Williams Machinery Co., Ltd.
64-66 Front Street W., Toronto
Halifax St. John, N.B. Montreal Winnipeg Vancouver



The B & D Switch Handle Cases illustrated are Franklin Die Cast in Aluminum.

Greater Comfort for Motorists

STEP into a car to-day — press a button—off you go! No cranking, no fuss. The development of automobile accessories has been largely responsible for making the ownership of a motor car more and more trouble-free.

In their search for speedy and economical production methods, automobile accessory manufacturers soon avail themselves extensively of the die-casting process. Franklin Die-Cast parts are used in magnetos, truck governors, engine-driven tire pumps, lighting systems, electric drills and valve grinders, measuring pumps for gasoline and other accessories.

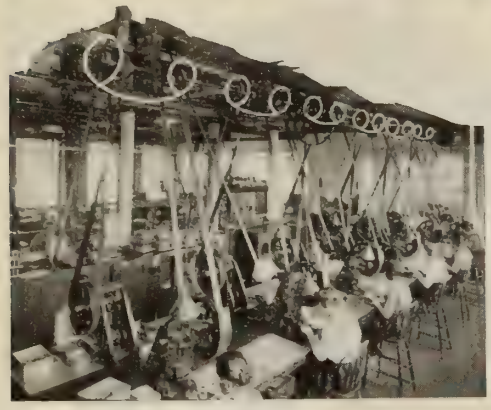
In 1892 we originated the Die-Casting Process. For nearly thirty years we have been reducing the cost and simplifying the output in many fields of industry. The addition of a special process for the production of finished brass castings now enables us to offer parts in brass, bronze, aluminum, tin, lead or zinc base alloys as conditions require, thus meeting a still wider range of work.

We quote from samples or blueprints. Write for booklet, "Franklin Die-Castings in Many Fields."

FRANKLIN DIE-CASTING CORPORATION
Gifford and Magnolia Streets Syracuse, N. Y.

FRANKLIN DIE-CASTINGS

THE JOHNSON FRICTION CLUTCH



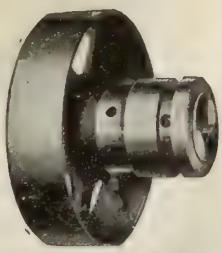
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

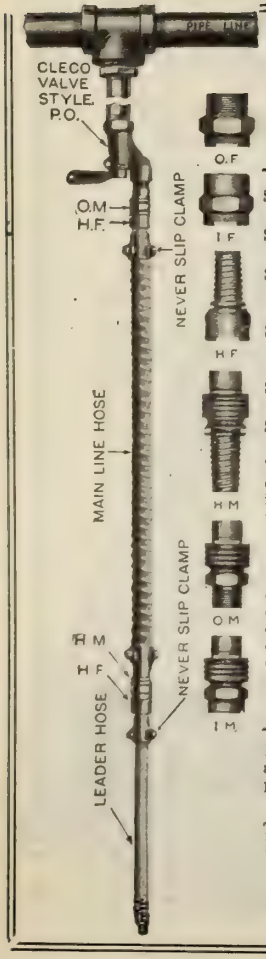
You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps and Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼ inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ⅜-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO AIR VALVES.



Style R.A. **Style P.O.** **Style A.**

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style R.A.—Right Angle Valve, made in sizes ¼ in., ⅜ in., ½ in., and ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lightening Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.

In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.



Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 46, 48 and 51. mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. **337 Craig St. W., MONTREAL, QUE.**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

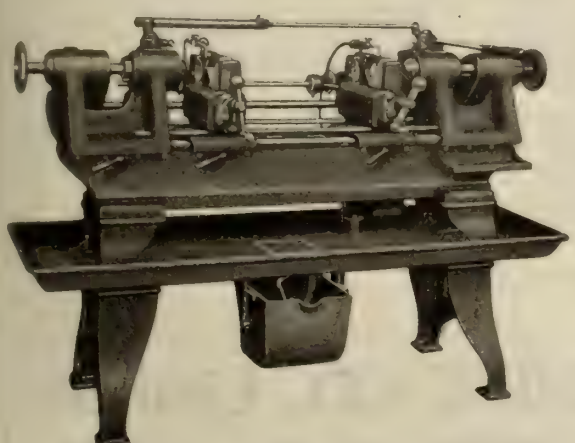
CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

HENDEY

Centering Machines

Single and Double Spindle



Double Spindle Machine

The distribution of metal on Hendey Centering Machines insures maximum strength with the least possible weight.
The head is rigidly clamped to the bed, giving permanent alignment of the spindle.
The jaws of vise and supporting block are made of steel, hardened and ground.
Parallel movement of vise and block is maintained by means of the connecting rod and bevel geared drive at back of machine controlled by handle in front of vise. No matter what the diameter of bar it will always be supported in a horizontal position.
All the other features which are required to make an efficient centering machine are to be found on the Hendey. Remember this fact when you need one.

The Hendey Machine Co.

Torrington, Conn., U.S.A.

Canadian Agents:

A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Vancouver.
A. R. Williams Machinery Co., 260 Princess St., Winnipeg.
A. R. Williams Machinery Co., St. John, N.B.
Williams & Wilson, Montreal.

LATHES, SHAPERS, MILLERS AND CENTERING MACHINES

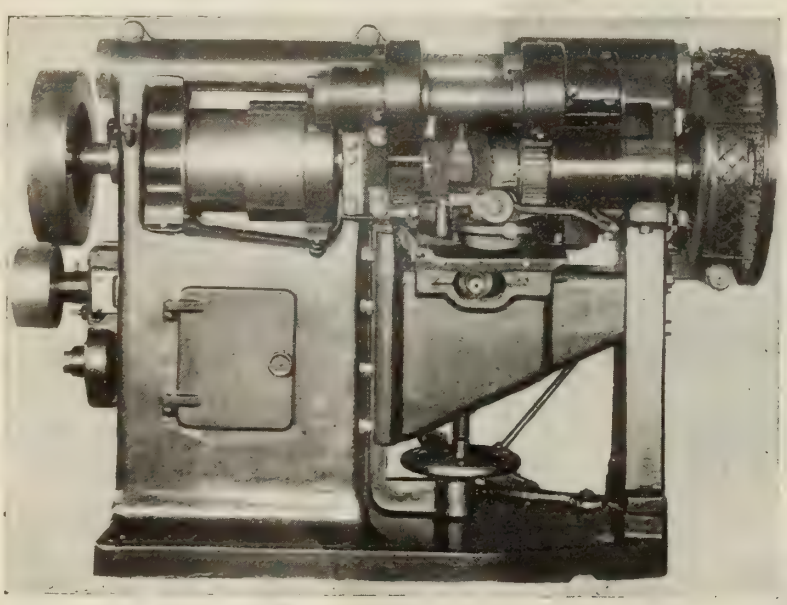
A Large Part of the Facilities in the FORD-SMITH Plant

is devoted to the production of

SPECIAL MACHINERY

DIES, GEAR-CUTTING, JOBBING WORK, ETC.

With an expert engineering staff and one of the most modern tool plants on the continent, we are ideally situated to supply *Special Machinery* to the most intricate specifications. Many of Canada's largest firms have been satisfactorily served by us. We will take your process, your design, or your blue-prints and build the machine to your requirements.



The machine illustrated above—a special Miller for milling transmission covers—will give some idea of our capabilities. This machine is now giving continuous service in a large Canadian Motor Firm. We have built Special Machines for Canners, Pulp Mills, Rubber Tire Factories, Sheet Metal Plants, Electrical Equipment Manufacturers, Porcelain Plants, Plaster Board Plants and many other industries.

If it is a matter of Special Machinery or Dies why not talk it over with our engineers? Their experience is at your service!

Dies as large as 8 TONS

The making of Dies is another important function of our organization.

Blanking, punching and Forming Dies — Dies from the smallest possible sizes to mammoth fixtures weighing as much as 8 tons.

All the automobile manufacturers in Canada avail themselves of our services.

THE FORD-SMITH MACHINE CO., Limited

Hamilton, Ontario, Canada

Foreign Agent: **W. E. Storey, London, Eng.**

BROWN-BOGGS

B B

Not Sometime—
Right Now!

"B-B" Tools Mean Bigger Opportunities

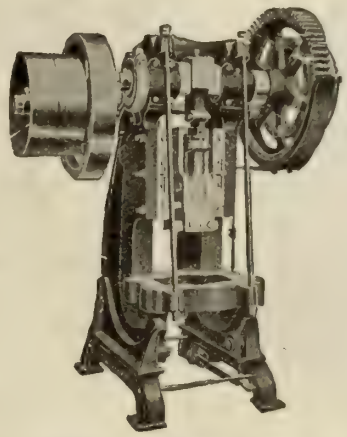
Is it really consistent practice in times of retrenchment to cut down your men's wages and still retain machines and methods of practice that are out-of-date, slow and costly? If economy demands adjustments a good place to start is an investment in a machine that will cut down operating expenses.

That's why we urge you at this time to investigate "B-B" Metal Working Tools.

What they will save you NOW can be approximately figured by the profits they have built up in brisker days.

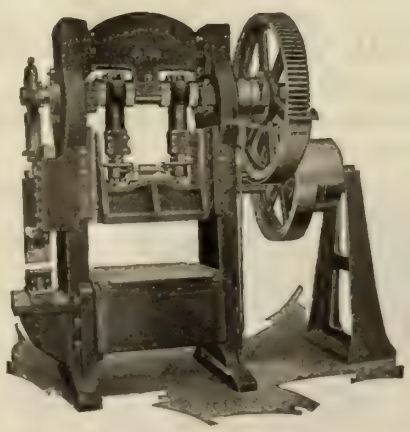
Rigidly tested and guaranteed—presses, dies, shears, punches, drop hammers and tinsmiths' tools of every description.

What our catalogue does not explain we will be glad to.



No. 215—Power Press

Easy-Running
Long Lasting
Sturdily Built
Greater Production

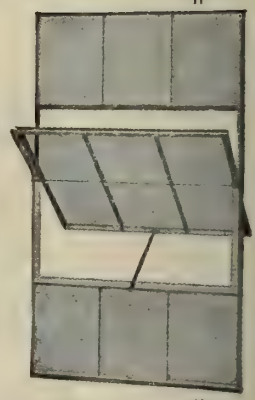


No. 140—Double Crank Trimming Press

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.

All You Can Say of Any Other Sash---And More

BOCA
SOLID STEEL SASH



"Boca" has all the good points of steel sash, and it has distinctive points in itself that make it a superior sash. It is the only steel sash made with three-point weathering ventilator.

Plans for the construction of Schools, factories and fireproof buildings of all kinds, should include "Boca" Solid Steel Sash, if economy and the best in building materials is to be used.

We Also Make

Steel Lockers, Steel Cabinets, Steel Lavatory Compartments, Steel Shelving, etc.
Ornamental Iron and Bronze
Commercial Wirework of all kinds
General Building Ironwork

Write for folders

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
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CANADA

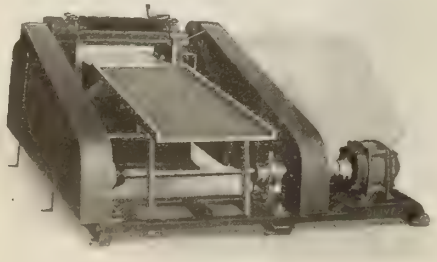
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The "Oliver" Pattern Shop Equipment

is a QUALITY line and the only complete line of wood-working machinery built for the pattern shop.



This is an **"Oliver" Surface Planer.** Note the direct connected motor and counter shaft on sliding base. These surfacers are also built with motor mounted directly on end of the shaft of the cutting cylinder.

The workmanship and design of this surfacer will meet the approval of the most critical.

Oliver Machinery Co.

General Offices and Works
Grand Rapids, Mich., U.S.A.

Underwood Portable Crank-Pin Turning Machine

Designed to give a smooth accurate finish to the work



For truing up crank pins on side crank engines, whether the crank is disc or bell shaped, you can find no better machine than this.

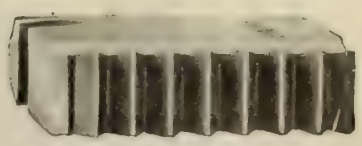
It can be properly set up to give the original alignment to the pin. And the work is always in full view of the operator.

Our catalog fully describes the entire Underwood line. Send for a copy.

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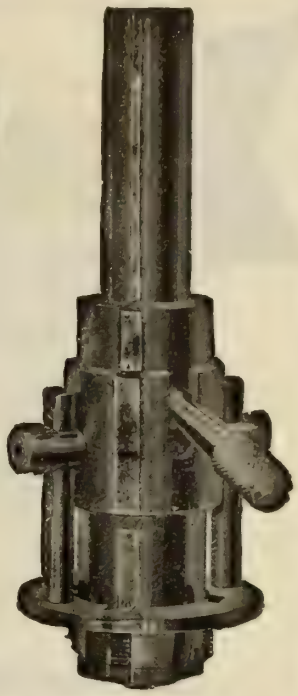
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Murchey Collapsing Taps and Self-opening Dies are the tools used by shops that want the **most** work for the **least** money. Murchey Collapsing Taps have the collapsing feature which means speedy adjustment and quick-acting operation. But under heavy work they are as rigid as the rock of Gibraltar.

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Murchey Machine & Tool Company

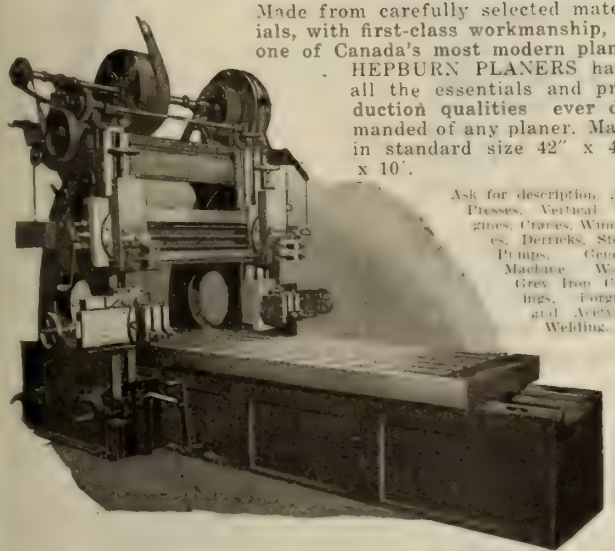
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Ask for description. Also Presses, Vertical Engines, Cranes, Winches, Derricks, Steam Pumps, General Machine Work, Grey Iron Castings, Forgings and Acetylene Welding.



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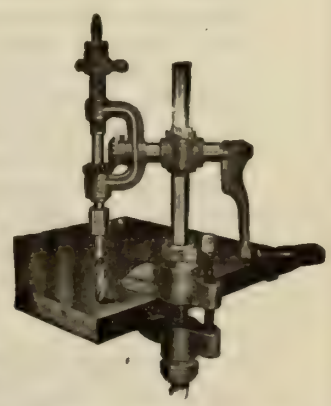
Engineers and Iron Founders

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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



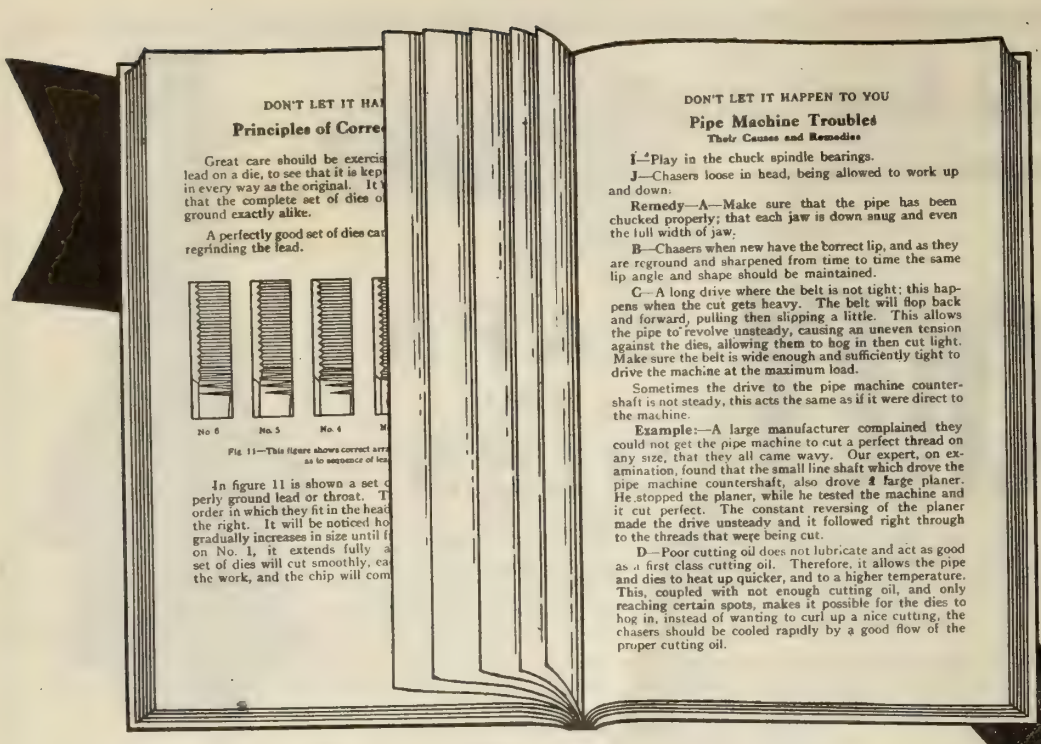


On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

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The latest pipe machine hand book. 60 pages of valuable information. Close to 75 drawings and photographs. Send in the coupon today.

Questions and Answers to Pipe Machine Troubles

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You'll find the answer to your pipe machine problem in the new Williams hand-book "Don't Let It Happen To You!" Whether it is how to grind dies, what kind of oil to use, or how to eliminate wavy, chattering threads, you'll find the practical answer in the new Williams 60 page hand-book entitled "Don't Let It Happen To You!"

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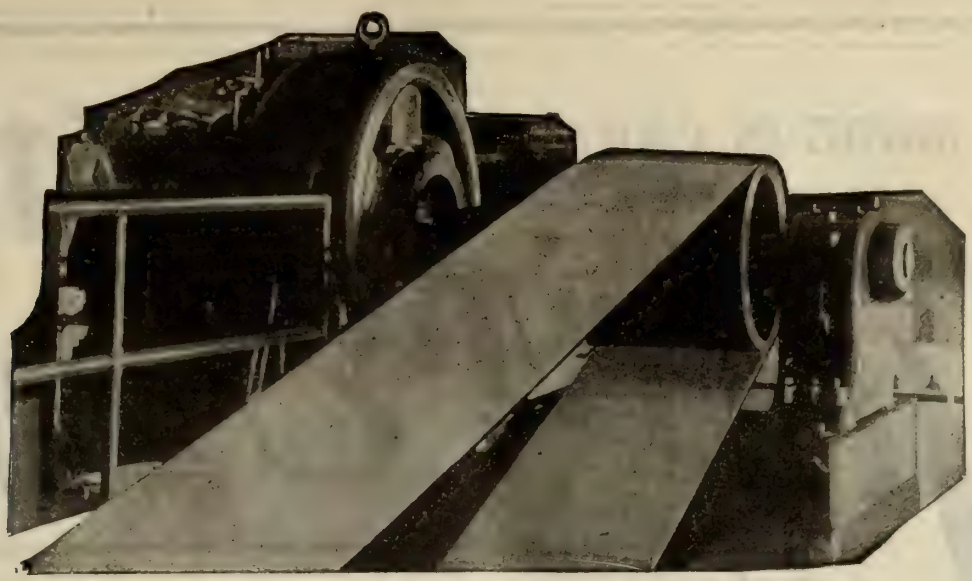
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Are your drives insured against belt unreliability? Power economy in machine shops and power plants is gained only by transmission efficiency. The highest efficiency is reached with

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—properly installed—because it represents the skill and experience of the largest manufacturers in Canada.
One of our belting men, from our nearest Service Branch, will gladly inspect conditions in your plant and submit recommendations for your approval.

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Overhead Costs Drop When These Dependable Screws are Put to Use—



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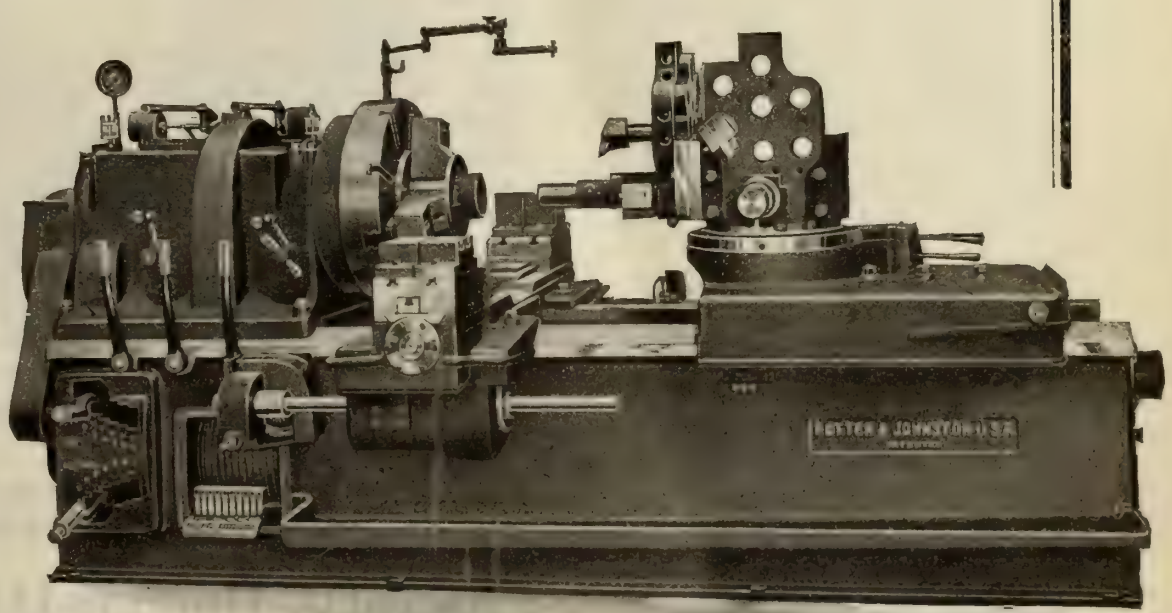
On Large Work

it is the rule—not the exception—to get more pieces per hour with a

P & J
8B—AUTOMATIC

The Lathe with a Pedigree

Swing Over Bed	35″
Swing Over Cross Slide	24″
Travel of Cross Slide (Front and Rear Separate)	10″
Number of Turret Faces	4
Diameter of Holes in Turret	3″
Depth of Holes in Turret	4½″
Distances from Centre of Turret Hole to Top of Turret Slide	5″
Maximum Turret Slide Travel	28″
Turret Feed	28″
Length of Turret Slide Travel which permits of Supporting or Piloting Turret Boring Tools	13½″
Turret Slide Adjustment	13″
Front Spindle Bearing	7¾″ dia. by 7″ long
Rear Spindle Bearing	7 5/16″ dia. by 5″ long
Diameter of Hole through Spindle	6″
Size of Geared Scroll Chuck furnished with Machine	24″

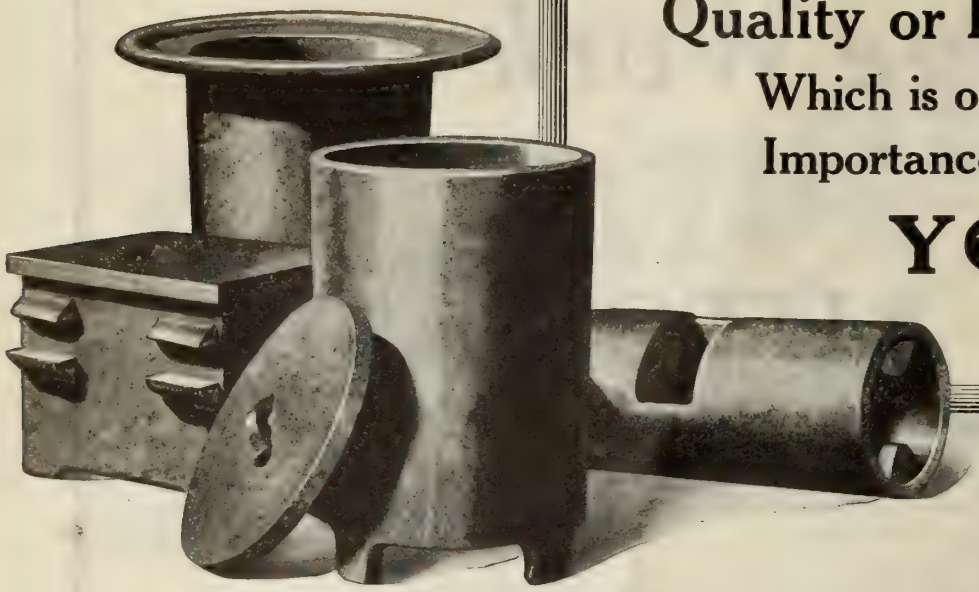


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Quality or Economy— Which is of Greatest Importance to YOU?

PRETTY hard to say; isn't it? In the final analysis quality and economy are mighty close to twin brothers, and both must be measured in terms of service.

How well the case-hardened part performs its function, on an average, depends on how the various elements in the carbonizing process "average up." Keeping down spoilage and maintaining a fairly accurate uniformity of case, heat after heat, calls for containers that not only give long service but behave in a uniform way throughout their entire usefulness.

From every angle that affects either quality or economy, Cast Nichrome Containers average up to the highest satisfaction point. The proof exists in hundreds of modern plants.

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Cast Nichrome Containers are Manufactured under HENDERSON Patents by

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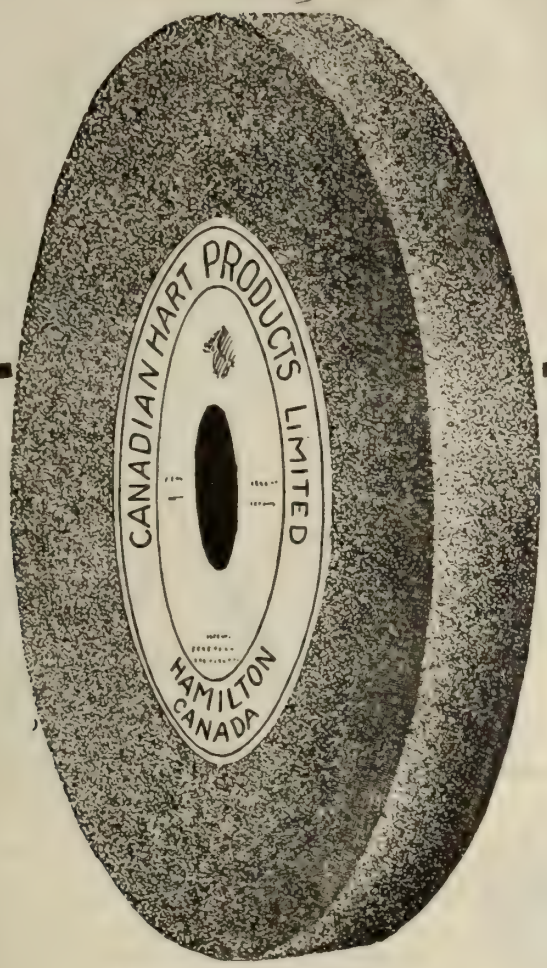
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CAST **Heat Treating Containers**

Endure in High Temperatures

Canadian Hart Wheels



Vitrified—Silicate Shellac

Three classes of abrasive wheels that embody all the essentials for a wide variety of operations. While Vitrified Wheels will meet most requirements, the others are characteristically suited for certain classes of work.

THE big reason for grinding wheel dissatisfaction lies in the improper choice of the abrasive with relation to the work in hand.

Just as there are different jobs so are there different abrasives.

For over 34 years we have been improving on our processes. You can, therefore, leave the choosing to us and get satisfaction.

Vitrified—Silicate and Shellac are the wheels that give long service.

Made in Canada

Vitrified Wheels—may be used wet or dry; give better all-round satisfaction and have a longer life.

Silicate Wheels—can be made in twenty-four hours and are sometimes substituted for Vitrified Wheels where speed is essential.

Shellac or Elastic Wheels—indispensable for slotting work where a thin wheel is required or where special finish is desired.

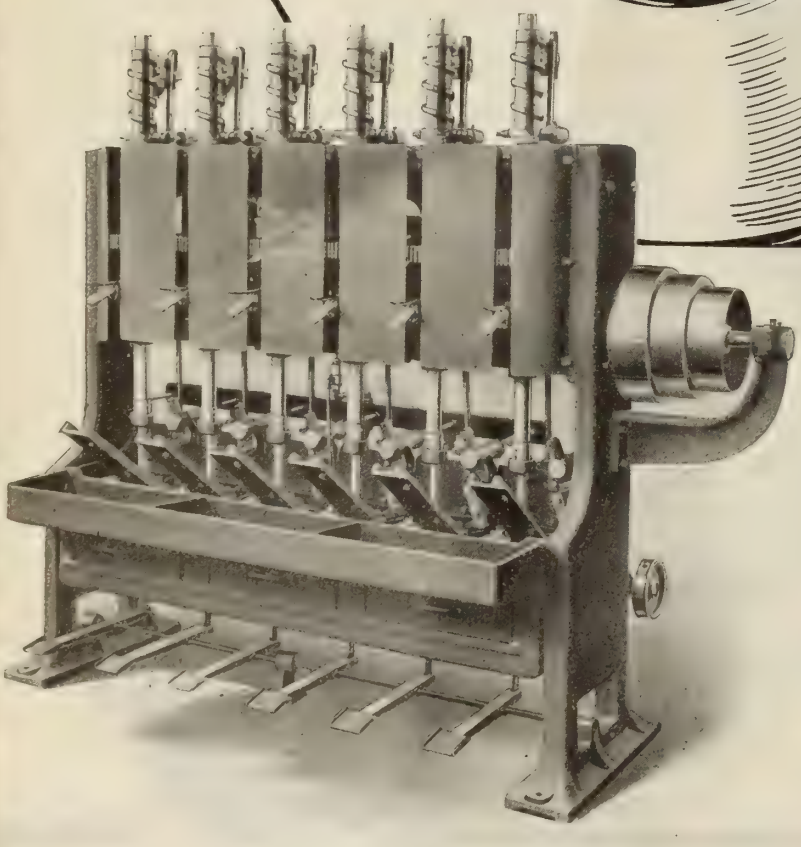
These wheels are fully described in our new catalogue. A copy should be in your files. Well?



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Bigger Output in Tapping!

SPEED—the all-essential of bigger outputs—is the chief feature of Acme Nut Tappers. With these easily operated tools it is possible to obtain speed which is limited only by the endurance of the taps.

But speed alone is useless. It must be coupled with accuracy and the ability to stand gruelling service for long periods of time. This too is found in Acme Tappers.

The Acme Six Spindle Semi-Automatic Nut Tapper shown here has many important features which facilitate rapid production. Each spindle is equipped with automatic lifting device which permits automatic feed to place nut under tap. Every action has been carefully developed and proved correct in practice.

Our catalogue gives complete details of Acme Bolt, Nut, Rivet, Upsetting and Forging Machinery. Write for a copy.

ACME

The Acme Machinery Company
4530 St. Clair Ave., CLEVELAND

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The John Bertram & Sons Co., Limited, Dundas



Landis Chasers Don't Roll the Stock---They CUT

The "close-up" shown in the circle explains how the chasers of a Landis Die are set against the work at a tangent. Incidentally it shows why Landis Pipe and Nipple Threading Machines are considered standard equipment by leading manufacturers of nipples. The Western Plumbing and Supply Co., of Chicago, where these photographs were taken, have five Landis Machines in the shop. The two-inch nipples shown are threaded for over two inches on each end. Threads are of good quality—production 200 pieces per hour.

This user says:—
"From results received we have decided to use the Landis on our work exclusively."

The chasers do not gouge, rip or push out the metal--they **cut** with a shearing stroke, which produces threads with the least exertion and least wear on chasers. Over 10,000 threads without regrinding is the usual thing in work like that above. Chasers cost you less than any others for all annealing, hobbing and retempering are unnecessary.

Let us tell you more about the economy and reliability of Landis equipment. Write to-day.

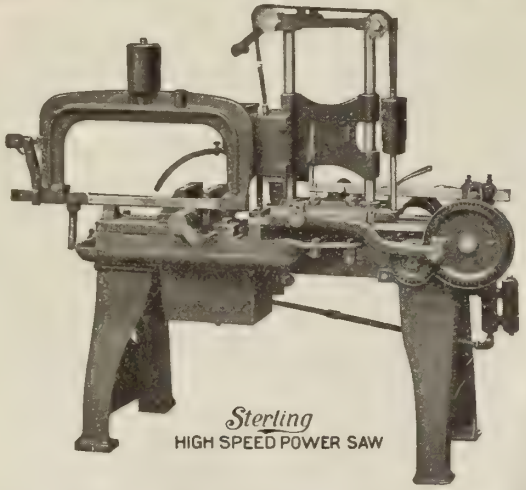
Landis Machine Company

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"STERLING"

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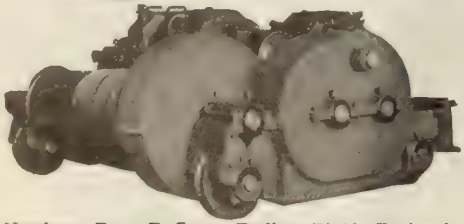
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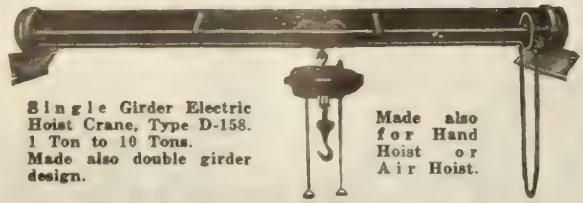


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Made also for Hand Hoist or Air Hoist.

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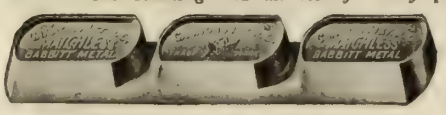


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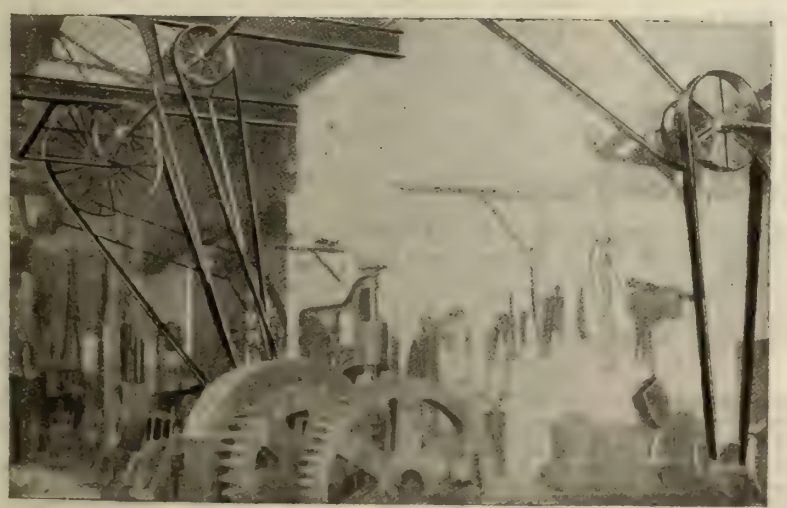
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Why should I buy GTD Taps and Dies?

AS you turn the pages of the magazines and note the many advertising announcements—you must often have asked this question:

"Are all taps and dies alike?"

If they are, then your decision is influenced mainly by the attitude of the people who make them—their friendliness, their understanding of your needs, and their aggressiveness in urging you to buy their product instead of some other.

If taps and dies are *not* alike, how do they differ?

Take the matter of metal buying—or heat treatment, or uniformity in production. Some products excel over others in each case. Or consider accuracy, rapidly becoming a first consideration in buying taps and dies. Or such elements as adaptibility or application!

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The *"Little Giant"* Die
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The *"Maxi-Staybolt"* Tap, etc.,

In all of these tools there are *differences* which distinguish them from taps and dies so often thought of as "all alike."

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It states specific cases of the profits earned and gives data which will enable you to figure just how much you can make in your own locality.

It tells who are best adapted to do this work and why. It also explains where to get work and advises how to make inquiries as to your chances. Gives letters and examples of what other regrinding concerns have done.

Perhaps you would like to know what equipment is required and where to get it. Are you fully acquainted with the component parts necessary for such a shop? All this is covered completely so you will know just how much you should have to handle regrinding properly.

Are you fully convinced of the advantages and know the reasons why a motor should be reground? Can you tell why regrinding will stop the engine from skipping and knocking, reduces the formation of carbon, increases compression, and gives many more miles on fewer gallons of gas and oil? All this is fully explained as well as the advantages of regrinding over reboring, reaming or lapping, why reground cylinders are better than new ones, also when to regrind. It has been carefully compiled and checked. It is not a catalog, volume of specifications, or a selling piece, but a real book covering the field and profits, equipment required, and the reasons why. The edition is limited. Where shall we send yours?

THE HEALD MACHINE COMPANY

51 New Bond Street, Worcester, Mass.

BRANCH OFFICES:—**New York**, 839 Singer Bldg. **Philadelphia**, 1302 Stephen Girard Bldg. **Chicago**, 26 South Jefferson Street. **Detroit**, 400 Marquette Bldg. **Cincinnati**, 311 Provident Bank Bldg. **Cleveland**, 721 Engineers Bldg. **Buffalo**, 331 Jewett Ave.

CANADIAN AGENTS:—**H. W. Petrie, Ltd.**, Toronto, Ont. **Geo. F. Foss Machinery & Supply Co., Ltd.**, 305 St. James St., Montreal.

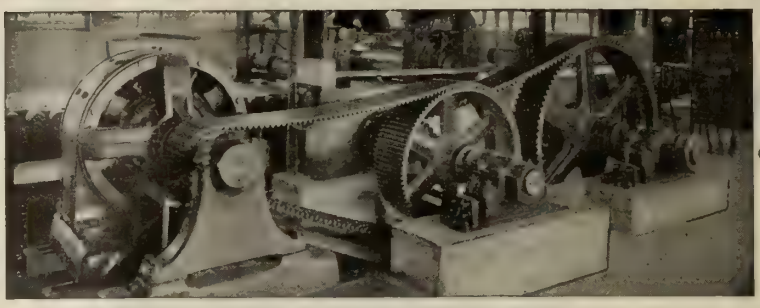
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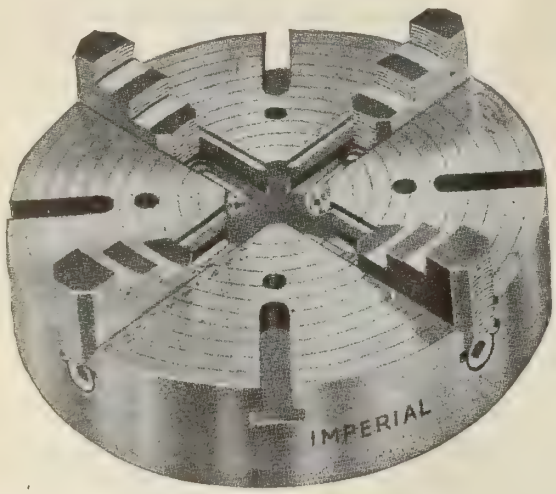
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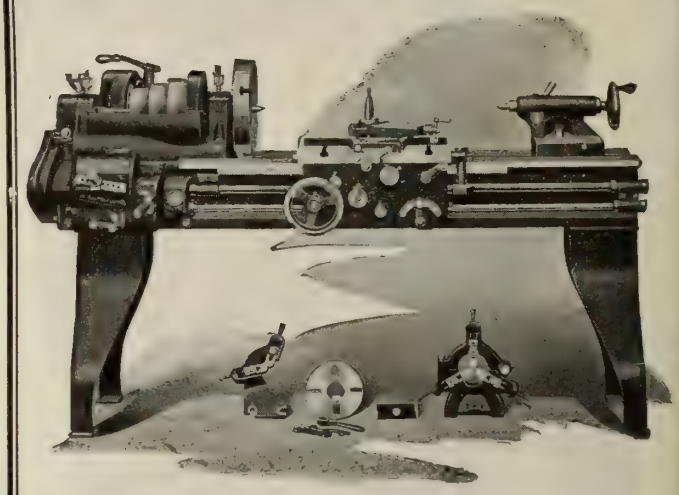
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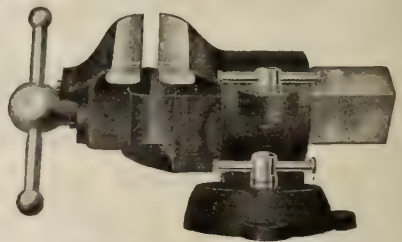
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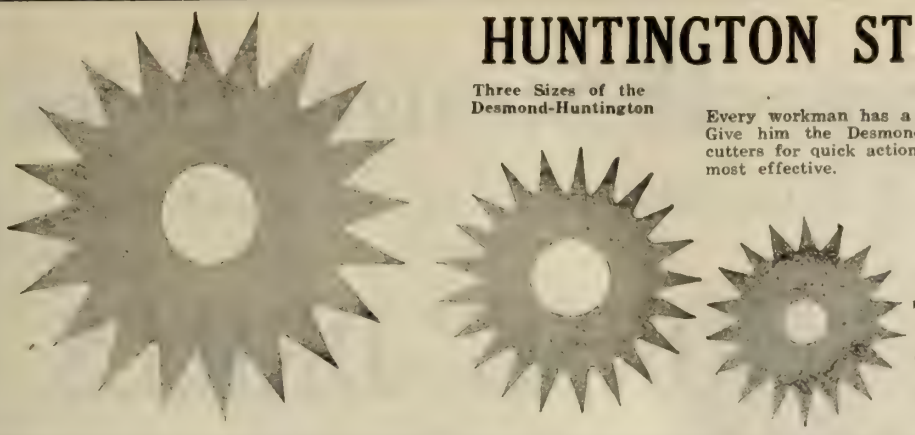


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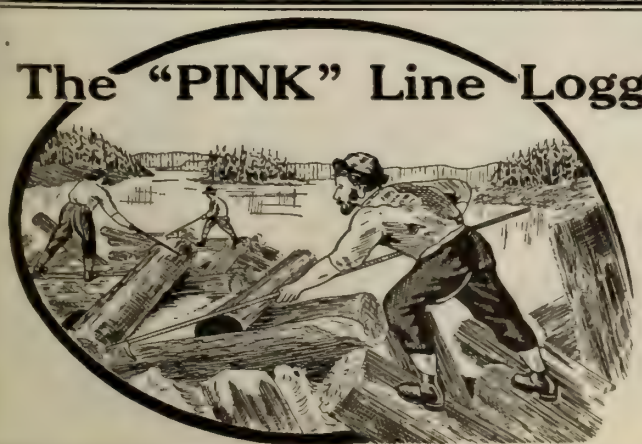
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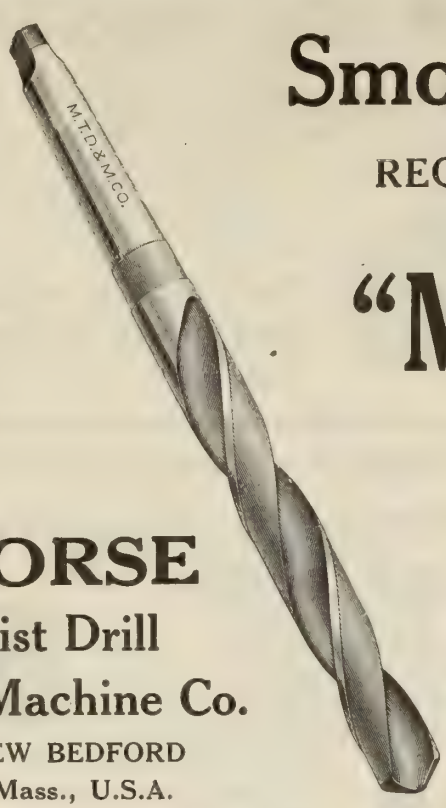
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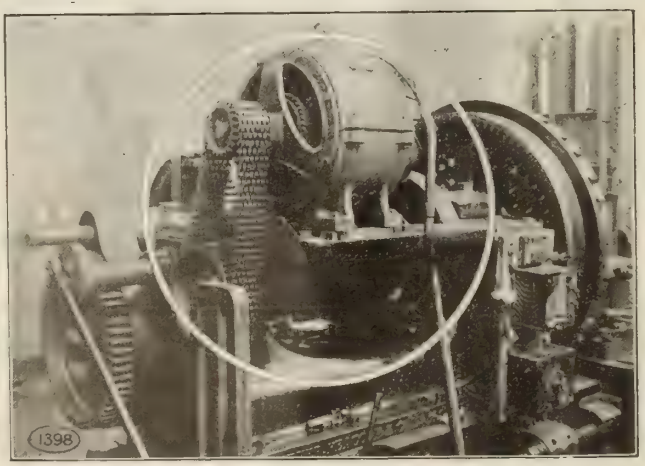
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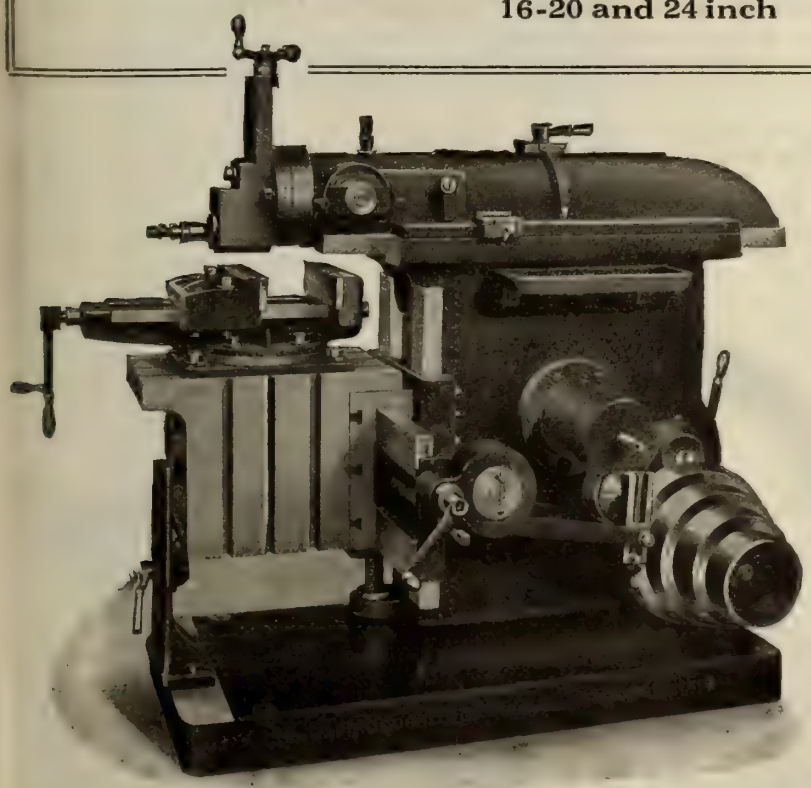
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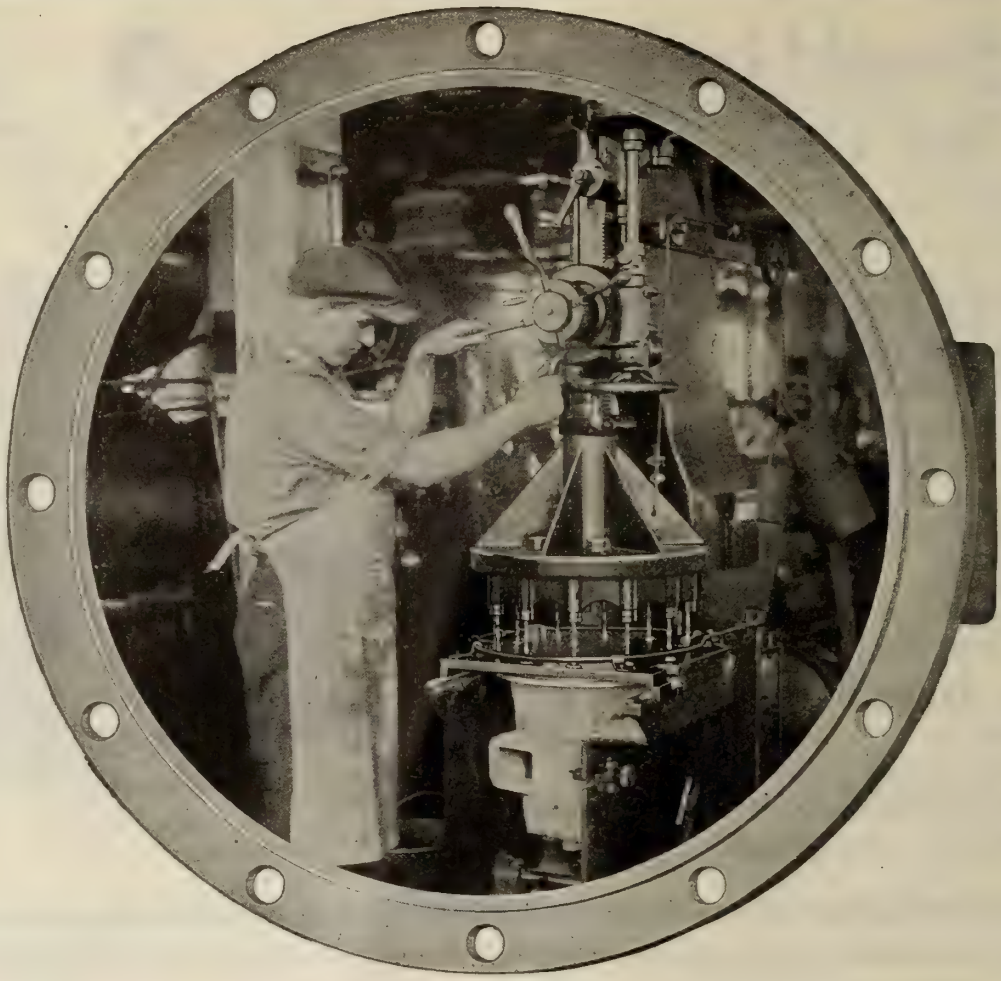
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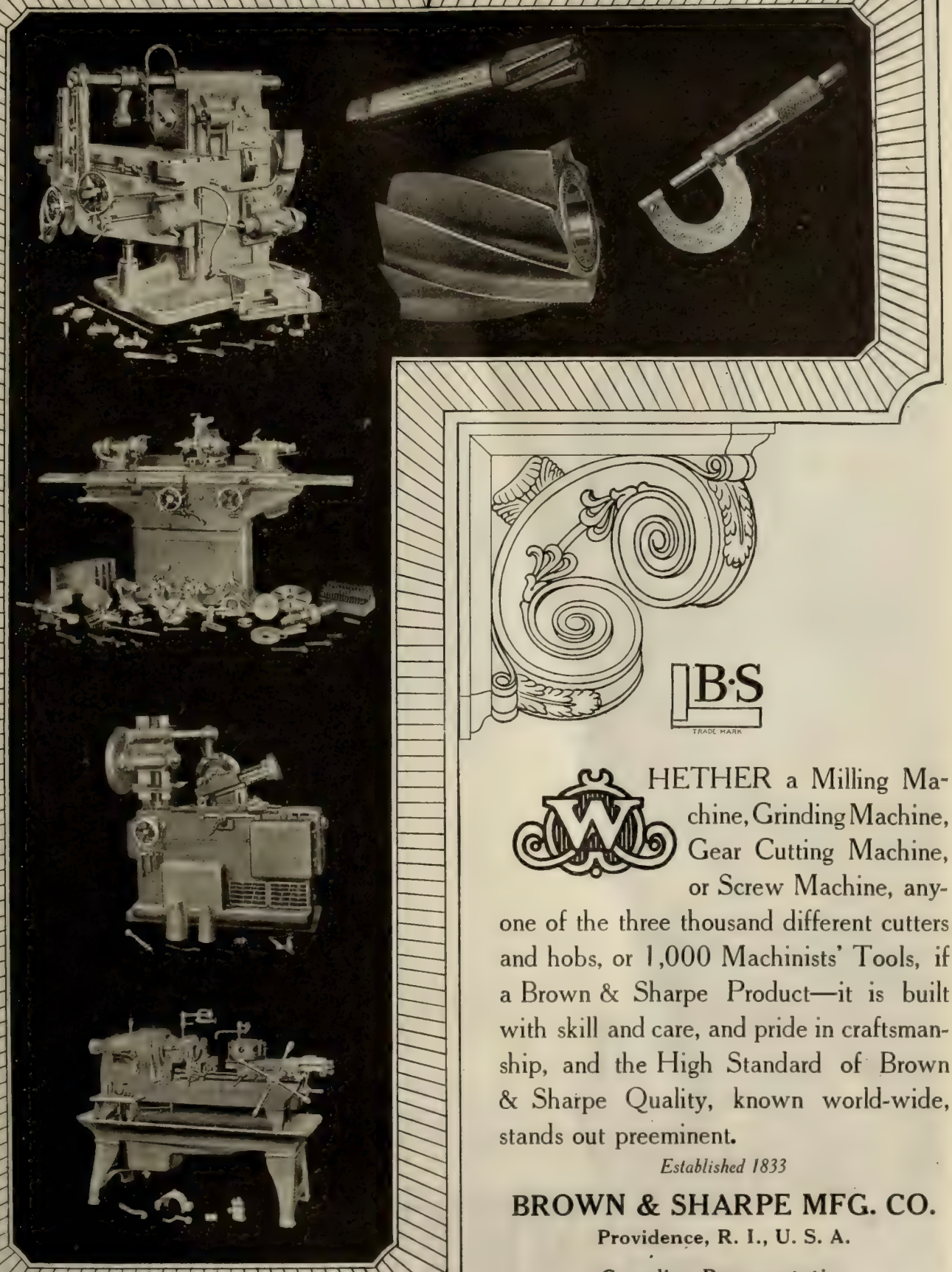
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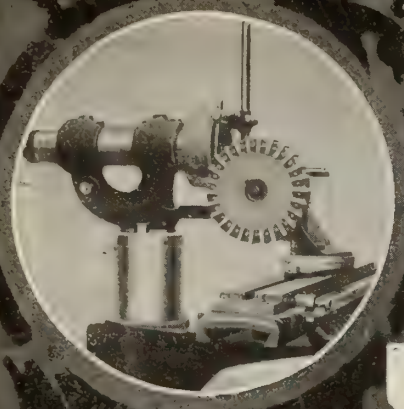
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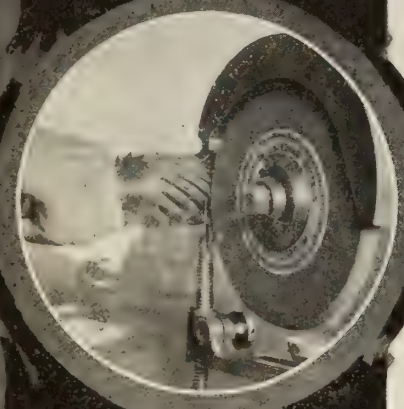
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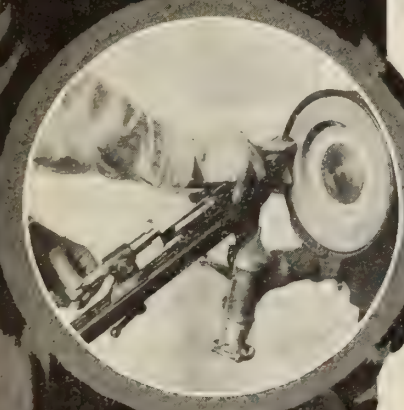
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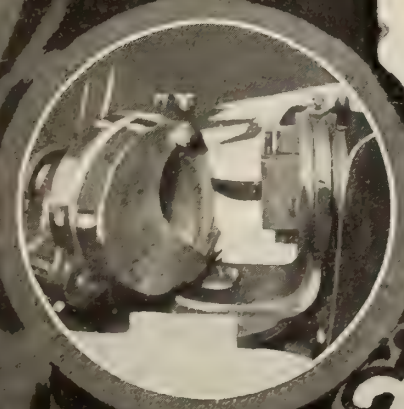
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ALUNDUM

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI, No. 14 October 6, 1921

Cutting a 3 in. Keyway in a 16ft½. Propellor

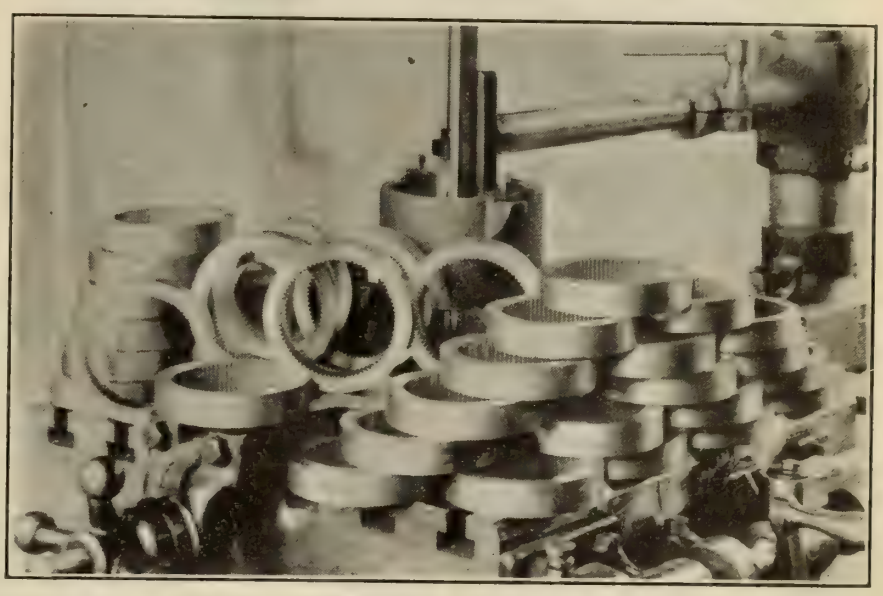
The Modern Keyseater Has Many Refinements—Quick Holding Fixtures are Big Asset—Rotary Tables Help to Speed up Work—Various Examples of Parts Completed on Keyseater

By J. H. MOORE

PERHAPS one of the most misunstood machines existent at the present time is the keyseater. Like the hack saw, the keyseating machine has shown wonderful development within the past twenty years. Who would think of comparing an up-to-date rapid cutting metal saw, with the old fashioned frame that slowly and methodically almost rubbed its way through a steel bar?

Of course such a comparison would be ridiculous, and to speak of the modern keyseater as a tool to be used on rare occasions only, is likewise out of all reason. From a small, light constructed, and sometimes inaccurate machine, the keyseater has now reached the point where it can be classed as a production tool. In many plants, batteries of such machines are busy all day long on various work that twenty years ago would have been considered too good to trust to a mere keyseating machine. In other words they have proved their usefulness and adaptability to modern production methods. Through the courtesy of certain manufacturers of such tools we are able to reproduce several jobs which have been successfully completed in manufacturing plants on keyseating machines.

*Photographs through courtesy of Baker Bros., Toledo, Ohio, and Morton Mfg. Co., Muskegon Heights, Mich.



Notching ratchet feed rings on the keyseater.

To enumerate all the various types existent would serve no special purpose, and to go into the question of design would be likewise futile. Various makers claim certain features for their particular product, but in all cases the principle is the same, (i.e.) to pass a cutter through the piece, thus cutting a keyway, or special shaped slot. When special shaped slots are to be cut, it merely means the making of duplicate shaped cutters, which are placed in the standard bar, or if the work is of very intricate shape, a special bar may be used. In any case it does not interfere with the production of the machine itself.

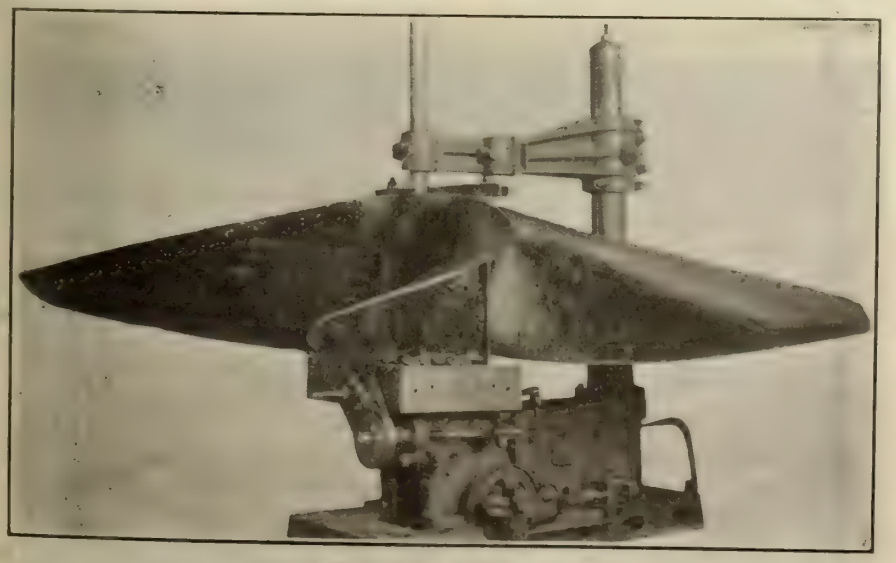
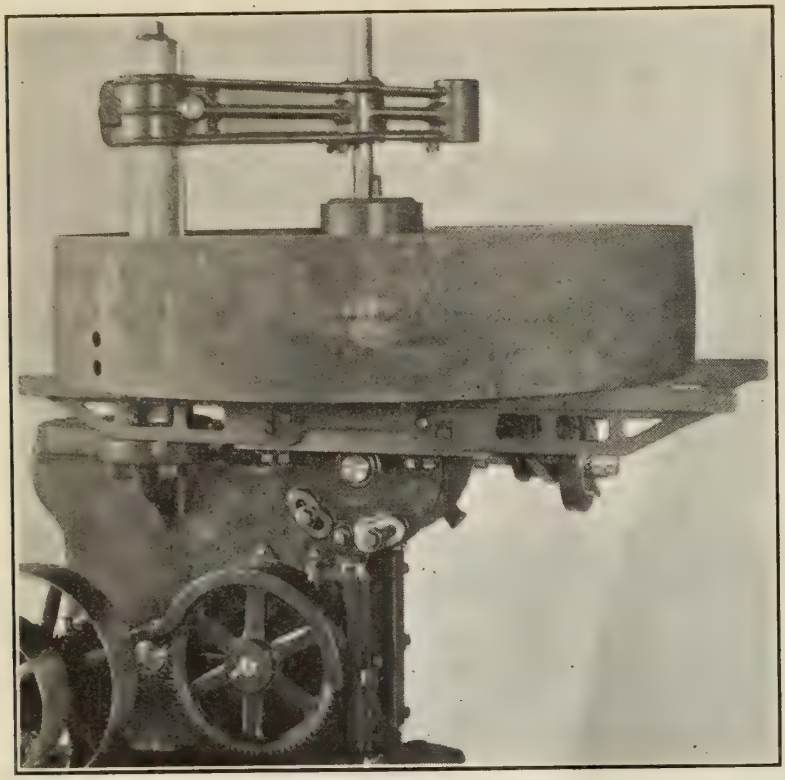


Fig. 1—Cutting keyway in a large propellor.

As a general rule, the modern keyseater is equipped with some type of feed which relieves the cutter on the backward stroke, and which may be set to cut the keyway to any desired depth. Once having been set, the machine is started and will cut any number of keyways alike without further adjustment. Where the keyway is very small, or where there is only one or two pieces completed at a time, the hand method of feeding is usually found to be quite sufficient.



Cutting keyway in a 60 in. pulley.

As stated previously, the modern keyseater embodies certain refinements which the old time machine never could boast of. For example: Gauge plates are used for regulating the depth of the keyway, also for centering the work, while any taper and depth can now be set to very fine limits by means of suitable graduations on the machine. Micrometer adjustment is usually provided on the better class of tools, so that keyways can be set to depth, without the use of a rule or other measuring device.

Even the cutter bars are nothing like what they used to be. Now they are usually made from a crucible-hardened steel, and are so designed that when wear or spring occurs, they can be planed and refilled without much trouble or expense. When small bars are used, the usual procedure is to grip them in a quick action chuck, so that they can be changed quickly and easily.

The cutters are generally made from the finest steel available, because speed is a big factor in the success of such machines. The proper clearance of cutting edges has been carefully considered this eliminating the drag which used to take the place on the old time machines.

Quick holding fixtures have also come into great favor since these tools have been used for production work. In many cases the handling problem is just as important as the machine itself, for if it takes as long, or longer, to handle the piece, as the machine takes to complete the operation, obviously production cannot soar as it should. Thus, to get the most out of a machine, more than the tool itself must be considered. The best and quickest method of handling should first be decided upon, then suitable fixtures should be made to accommodate the parts. The first cost is a trifling consideration, alongside of the ultimate saving. Rotary tables are also used to help speed up the work, in fact devices which tend to increase the production of such machines are being developed every day.

Examples of Work

We have on file many photographs showing ordinary keyseating jobs met with in the common course of events. These include the cutting of keyways in gears of all kinds, pulleys, fly wheels, sleeves, etc., etc., but it is hardly necessary to show these in illustrative form. Let us confine the photographs to jobs a little out of the ordinary and which will prove the adaptability of such tools.

For example Fig. 1. Here we see a keyseater cutting a 3 in. wide keyway in a steam boat propeller which is 16½ ft. in diameter. The propeller is a steel casting, and the total length of keyway is 28 in. It will be noted that a good heavy cutter bar is used, and with the aid of the upper support for the bar, heavy cuts can be taken without impairing the accuracy in any way.

Fig. 2 will give readers a good idea of a very common job in keyseaters, viz, cutting keyways in a pulley, although in this case the pulley is larger than the general run, being 60 in. dimeter. The keyway cut is 18 in. deep, and in the example shown the machine was able to accommodate the larger piece owing to the possible moving of the column. This feature is very desirable when the circumference work would otherwise interfere. With this arrangement it is possible to cut any size or shape within the capacity of machine, and the cutter bar will always be supported above as well as below the work, this in turn insuring accuracy and speed.

In work where the pieces to be keyseated are drilled and bored, they can quite easily be chucked by using centering bushings, thus allowing many pieces to be placed one on top of the other. This holds especially true in such parts as small spur and level gears.

Fig. 3 illustrates a keyseater arranged for notching ratchet feed rings. In this case a special fixture is used to hold the parts in place and the rings are revolved as the machine proceeds with the notching work. Another interesting job for a keyseater is shown at Fig. 4. This depicts a large rack being cut, and the method of handling the part is so self evident that we need not comment further upon it. These last two ideas show clearly that keyseaters are not held down to the mere task of cutting keyways. In fact a machine that is standing idle because there are no keyways to be cut, is not being used correctly. In many cases a ltle thought will relieve some other congested machine, the work being turned over to the keyseater. True, it may have to be handled a little differently, but what of

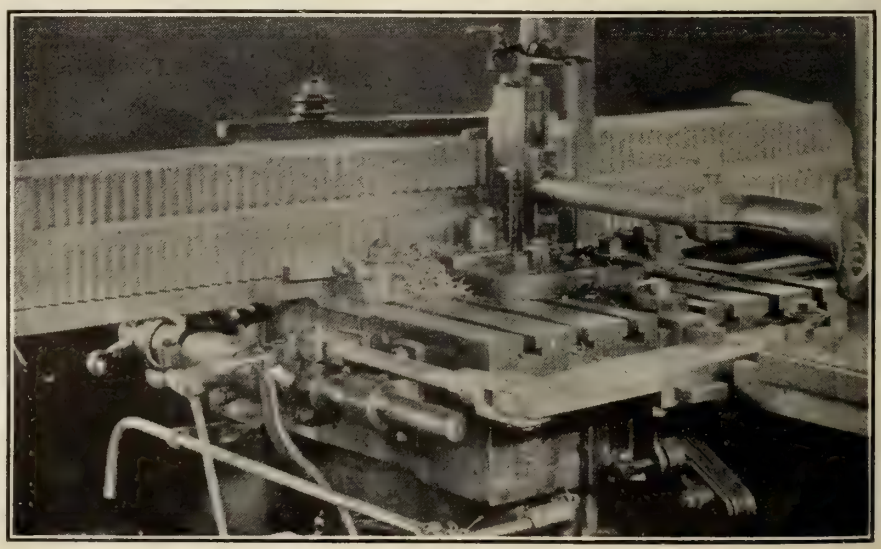


Fig. 4—Cutting a large rack on the keyseater.

that, so long as the parts are produced economically and efficiently.

The remaining illustration shows a rapid binding attachment being used to hold down a gear which is being keyseated. Note the notched rod which permits of rapid clamping, and where the size of the work does not allow the use of such an attachment it is a simple matter to remove it. Like any other machine tool a keyseater cannot produce to its full extent without capable management. The labor used to operate the machine itself does not need to be of highly specialized nature, but to attain the best results, trained mechanics should plan suitable fixtures and attachments to speed up production.

Cornwall, Ont.—The Canada mill of the Canadian Cottons, Limited, has resumed full time. The Dundas Mill of the same company has been working on special orders all summer, therefore has never suffered from any reduction of time.

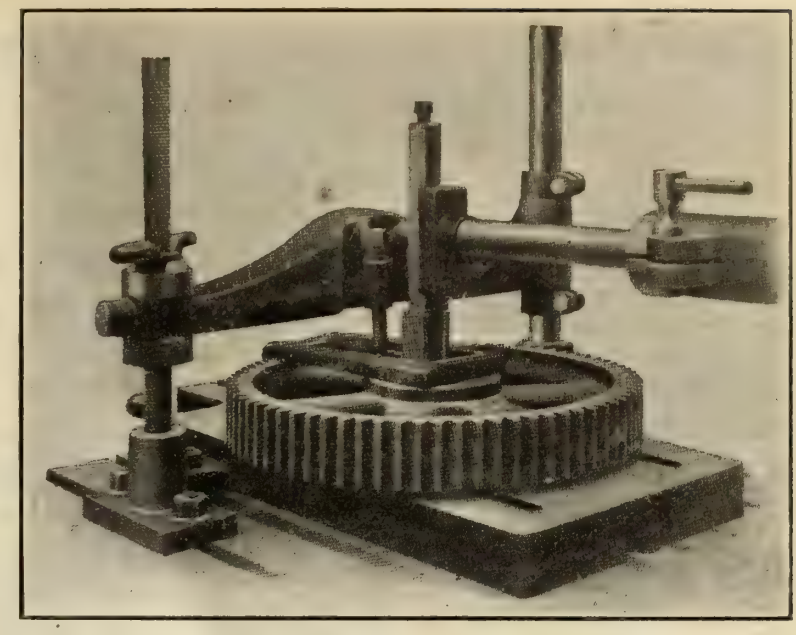


Fig. 5—Showing a rapid binding attachment used in holding down work.

Combination Gear and Cam Drive

By F. Scriber

An unusually compact spur gear, bevel gear and cam drive arrangement that was incorporated in a special purpose machine is shown by the accompanying illustration. It was desired to drive the small bevel gear A, by means of large gear B, thus revolving shaft C, while at the same time operating a slide attached to E, this being accomplished by means of a roll F, which is caused to travel in or out by the groove G cut in the side of spur gear H. The spur gear is in turn driven by a small gear J, revolved by the shaft to which it is held by a key.

It will be noticed that the large spur gear has the large bevel gear attached to one side while the cam is cut in the other side of the spur gear thus all of this mechanism becomes crowded into but little more space than would ordinarily be required for one spur gear.

Following out this drive from the small spur gear J through each movement, it will be observed that J driving the spur gear H causes shaft K to revolve, thus operating one portion of the machine; bevel gear B being held by screws and dowels to spur gear H. This likewise revolves by the same action and drives gear A, and shaft C. As previously described, E is reciprocated by the cam engaging roll F, and thus three distinct movements are imparted to the various units of the machine in which placed.

By keeping in mind such combinations one may often times materially reduce the size of what would otherwise become a large and clumsy apparatus, and the sketch shown is only meant to be suggestive. Part of the construction shown might be applicable to a problem at hand. For instance, the spur gear and cam might be combined as a unit, or the spur and bevel combination would be used at another time.

VALUE OF LUBRICANTS

Solid lubricants, such as mica, graphite and soapstone, have great carrying power at low speeds, but their value depends as much on the nature of the surfaces. Graphite, for example gives the best results when used on cast-iron surfaces, which are naturally very porous and hold the graphite, but the frictional loss and wear are great. Solid lubricants mixed with animal fats, greases, vaseline, or rosin oil are suitable for low speeds and heavy loads, as they give a low coefficient and do not waste away rapidly by evaporation nor run off the bearings. Greases compounded from animal and vegetable fats, or mineral oils emulsified with water soap and alkali enough to neutralize them, are good lubricants for slow-moving bearings with excessive loads, provided the oils do not contain too much water and are not adulterated with foreign substances; the oil should not run down and leave the soap, which is liable to occur in poorly made greases.

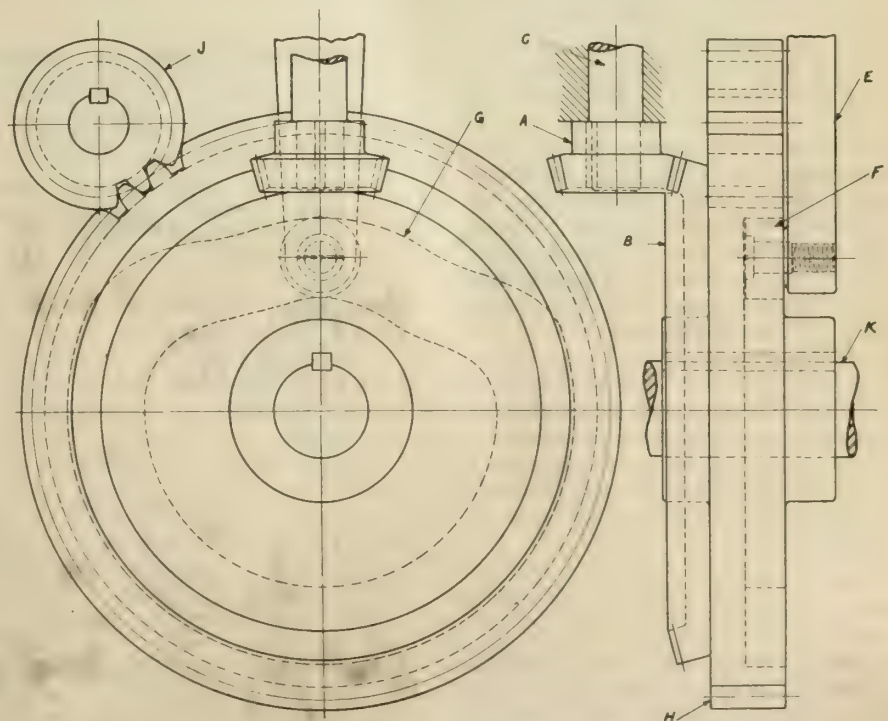


Fig. 7.—Showing the type of gauge described.

Elements of Machine Design—Lesson No. 1

Forces in Machines—What is a Force?—Classification of Forces —Stress and Strain—Elasticity and Elastic Limit—Modulus of Elasticity—Resilience—Working Stress

*By L. T. RUTLEDGE, BA. Sc.

A MACHINE is a combination of resistant bodies or links, whose motions are completely constrained and whose links are so arranged as to transmit motion to some particular part where useful work is to be done. The transmission of this motion gives rise to forces which must be resisted by the various parts of the machine through which the forces are acting.

What is a Force?

A force is that cause which produces the following effects:—

(1) Change of motion or acceleration of a body.

(2) An opposition or balancing of other known forces.

(3) A measurable deflection or distortion in elastic bodies.

The first item relates to kinetics which is that branch of mechanics that treats of the movement of solid bodies produced by forces not in equilibrium, as in the case of machines.

The second item relates to problems in statics, which treat of the laws and conditions of forces acting upon solid bodies at rest, as in the case of bridges and buldings. A force is clearly defined when its point of application, magnitude and direction are known.

Classification of Forces

Forces acting upon machine parts may be classified as follows:—

(a) Useful forces—In doing useful work for which the machine was originally designed: for example, the parts of a drill press must transmit the forces produced by the resistance offered to the cutting tool by the material to be drilled.

(b) Dead weight forces—These forces are present due to the dead weight of the individual parts of the machine. In many designs these forces are overlooked but in many structures such as cranes, or heavy gear wheels on shafting they cannot be ignored. In structural steel work the dead weight or dead load is a very important item.

(c) Frictional forces.—Frictional forces are forces caused by friction between moving parts as in bearings or guides. Where these forces exist, provision must be made for the transmitting of the energy necessary to maintain the force.

(d) Forces due to expansion and contraction—In some structures such as boilers, steam pipes, etc., provision must be made for the forces of expansion and contraction caused by heat. In steam mains expansion joints are provided.

(e) Forces due to change in velocity—Where the direction of motion is constantly changing, as in a connecting rod, or where an acceleration exists, forces are present due to these causes. The design of a flywheel is very complicated on account of the centrifugal forces due to its motion of rotation.

Now it should be quite clear that the designer of a machine must make a careful analysis of all the forces acting from any cause whatever. These various forces should be listed so that all will be provided for. Failures are due to the neglect of this very point.

2:—Stress and Strain

In engineering problems, the external forces acting are usually spoken of as the loads. These loads, coming upon the members of a machine, causes the latter to undergo a deformation or change of shape which is known as the strain. The very instant the strain comes into existance, an internal resistance is set up by the molecules of the material to oppose the strain. As the strain increases, the resistance to it increases until a state of equilibrium is reached. The internal reaction is known as stress. So that the stress may be defined as the internal reaction against the external forces that cause a strain in the material. Forces and stresses are measured by the same units, namely, pounds or tons per square inch. Strain, which is really a stretch, an elongation, or a shortening up is measured, generally, in decimals of an inch.

The purpose of this series of articles, is to provide a short course in machine design, dealing with the fundamental principles involved in the design and operation of machinery. A definite and concise system of reasoning will be suggested for the solution of practical problems.

The course has been designed in the first place, to stimulate interest among any connected with mechanical work, especially such work as draughting, designing, superintending, inspecting, etc., and any who have not received a college or technical school education but who, nevertheless, are desirous of increasing their knowledge in this particular branch of engineering. Many who may have already studied mechanics and machine design will find it advantageous to do some reviewing.

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

Elastic Limits and Moduli of Resilience in Tension.

Type of Steel		Elastic Limit	Modulus of Resilience
Open-hearth Carbon Steels	.08 per cent carbon	25000	10.4
	.15 " " "	30000	15.0
	.30 " " "	35000	20.4
	.40 " " "	41000	28.0
	.50 " " "	47500	37.6
	.60 " " "	63500	67.2
	.70 " " "	70500	82.8
	.80 " " "	75000	93.8
Alloy Steels	Nickel Steel 2.85% Ni — Annealed	52000	45.1
	Nickel Steel 2.85% Ni — Oil-tempered	121000	244.0
	Chrome Steel — Oil-tempered	127500	271.0
	Nickel Vanodium — "	126250	266.0
	Chrome Vanodium — Annealed	63.700	67.5
	Chrome Vanodium — Oil-tempered	170.000	482.0

Table 1.

The relationship between loads and stresses is very simple. If a pull of 3,000 lbs. is maintained on a fastened rod, then the stress in any cross section of the rod at right angles to the direction of the forces is 3,000 lbs. If the cross-sectional area of the rod is 3 sq. in. then the unit stress is 1,000 lbs. per sq. in.

Therefore, if "P" were the load acting on a member whose cross-sectional area is "A" then the unit stress "S" $= \frac{P}{A}$

When a body is stressed, there are always, at least, two forces acting. For example, consider a short post resting on a concrete block and let the post be loaded on the top with a weight of one ton. Where are the two forces? It is certain one of the forces is the weight on the post and the other must be the upward resistance of the concrete equal in magnitude to the downward force. If there were no opposing resistance the post would move downwards under the action of the weight and it would keep going till opposed. It is very important to realize fully that there must be, at least, two forces present for equilibrium.

Kinds of Stress

(a) Tensile stress or tension occurs when the opposing forces acting upon a body tend to pull it apart as in the tie bars of a bridge. Then the tensile stress is the internal molecular resistance, cohesion, etc., that acts to resist the separation of the material.

(b) Compressive stress or compression occurs when the opposing forces acting upon a body tend to compress or squeeze it and the particles of the body act to resist the crowding effect.

(c) Shearing stress or shear occurs when the opposing forces acting upon a body tend to cause one section to slide past another.

(d) Bending Stress, or bending, also called transverse stress is a combination of tension, compression and shear and is produced by loading a beam transversely. When the beam bends downwards the top fibres are in compression and the lower ones in tension. The load, in this case, tends to shear the beam in a vertical plane, the shear being maximum under the load. In addition, there is a horizontal shearing stress, brought about by the variation in the vertical shear and other conditions.

(3):—Elasticity and Elastic Limit

Elasticity is the property which a material possesses of returning to its original form and dimensions when the external forces causing distortion are removed. Steel is the most highly elastic material met with in practice. But within certain limits every solid body is elastic and the strain therein is directly proportional to the forces producing it. This is a statement of Hooke's Law. In other words the law states "that unit stress is proportional to unit strain."

The relation existing between the unit stress and unit strain for any material is best given by a diagram or curve, called the stress-strain diagram. The diagram is plotted from observations made when a test piece of the material is subjected to an increasing load and finally broken in a testing machine.

Where E_t = modulus of elasticity in tension

" S_t = unit stress in tension

" δ = unit strain

Then $E_t = \frac{S_t}{\delta}$

Fig. 1 is a stress-strain diagram for a mild steel. The unit stresses in pounds per square inch are plotted as ordinates on the vertical axis, and the unit strain or strain per inch of length in thousandths of an inch. An inspection of the diagram shows how the steel behaves under load. It is seen that up to about 35,000 lbs. per square inch the diagram is a straight line, the unit stress being directly proportional to the unit strain.

At the point "B." the curve departs from the straight line. The behaviour of the beam of the testing machine indicates to the observer when this point is reached. The stress at the point "B." is called the elastic limit. It is the limiting point of perfect elasticity, that is, it is unit stress below which the strain disappears completely upon removal of the load or the elimination of the stress, or in other words, no permanent set can be detected. The point "C." is called the yield point and it is always quite close to the elastic limit. Beyond the point "C" the strain increases at a greater rate than the stress until finally rupture of the test piece occurs. The external load necessary to cause rupture divided by the original area of the cross-section of the bar is called the ultimate strength.

4:—Modulus of Elasticity

In order to determine the strain for any known load acting on a given material, it is very convenient to make use of a so-called modulus of elasticity. It is a factor obtained by dividing the unit stress by unit strain, the stress being not greater than the elastic limit. The value of this factor can, therefore, be obtained for any material from the straight line part of the stress-strain diagram. The slope of the line "A B" in Fig. 1 gives the value of the modulus of elasticity. The slope of a line is obtained by constructing a triangle, having the line as hypotenuse and having for the other two sides two lines, each parallel to an axis of the diagram, that is, have one vertical, and the other horizontal. Then the slope is given by dividing the opposite side by the adjacent. In trigonometry this ratio is called the tangent of an angle. Referring to the figure, the ration is B. D. A. D. Considering the case of mild steel it would be found that for a unit stress of 30,000 lbs. per square inch, the strain would be .001 per inch of length. Therefore the modulus of elasticity would be 30,000 divided by .001 or 30,000,000.

It is very important to know the modulus of elasticity for all metals and materials used in construction. It is a remarkable fact, however, that the modulus of elasticity of every steel is constant, or nearly so, no matter what the grade of the steel.

This is illustrated in Fig. 2. The diagram shows all the steels mentioned to have the same slope and the one straight line in the stress-strain diagram is common for all. Therefore the moduli of elasticity are equal and as was stated above, approximately 30,000,000 lbs. per square inch. The modulus of elasticity is a measure of the stiffness or rigidity of a material and since all grades of steel have approximately the same modulus of elasticity, it is apparent that a piece of soft, ordinary steel is just as stiff or rigid as the most expensive alloy steel of the same size and shape. So that, as far as stiffness is concerned and where strength is not considered and where the shock loads are not present, it is quite good enough to use a low-priced grade of mild steel.

5:—What Factors Determine Strength?

Though one grade of steel is as good as another as far as stiffness is concerned, it does not apply from the standpoint of strength. The quantities that determine strength are the elastic limit stress, the breaking stress, or ultimate stress and the amount of maximum elongation possible. Table 1 gives the elastic limits for a few steels. The elastic limit of oil-tempered chrome vanadium steel is 170,000 lbs. per square inch, which is five times that of machinery steel. The strength of a machine part not only depends on the strength of the material in it, but also on the shape and size of the section. This latter point shall be considered later.

6:—Resilience

Referring to the stress-strain diagram, it is evident that the area under the curve is the product of pounds and distance, the pounds being plotted vertically as stresses and the distances horizontally as strains. In mechanicsthe product pounds by distance, usually feet, is an expression for work or energy. Then the total area under the complete stress strain curve is the amount of energy required to rupture the material, while the area under the curve up to a certain point is the total work required to deform the material an amount equal to the deformation corresponding to the assumed point. If the assumed point be taken as the elastic limit, then the area

under that part of the diagram is the energy known as the resilience. This area in Fig. 1. is represented by the triangle A D B. Since the area of a triangle is one-half the product of the base and the perpendicular height or ½ (A D x D B), it follows

$$\text{That, Resilience} = \frac{1}{2}\left(A\,Se \times \frac{Se\,L}{Et}\right)$$

$$= \frac{AL\,Se^2}{2Et} \qquad (3)$$

In which A = cross-sectional area

Se = unit stress at the elastic limit

L = The length of the specimen

Et = modulus of elasticity in tension

Though the stress-strain diagram is plotted for test piece of unit dimensions, that is, 1 square inch in area and 1 inch long, multiplying by "A" and "L" converts it to suit the case of an actual bar.

However, if the specimen had a cross-section area of 1 square inch and a length of 1 inch, the symbols A and L will have disappeared from the equation (3) and the equation is reduced to

$$(2) \qquad \frac{Se^2}{2Et}$$

4:—This magnitude is the unit of resilience and is called the modulus of resilience. The modulus of resilience is very useful in mechanics of materials for comparing the capacity various materials have for resisting shock. Since the modulus of elasticity is practically constant for all grades of steel, it is seen that the capacity of two steels for resisting shocks varies directly as the squares of their stresses at the elastic limit. For example, the elastic limit of a certain machinery steel is 34,000 lbs. per square inch, and of oil-tempered chrome vanadium steel is 170,000 lbs, per square inch, the latter being five times the former. Then from equation (4), the capacity of the alloy steel for resisting shock is 5 squared or 25 times that of the machinery steel. This point relating to resistance against shock is a very important one for the designer to note.

7:—Working Stress and Factor of Safety

In general the maximum permissible stress induced in a machine member must be kept well below the elastic limit, so that the action of the load may be perfectly elastic. The stress used by the designer in determining the size of the part is known as the working stress. The number of times the ultimate strength contains the working stress is the factors of safety. The size of this factor varies from 4 to 29 with conditions, some of which are listed below. In the case of cast iron, which is brittle and which often has blow holes and bad spots, it is customary to use a high factor of safety, whereas steel which is very ductile and more uniform in structure admits of the use of a smaller factor of safety.

The magnitude of the working stress depends on the following conditions:

(a) Kind of material, quality of it, its chemical composition, elastic limit, ultimate strength, resilience, elongation properties.

(b) Is the application of the load steady or variable, and if variable, does it vary from zero to a positive maximum or from a positive maximum to a negative maximum?

(c) Is the part subject to shock loads?

(d) Is the stress produced from the application of the load a simple stress or a compound one and what kind of stress is produced?

(e) Is the material used in the construction reliable and all the same as the sample tested?

(f) Is the material of the machine part subjected to unnecessary and speedy deterioration?

(g) Cost of manufacturing.

(h) The demand on the machine at some future date.

(i) Is human life or property endangered in case any part of the machine fails?

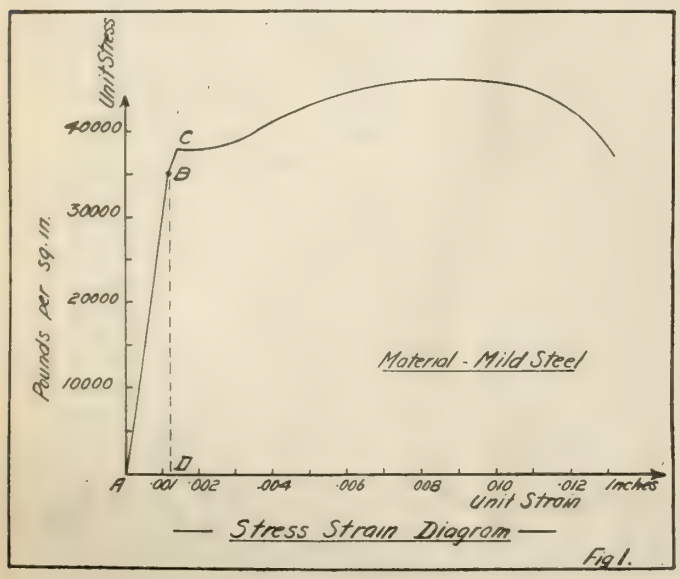
(j) Is the machine to be designed to do a certain work for a short time only and then be scrapped, or is it to be a part of a permanent equipment.

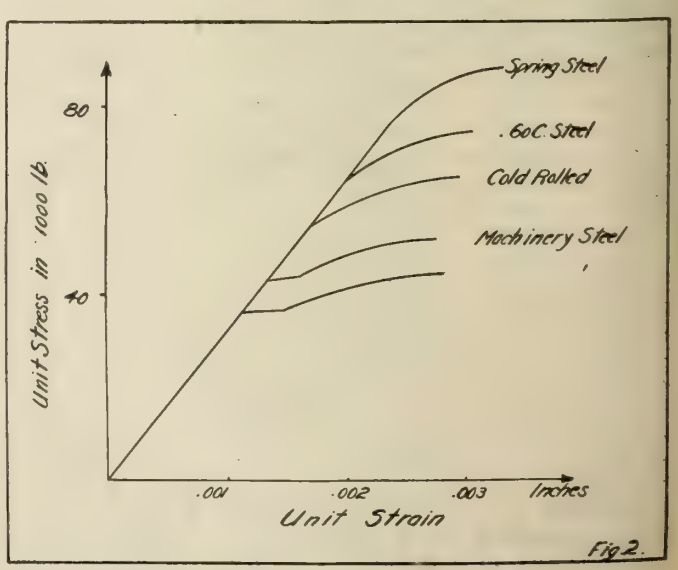
(k) Have temperature stresses to be considered?

OIL FUEL IN 1921

Lloyd's "Register of Shipping" gives the following interesting information in reference to the use of Oil Fuel for ships. In 1914 there were 364 steamers of 1,310,000 tons fitted for burning oil fuel, whereas at present there are 2,536 such vessels of 12,797,000 tons, the amount being more than nine times larger than that of 1914.

The percentage of total gross tonnage using oil, etc., in internal-combustion engines in 1914 was 0.47 and in 1921, 2.0. The percentage using oil fuel for boilers was 2.62 in 1914 and 20.65 in 1921.





What Muscular Effort is Exerted by Operator?

A Novel Method of Arriving at Muscular Effort—Method of Locating Levers—Working in Horizontal Plane—Pulling in Vertical Plane, etc.

By JOHN S. WATTS

IN THE design of every piece of mechanism the most desirable location for the control levers and handles has to be considered. And to this matter more care should be given than is usually done, as upon the right placing of these levers largely depends the speed with which the machine can be operated. The men who run machines will generally be found to have strong preferences for a certain make of machine, and investigation will show that this preference is largely based upon the convenience of the control of the machine.

Notwithstanding the importance of this subject, there is a singular paucity of data in the technical publications upon which to base muscular effort which can be exerted by the operator of a machine under the varying conditions to be met with. That the designer can decide such questions as the possible reach, and convenient heights for handles, etc., by reference to and measurements of his own body, seems to be the reason for this lack of data, but as few of us are of average measurements, and all machines should be built to suit the average man, it would seem to be desirable to have the measurements and muscular strength of the average man given in some convenient form.

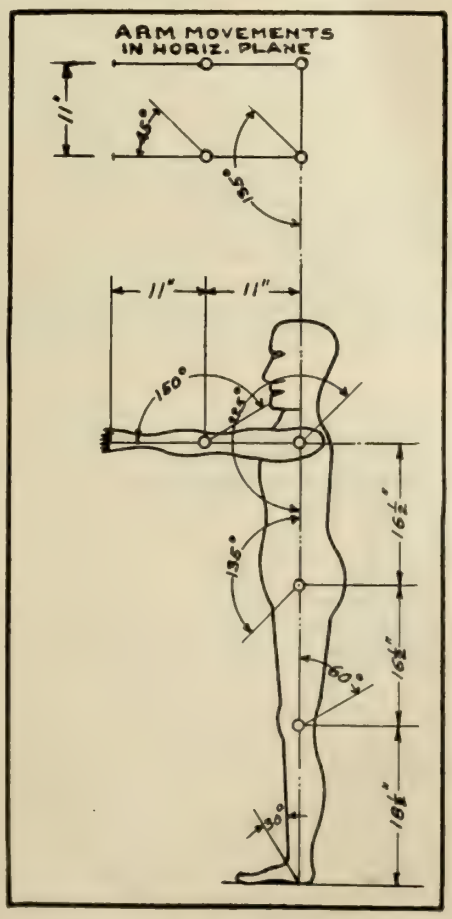
That some dimensions, such as the height of a lathe bed, have become more or less standardised, does not prove that it is in fact the one best dimension for the purpose, and should not deter us from an independent study of its desirability. As an example we may take the height of the sinks in our homes, which were from as far back as we can trace, placed at 28 to 30 inches from the floor, until, someone of a more than usual enquiring type of mind, discovered that a few inches more in height relieved the strain on the muscles of the back almost entirely.

As an example of a case where it is important to know what force the operator can exert when reaching out a certain distance, we may cite the picking belt. This is in essence a horizontal conveyor, upon which the material is carried past a number of men whose duty it is to pick out the impurities from the stream of material as it passes them.

For certain materials the width of the belt has become practically standardised at five feet, which involves the men having to reach over a distance of thirty inches and lift up a piece of material. As the width of the belt determines the amount of material which it can handle, the deciding factor is how wide it can be made, and still not compel the men to reach out so far that they are unable to lift the impurities, without undue fatigue. This weight that can be lifted is also dependent upon the height of the belt from the ground, and to some extent upon the nationality of the pickers, as for example a race of men such as the Japanese, of short stature, would compel the use of a much narrower belt than would be desirable for say the Anglo-Saxon.

Method of Location

The best way to locate the required levers, etc is to sketch in, on the drawing of the machine, a skeleton diagram of the average man, such as is shown in the accompanying sketch, which also gives the maximum movement of each of the most important joints in his body, and from this can be quickly determined the maximum posibilities of movement in his hands and feet to operate levers, without his having to move from one position. While it is not good policy to use the maximum possible movements of the average man, a good idea of the convenience or ease of any given movement may be gained from a consideration of how much this contemplated movement is within the maximum. Also the nearer we come to having the required movement central with regard to the maximum one the better as a general rule.



How's this for a diagram?

The remaining datum that is needed, is the force that can be exerted through each of these movements by the average man working continuously without undue fatigue.

Working in a horizontal plane, as in working a hand lever, we may figure on a force of 35 pounds, pulling towards the body, and twenty pounds pushing away from the body, through a stroke of 30 inches, at the speed of 120 feet per minute.

Pulling in a vertical plane, using the shoulder muscles, as in hauling on a rope or chain block, we can count on a pull of 35 pounds, at a speed of 45 feet per minute, that is the rope will travel 45 feet per minute. This may be increased up to a pull equal to the weight of the man, but this maximum can only be exerted for a few moments, and at a very much lower speed.

A complex movement, involving the use of all the major joints of the body, will reduce the available force to 20 pounds, if used intermittently with fairly long periods of rest, or to 10 pounds if used continuously. An example of such a movement is the operating of a hand wheel actuating a clutch or brake, when 20 pounds may be allowed, but in turning the crank of a hand winch for comparatively long periods, we should not expect a force of more than 10 pounds. In both cases the speed will be about 220 feet per minute. The best results for men of average height of 66 inches, are got when the crank handle has a radius of 18 inches, and has its centre of rotation about 30 inches above the floor. The speed of the crank handle may be taken as 55 revolutions per minute.

The weight that can be lifted depends upon its height above the floor, and its distance from the feet of the man. The maximum weight for continuous work, that can be lifted is 40 pounds, when the weight is close to the feet, and not over 3 feet high above the floor. This is reduced to 10 pounds when the weight is 3 feet away from the man.



WHAT OUR READERS THINK AND DO



DRILL PRESS TABLE

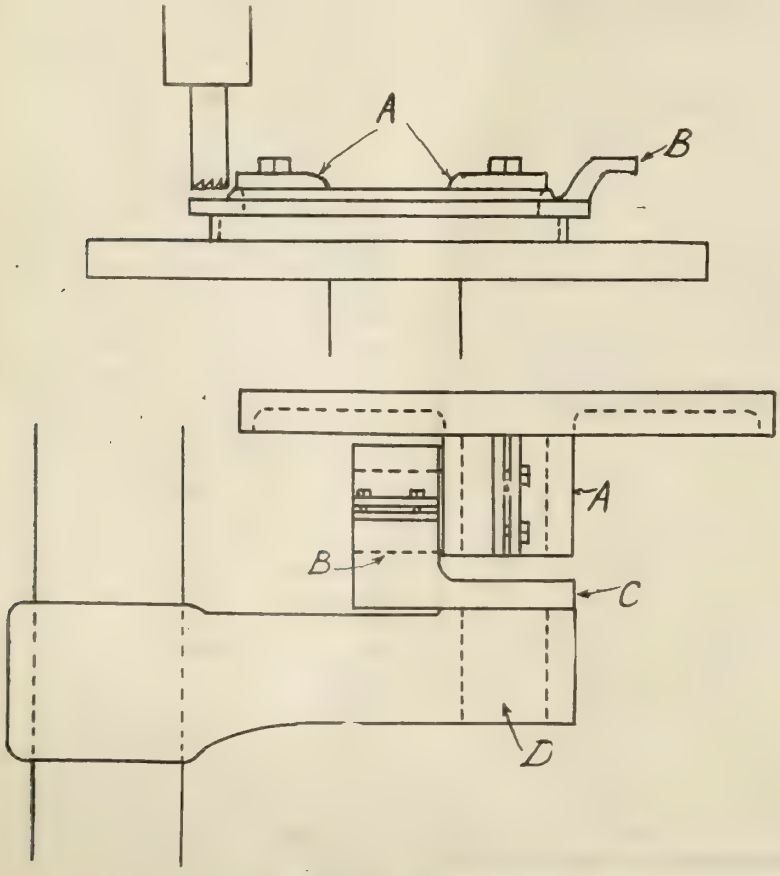
By H. T. Osborn

The swivel joint table shown in the sketch will be found very handy for the unlooked for job on the drill press. The casting A is bored to fit the stem of the regular work table, and this casting has a similar shank B which enters the hole in casting C. This casting in turn has a stem on it which fits the hole in the drill table arm at D.

Both pieces are split on one side as shown and are provided with suitable clamping screws. The shank B should be made to fit the hole D also so that it can be used in that position if necessary.

We had a contract recently to make the circular frame shown in position on the sketch. The piece was of brass, had to be turned in several places, and the outside had to be polished. The latter operation was the problem for there were several lugs as shown at B, in the way. We first of all tried filing and scraping but it was too slow.

At last we hit upon the scheme as shown. The work was held by clamps A and located in the centre of the table by pieces bolted thereto. The arm of table was locked to the column, but the table itself was free to turn, this being accomplished by taking a grip over the side of the work with a monkey wrench using it as a lever to turn the table, thus feeding the work to the cutter. The vertical miller would of course have been a better proposition, but as we did not have such a machine we simply had to do the best we could. The main object was to get the surface fairly flat, and get the scale off. Touching up the corners with a file and emery cloth completed the job.



Two drill press kinks that save time.

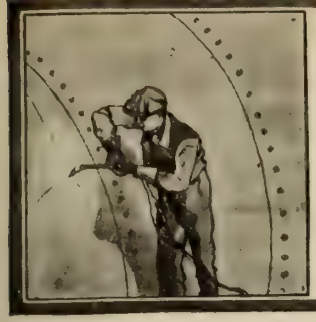
SHARPENING FINE TOOLS

By RALPH H. BUTZ

Fine files can be resharpened in the following manner. First remove the adhering dirt by means of a fine wire scratch brush, together with a hot solution of crystallized soda, or better still, some warm soapmakers waste lye. Next place the files alongside of each other in an earthen vessel, and on the bottom of the container place two strong wires. This precaution allows the fluid which is later poured in the vessel, to come in contact with the lower portion of the files. Make up a fluid containing a careful mixture of eight parts of cold water to one part of concentrated nitric acid, this to be prepared in another vessel.

Sufficient of this mixture is poured on the files to cover them, when the acid is left to operate upon the files for about twenty-five minutes. After this lapse of time, they are taken out of the bath, treated with a scratch-brush in clean water, similar to the first time. They are next immersed a second time in an acid bath of the same strength, (eight parts water and one part nitric acid), for twenty-five minutes, during which time they are occasionally changed about. The files are then again treated with the scratch-brush, and returned to the same bath, to which one-half part of English sulphuric acid has been added. The bath heats, and reddish-brown vapors escape, during which time the sharpening of the files by corrosion progresses. Care must be had to keep the vessel (the best is an earthen) in a rocking motion, so that the acid operates equally upon the files, which are not to be left longer than five minutes in this bath. They are then withdrawn, again treated, as above stated, with the scratch-brush and clean water, and once more placed in a new bath of the same composition, in which they must not remain longer than five minutes.

This ends the operation. They are now treated with the scratch-brush, first with clean water, and finally they are laid for a few minutes in a bath to which a little lime water has been added. This is for the purpose of neutralizing every trace of acid. They are last of all rinsed in clean water, wiped with a dry rag, and heated to dry the moisture. As a final precaution rub a little oil on them.



WELDING AND CUTTING



Learning to Weld—Points for Beginners

Torch Movement Imported—Beginners Should Concentrate On One Kind of Welding Until Proficient—Beveling—Preparation of Thin and Thick Metal Sections for Welding

*By FRED E. ROGERS

BEGINNERS should commence by welding strips of low-carbon steel from 1-16 to ⅛ inch thick, using a No. 2 tip. Thin gauge metal can be welded without using welding rods or beveling the joint. The strips should be laid on metal supports or preferably firebrick resting on a metal plate. Never attempt to weld on a wooden top workbench without protecting the planks from the torch flame.

The torch should be given a slow zig-zag motion across the joint, holding it slightly inclined sideways so that the flame strikes the metal at an angle in the direction of the joint. The torch movement should extend about ⅛ inch each side of the joint. The forward movement along the joint will depend on how quickly the metal fuses and welds together. In no case, however, should the flame be directed against the metal without motion, as it will be overheated if the flame is not kept constantly moving.

As the metal fuses the motion should be maintained keeping it in step with the melting metal, going no faster nor slower. The operator will experience difficulty at first in seeing just what is taking place when looking through colored glass spectacles or goggles, but ability to distinguish between the melted and unmelted metal will come after some practice.

It will be realized that correct torch manipulation requires considerable muscular training and the operator will find the practice tiring at first. The weariness comes more from mental exertion than muscular effort, however, and after a few days the operation will no longer be irksome.

Beginners should concentrate on one kind of welding until they are able to produce fairly satisfactory work. Avoid experimenting with various kinds and thicknesses of metal until satisfactory proficiency has been obtained with one gauge and kind of metal only. Study to learn principles in the beginning and endeavor to do one thing well at a time.

*Extracted from a book entitled "Welding and Cutting," which is published by the Davis-Bournonville Co., Jersey City, N. J.

Holding the Torch.

The torch should be grasped by the handle in the right hand, at or near the point where it balances with the hose hanging free. It should be held across the joint and worked back and forth in this direction when welding. Always hold the torch with the tip down and avoid flourishing it around. The flame is very hot and will instantly set fire to clothing or other combustible with which it comes in contact. Severe burns will follow exposure of the flesh, if but for an instant, to the direct flame.

The point of the white-hot bulb or cone should be held touching the metal or from 1-16 to ⅛ inch above it, dependent upon the size of tip in use and the metal being welded. Care should be taken to hold the torch uniformly at the prescribed height. Touching the tip to the metal will obstruct the flow of gas, and it may cause a flashback in the older types of torches and tips, that will continue to burn within the tip head and soon ruin it if not checked. In case of a flashback turn off the oxygen needle valve immediately, relight and adjust as before.

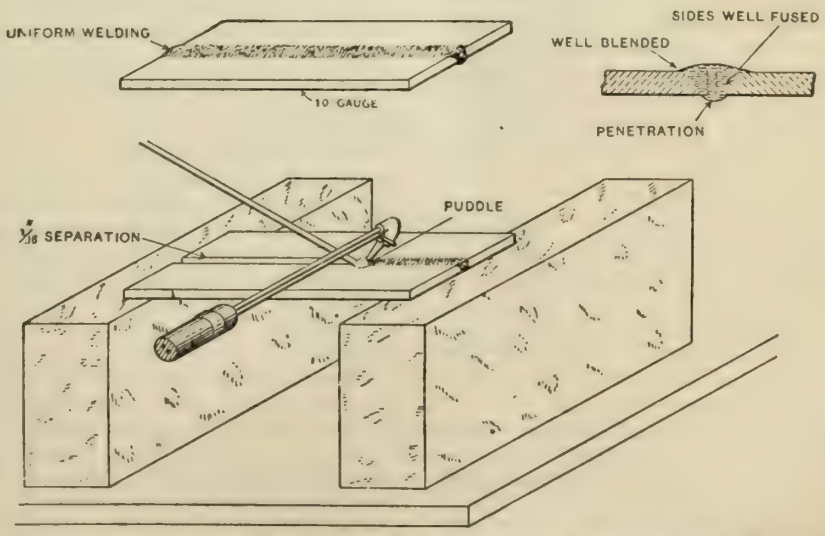
The operator should learn to stand easily and hold the torch in the hand so as to control its position and motion without tightly gripping the handle. When welding, the flame should not be held steadily in one place but should be kept in constant motion, the movement depending on the character of the joint and the thickness of metal as before stated.

One of the first things for an operator to learn is to have confidence and not be afraid of the apparatus. If the torch backfires, seek out the cause of the trouble and correct it. It is rarely that a flashback extends further than the head of the tip, and if the oxygen is immediately shut off no damage should result.

Go through the motions of turning on the gases, adjusting the working pressure, lighting the torch and regulating the flame until the order becomes fixed in mind and automatic.

The Puddle.

Beneath the torch flame is a pool of molten metal known as the "puddle." The size, heat and condition of the puddle are what determine the success or failure of welding. Learning to weld



Welding Prepared Joint showing Welding Rod, Firebrick and Cross Section of Weld.

is largely a matter of seeing the puddle clearly through colored glasses, understanding what is going on and being able to correct the defects seen.

When welding steel the puddle should lie clean and clear, having no foam on the surface, and "wetting" the sides of the groove in which the weld is being made. Anyone who has soldered a joint knows the difference between the molten solder that amalgamates or unites with the parts to be soldered, and that which persists in a spheroidal state, refusing to unite with the metal and standing on the surface with rounded edges. So long as the spheroidal or rounded edges persist in the puddle the welder should know that he is not making a sound weld. He is not securing penetration and union of the adding material and parent metal.

The remedy with steel is usually more heat to melt the oxide but when welding cast iron the oxide in the puddle which interferes with penetration cannot be eliminated except by the use of a flux that reduces it.

The welder's training should enable him to tell immediately when the puddle conditions are right, whether too much or insufficient heat is being radiated to it by the flame, when it is properly located and if the condition of the metal is such as to need clarifying by the use of a flux.

Leaks in the Torch Head

The seat of a D-B torch head is reamed to a standard angle, and the tips are carefully turned to fit. No trouble need be apprehended from leaks when the torches are new, but after a period of use the torch if misused may become distorted in the head to such extent that the tip seat no longer fits closely, the result being that the gas leaks and catches fire, burning around the tip nut. The welder should immediately correct this trouble if possible. While it is not necessarily a source of danger, it represents waste and interferes with good work. Removal of the tip may disclose the leak to be due to the presence of a foreign substance which removed obviates the trouble. If the cause is due to distortion it may be necessary to return the torch to the factory for refitting. Minor troubles of this sort may sometimes be overcome by grinding in the tip with oil and sifted powdered glass. Care should be taken to clean out the cavity and the gas holes thoroughly afterwards to prevent clogging the tip.

Flashbacks

The following regarding flashbacks applies to the older torches made before all the principal causes of flashbacks had been found and eliminated. Non-flashback tips are now furnished for all style C torches, which are free of this trouble when used under reasonable conditions of service.

Flashbacks in the older torches are troublesome to the beginner and are likely to be more or less frequent with any operator depending on the skill or lack of skill with which it is used. Any torch will develop a flashback if held with the tip so close to the metal that the flow of gas is obstructed, or if an obstruction is slapped against the end of the tip. Flashbacks also result from overheating. The beginner should learn first of all to avoid holding the tip too close to the work and to prevent the tip or head becoming hot. No trouble is experienced from overheating when welding thin gauge metals, but on heavy welding of preheated parts it may become serious and require frequent cooling by plunging the tip and torch head into cold water. Water-cooled head torches are used on heavy preheated parts, or the special No. 37010 non-flashback torch with long curved tips.

Flashbacks may be caused by insufficient acetylene pressure or the presence of an obstruction in the tip. Particles of metal sometimes fly up and stick to the tip partially shutting off the opening. Hence the operator should remove the obstruction either outside or inside the tip and see that his gas pressures are correct for the size of tip used.

Care should be taken to prevent the hose becoming kinked or pinched as this will reduce the flow of gas and may cause a flashback or improper flame adjustment.

Preparing for Welding

Acceptable commercial welding is produced by proper and thorough preparation of the parts before actually undertaking to weld. By preparation is meant cleaning, beveling the edges to be welded, lining up, preheating in the case of castings to produce expansion and to counteract the effects of contraction, providing sufficient supply of gases and welding rods and starting work at such time that it can be finished in one heat. Work should not stop on a weld until it is finished. Hence, making ready for welding means planning to finish it without interruption.

Cleaning Parts to be Welded

Remove all rust and scale from the edges to be welded. The time spent in cleaning a joint, removing all foreign matter will be well employed. Never undertake to weld parts covered with grease without cleaning them if for nothing more than comfort of operation. Remember that a weld should be kept free of everything except the weld metal and flux. Anything else interferes with good work.

Heavy grease and thick oil may be removed by the use of scrapers and waste soaked in kerosene. The addition of 5 to 10 per cent. machine oil to kerosene makes it more effective as a cleansing agent than the clear kerosene. A wire scratch brush is good for removing scale and rust as also are old files ground to a chisel edge. Care should be taken to have large parts thoroughly dry and free of oil before starting to preheat. The heat might gasify the grease and cause a puff or an explosion in a confined space of sufficient force to knock down a loosely laid brick furnace around the parts and thus cause considerable loss of time and annoyance.

Beveling

Following usual practice, wrought iron, steel, cast iron and other metals in general, thicker than ¼ inch are beveled on the edges to an angle of about 45 degrees, preparatory to welding. Thus, an included angle of about 90 degrees is formed when two beveled edges are butted. If the parts of an iron casting are thicker than, say, two inches and it is possible to weld on both sides the bevel may be cut to the middle only. Less labor will be required to make the bevels and less welding rods and gas will be needed for the weld.

A wide variation in practice is allowable in beveling steel plates. While it is generally agreed that the edges should be beveled it may not always be absolutely necessary, however. Two square edge plates may be successfully welded by tacking them a distance apart approximately equal to the thickness of the plate. The welder must then break down the corners thus forming a groove in which the adding material is puddled and welded in the same manner as though the joint had been mechanically prepared. Of course, it is better to bevel mechanically than by torch manipulation. Recommended practice for tanks and drums is beveling the edges of the plate to an angle of about 45 degrees before rolling into cylindrical form. The edges for the longitudinal and girth seams are then presented in the form which requires the least torch manipulation to produce dependable welds. It is not necessary that the bevels be carried clear across the edges so as to make a sharp angle, but a thickness of 3-32 to ⅛ inch may be left square at the bottom. Less metal will be removed and there will be less danger of overheating the metal at the bottom.

A variation in practice worthy of consideration in firebox patching is beveling to sharp angle in the conventional manner, and then hammering or otherwise bending the edges over slightly. In this manner the danger of overheating is reduced but of more importance is the somewhat greater elasticity of the joint to contraction stress as the weld closes.

Thin metal especially sheet aluminum should be prepared for welding by turning the edges up to a 90-degree angle. The weld is made by fusing the turned-up edges which unite and sink down approximately flush with the plate.

Cutting Bevels

Bevels may be cut rapidly in steel and wrought iron with the cutting torch and at low cost as compared with hand chipping, grinding, sawing or filing. In manufacturing plants it is feasible to cut bevels of plates with a planing machine and to turn the ends of flanged pressure container heads in a lathe to the required angle. Cutting-off machines may be used to cut pipes and bevel at the same time. Cast iron may be beveled with hammer and chisel, emery wheel, hacksaw or file, also with cutting torch fitted with a tip for cast iron cutting.

To be Continued

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Two readers submitted lists for the Sept. 15th contest, these being T. Parkin, and J. H. Wood. Mr. Parkin resides in Montreal, Mr. Wood in Toronto. In the elimination test Mr. Parkin was lucky enough to have his paper selected. Stay with it Mr. Wood, next week may be your lucky one.

CONTEST FOR OCTOBER 6TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something that is reversible.
2 How to reduce cost of fabrication.
3 Something alloyed by a S Process.
4—How to save space, light and fuel.
5—Certain points to keep in mind.
6 What to use to increase production.
7 A product built to stand rough usage.
8—Something that has been proven over and over again.
9—How to make heavy lifting easy.
10—Something that can be done in a few minutes.
11—How to secure accurate production.
12—Something that is fire resisting.

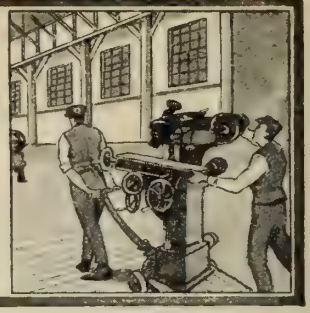
These are Correct Answers for List from September 15th Issue

1—Nicholson File Co.
2—Bilton Machine Tool Co.
3—Henry Berry & Co., Ltd.
4—The National Acme Co., Windsor, V. T.
5—C. E. Johansson, Inc.
6—Brown, Bogg Co., Ltd.
7—Crane Limited.
8—Pratt & Whitney Co., of Canada.
9—The Ford Smith Machine Co., Ltd.
10—Algoma Steel Corporation, Ltd.
11—The L. S. Starrett Co.
12—S. F. Bowser Co., Ltd.

Closing Date for This Contest is October 27th



DEVELOPMENTS IN SHOP EQUIPMENT



NEW TAP GRINDER

The Bickford-Switzer Co., Greenfield, Mass., have placed on the market a new tap grinder. This machine is designed to sharpen any style of tap, having any number of lands or flutes from two to six inclusive, by grinding an eccentric relief on top of the cutting land, the limit of capacity being 1½″ in diameter for hand taps, 1¼″ for tapper or machine nut taps, and 2″ for pipe taps. The machine grinds the different lands of the tap consecutively, a cam on the main or work carrying spindle riding against a positive shoe, thus causing the tap to approach and recede from the wheel as it is revolved on its own centres.

The squared end of the tap is driven by a bell centre of the ordinary type, while the point is supported by a male or female centre as required, these two centres being made on a revolving plate which also provides for remaining out of the way to give space for inserting the shank of any long tap that it is necessary to hold in the chuck. The different cams are made together in a single shell and mounted on the work spindle so that when the spindle is turned in a backward direction the cams do not revolve, but will start forward from any position when the spindle is turned forward.

This arrangement is made to assist in setting the tap to bring the proper relative position between its cutting land and the cam.

In order to do this it is only necessary to turn the tap backward until the contact point of the wheel is in a position between two tap lands and then turn the tap forward.

The head which carries the main spindle is arranged to clamp in the desired position on the rocker shaft, a flat spring underneath holding the head over to keep the particular cam in use in contact with its shoe. A small cam shaped collar is conveniently arranged to force a shoe into contact with whatever cam it is desired to use. The machine is also designed to sharpen countersinks and chucking reamers, if they are of not more than six flutes.

A lever at the left feeds the work forward to a position opposite the wheel when a lever at the right sets it to the desired angle, and the wheel is fed in as the work is revolved by means of the crank. A special feature of the machine changes the angle of the work as it passes the wheel, giving a rounded contour where the angle of the bevel near the end of the tap approaches the parallel sides. This is said to prolong the life of the tap, taking off the point of the tooth that projects on one land when the tap is sharpened by ordinary methods, and it is claimed to be equally valuable when sharpening chucking reamers, saving the use of a hone to take off the sharp corner.

PRECISION LEVEL

The Universal Boring Machine Co., Hudson, Mass., has just placed on the market a precision machine aligning level.

The design and construction is said to be different from previous levels. The frame is of cast iron, truss construction of sufficient strength to eliminate strains. The levelling surface is 27 inch long, which is claimed to be longer than the majority of precision levels on the market. The vial used is the best Jena Glass, especially ground, and is filled and guaranteed by a leading level maker. It is set in a brass japanned case which in turn is mounted on two lacquered brass studs one at each end. After adjustment the vial is locked by two nuts working against each other. The adjustment also has a cross travel. This ensures all adjustments similar to those on the finest surveying instruments.

The bubble in the vial has a guaranteed sentitiveness of 5 seconds of arc per graduation, equivalent to 0.0002908 of an inch per foot. The vial is carried in such a manner that protection from breakage is assured. The level casting is thoroughly insulated from the palm of the hand by means of a handle of non-conductive material. Distortion from this source is thus eliminated. The casting is first planed and drilled and allowed to thoroughly season. After the metal has proved its season, the base is hand scraped and tested. It is then allowed to rest for a period and is tested again. The vial is then adjusted. The instrument is finished in dull black, and a durable felt lined mahogany case protects the instrument. This is equipped with a strong brass handle thus enabling the instrument to be conveniently carried by service men on the road as well as a convenience for use in the shop. The weight is 9¾ pounds.

IMPROVEMENT TO SURFACE GRINDER

Several new features are incorporated in the line of Pratt & Whitney vertical surface grinders of the moveable platen type. Here are a few of the changes:

The ball bearing mounting of spindle has been completely redesigned, weight of the wheel unit being carried on springs set against the upper bearing. This provides an automatic take up so that no adjustment for wear is necessary. All openings are carefully guarded from grit and moisture by the interlocking construction of the parts. Lubrication in the upper section is provided for, the oil dripping from regulation oilers through the bearing and falling into whirling cups which throw it back into the bearing by centrifugal force.

In the lower section the oil is poured into a large reservoir, flows through the upper bearing and runs along the spindle to the lower bearing, the grinding wheel face plate acting as a retainer and ribs in this plate throwing the oil continually up into the bearing by centrifugal force.

An aperture in the column with a removable cover provides easy access to the spindle counterweight. The table drive has been strengthened by hardened shafts, gears and clutches, amply lubricated from sight feed oilers on the front of the case. The entire drive shaft unit may be easily removed as split bearings are now used.

Hand operation of the table has been simplified by providing a sliding gear in place of a clutch on the hand wheel shaft. The table reverse is assured of smoother action by means of a dwell in the pinion drive so that the table comes to a stop before reversal takes place. This practically eliminates shock of "jumping" and protects the clutch mechanism. The feed shaft has been fitted with a keyed coupling for easy removal of the main drive unit.

The idlers over which the main drive belt runs have been equipped with roller bearings lubricated by extra large grease cups in the ends of the stationary shaft. Frictional power losses are minimized and smooth running is assured. The spindle drive pulley is surrounded by a heavy sheet metal guard. The tank has been redesigned after numerous experiments. A series of baffle plates cast integral with the tank proper are provided with openings alternately at the top and bottom so that the solu-

tion flows over and under these plates in such a manner that in the last compartment where the solution is drawn off by the pump, a clean "free from grit" solution is obtained.

Cleaning the tank is a simple matter as the settling pan can be lifted off giving accessibility to all compartments. To add to the oil retaining capacity of the main drive cone at the rear, the hollow stationary shaft (keyed to the bracket) is supplied with grooves packed with felt. These grooves are connected to the centre oil hole.

The motor drive has been improved by making the motor base adjustable so that the drive belt can be adjusted correctly in relation to the step of the main drive cone. This prevents creeping and curling in the corner. The drive for the rotary tilting chuck (plain and magnetic) is now equipped with a flexible coupling which facilitates mounting.

This equipment can be easily mounted at any future time in case the machine is not so equipped when purchased. The demagnetizing switch has been improved to make the current reversal positive, quick and smooth.

SPRING PRESSURE ATTACHMENT

The E. W. Bliss Co., of Brooklyn, New York, have designed and marketed a combination spring pressure attachment for combination dies. This combination toggle joint spring pressure attachment presents to users of combination dies, particularly where lithographed metal is handled, advantages not to be had in the ordinary spring pressure attachments now in general use. It insures uniform drawing pressure on blank during the entire draw, producing a more uniform edge. The uniform pressure increases efficiency by minimizing strain on the metal, reducing wrinkles, breakage and wear on dies. The application of the toggle motion, in addition to giving a uniform pressure, reduces the total rubber or spring compression materially.

The strain on the press is reduced and a positive saving in operating power saving is made by the elimination of accumulative spring pressure. The reduction of compression adds considerably to the life of the rubber or spring.

Reduced compression allows the economical manufacture with combination dies of shells deeper than heretofore practical. It is possible by the use of the attachment, to reduce the number of operations where there is reducing operations to follow the first cutting and drawing operation. You also can make in combination and reducing dies certain work which formerly required double action dies.

Another advantage is that the reduced spring or rubber compression means proportionate reduction of "back-lash" of the press on the upstroke. The attachment does not interfere with the operator and dies can be removed the same as with the old style attachment. To install there is no change necessary in the press equipment. The new fixture is built in four sizes for standard Bliss presses, and the depth of draw obtainable on various sizes is as follows: No. 18 Press 1¼ inch depth of draw; No. 19 Press 2 inch; and on No. 20 press 2½ inch.

To obtain the maximum draws, given presses must have same stroke and die space as necessary with the old style attachment. While it is possible to draw in one operation a shell of greater depth than with the old style attachment, it should be understood that to get the maximum depth of draw, correct working proportions between diameter and depth of shell must be maintained.

NEW PRECISION INSTRUMENT

There has been recently placed on the market by the Young-Fischer Inclinometer Co., of Minwaukee, Wis., a new instrument known as an Inclinometer intended to take the place of the plumb, level or protractor in mechanical laboratories, machine shops and in all building operations where angles are to be determined, and particularly where extreme accuracy is rquired.

The Inclinometer is said to be a fully designed tool consisting of a machined case of cast metal containing an accurately adjusted gear train driven by gravity impulse. The hand on the degree dial moves in unison with the multiplying gears causing the minute hand to make 36 revolutions while the degree hand is making one revolution. The multiplying effect of the gear train is such that the instrument gives angle readings in degrees and minutes with accuracy corresponding to that of a single dial Inclinometer having a dial approximately ten feet in diameter.

CYLINDER RE-BORING TOOL

The International Purchasing and Engineering Co., Detroit, have marketed a reboring tool which is fitted with an individual motor drive. The motor is mounted as a part of the tool, no flexible shaft being employed. A friction clutch is incorporated between the motor and the tool, so that slippage is possible in the event that the cutter head becomes wedged, thus protecting the motor. The final drive is through a hardened worm wheel running in oil. Without making any disconnections, it is stated, the tool can be operated by hand or by the spindle of a drill press. The tool has a range of from 2¾ to 5-16 in.

The machine contains various features, including a solid hardened and ground feed bar that has no thread; heavy bearings 10¼ in. long; a tapered arrangement for fitting the boring head in the feed bar; six high-speed-steel blades, and a quick return feature that allows the boring head to be brought instantly to the starting point, also the elimination of split guide rings.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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What Can We Do to Help?

THE WEEK commencing October 9th, will be generally observed throughout both Canada and the United States as "Fire Prevention Week." The success of this annual campaign does not depend entirely on those responsible for the propaganda work, but the onus of responsibility dests equally as heavy on every man, woman, and child in the country. Very few people realise that over $300,000,000 goes up in smoke every year, or that each year sees an average of 18,000 lives lost through fire. On top of this alarming total, the figures show that some 60,000 persons suffer bodily injury in varying degrees. The stupendous amount of damage caused by fire should make people more careful, but unfortunately they do not seem to profit by experience as they should. It is this fact that makes fire prevention weeks essential.

The total fire loss in Ontario for 1920 amounted to $11,771,718. The loss to manufacturers alone was $3,508,524. This alarming total represents 483 fires, in other words. an average of $7.264 per fire. The causes of such conflagrations make interesting reading. Friction caused 38 fires, with a resulting loss of $299,312; electricity 618 fires with a $943,616 loss; stoves, furnaces and boilers 1014 fires with $895,341 damage; spontaneous combustion 16 fires, having a loss of $717,268; steam and hot water pipes, 5 fires, with a loss of $12,827; smoking 556 fires causing damage to the extent of $390.038, while rubbish and litter was the means of creating 179 fires with a damage bill of $162,760. These figures cannot be denied. They stare us in the face, and should stir us to greater effort to stamp out this seemingly constant evil. How can we cope with the situation?

During fire prevention week, lithographed wall hangers will be scattered broadcast over the country. These will reach schools, libraries, factories, etc., and will be placed in every town an dvillage, even to the very smallest. In addition to this, suitable booklets, placards, letters, and other miscellaneous literature will be sent to all branches of the industry. The pupils of the public schools, colleges, and universities, will receive medals for essays on the subject of "Fire prevention in the home and factory," and many other education features will be inaugurated. All these movements are very essential and will accomplish much good, that is, IF WE, as true citizens of Canada. do our part in making the campaign a success.

Let the mayors throughout the country issue proclamations, calling the attention of merchants, manufacturers, and home dwellers to the danger of fire, and means of prevention. Let us individually start a clean up movement, getting rid of all rubbish. Clean those chimneys that should have been done long ago, see that factory aisles are kept clear, and that no oily waste is left lying around. Get away from the habit of throwing matches carelessly around, and see that all electric wires are well protected. Do not give the demon of fire a chance to show his head. Smother his activities, and the best way to accomplish this is by exercising care and judgment in the prevention of such a danger.

Architects, engineers, and contractors, know quite well that structures can be built which are firepoof in almost every particular. They know that in such a building a fire could be speedily extinguished. yet how many firms are short sighted enough to leave themselves open to the fire danger by using some old structure that is nothing short of a fire trap.

All these changes for the better cannot happen at once, but by constant plugging, we can at least improve conditions day by day. Let us decide to forget the term "Fire Prevention Week," and make instead, each succeeding day one of bigger and better effort in stamping out of the fire evil. We are told that eternal vigilance is the price of liberty. We naturally wish to be free from the fire hazard, and there is only one road to freedom. We must combine our efforts, each branch of the various industries doing their own especial part. It is another case of "United we stand, divided we fall." The campaign about to commence will not be the success it should, if we do not get behind the movement as a nation. Make up your mind to be a booster of fire prevention. Do not merely talk about it, but act as well. If everybody will do this we will soon be able to practically disperse with our present fire fighting forces.

Cheaper Means of Transportation

CAN you imagine an automobile made from cotton, and driven by power generated from coal dust? Personally, we cannot picture such a means of transportation, but Roger W. Babson, head of a statistical organization in the United States, claims that while such radical departures in the design of automobiles may not come immediately, they are within the realms of possibility.

Speaking further on the subject, Mr. Babson says:—

"The principal factor in the decline of the automobile industry has been the steady increase in the price of gasoline. The car of the future will be run by other fuel. Already, the use of coal dust has passed the experimental stage. In my opinion it will be used extensively within a short time.

"Lighter cars must be manufactured in order to cut down the cost of manufacture and maintenance. Steel is too heavy for use in automobile construction and aluminum is too expensive. A composition of cotton, glue and formaldehyde is being used to produce a material that may solve the problem. Paper pulp, formaldehyde and glue are now used in making tubs, buckets and other articles. By substituting cotton for paper, the strength of the composition is enormously increased."

When one considers the modern and efficient methods employed in the production of the present style of automobie bodies, it is questionable, even should Mr. Babson perfect a cotton body, whether he could produce it much cheaper than at present. Were we inclined to be of a so-called humorous trend, we could elaborate on the trials which a cotton body would go through while a beginner mastered control of his car.

Powdered coal as a motor fuel sounds more reasonable than the cotton type of body. Experiments have been progressing favorably with powdered coal, although to our mind, this form of fuel will never supersede the present liquid form. Gasoline will no doubt be replaced by some other liquid that will sell cheaper, but it is doubtful if this will occur for quite a time as experiment for a gasoline substitute are still in their infancy.



MARKET DEVELOPMENTS



Steel Production Expected to Increase Shortly

Sheet Industry Is Operating at About 75 Per Cent. Capacity—Wire Mills are Running at 50 to 75 Per Cent.—While Tin Plate Mills are Fully Double the Rate of Last July

THE PRESENT market situation continues to show signs of renewed activity. While we cannot report any substantial business, we can truthfully say that if enquiries are any guide to go by, business is about to be placed. Some of these enquiries may take time to develop while others again look like real orders in the very near future.

Pittsburg reports that the sheet industry has reached the 75 per cent. production mark, and that oher mills also show a considerable increase in this respect. The steel ingot production however is only 33 to 35 per cent. of capacity. Steel production is expected to increase during the next few weeks.

15,000 tons of foundry iron has been purchased by a large American concern. The price paid for this material varied somewhere but foundry iron is quoted around the following figures. Bessemer $20; $19.25 to $20 for basic, and $21 for foundry, f. o. b. valley furnaces; the freight to Pittsburg being $1.96.

Machine tools are not especially active. Second hand and re manufactured tools seem to be more in demand than the new machines.

The small tool market plods away at its regular gait, and the scrap situation can well be said to be asleep at the switch. Nobody seems to interest themselves in the latter market and no improvement is looked for at present.

SHEET INDUSTRY IS OPERATING AT 75% CAPACITY—OTHER INCREASES

PITTSBURGH, October 6.—The great decline in steel prices having very nearly ended last July, while in the past three or four weeks wire products and sheets have definitely advanced, the three "heavy rolled products," bars, shapes and plates, are now the center of interest in the matter of prices. The demand for these products, in proportion to the productive capacity has been much smaller than the demand for lighter products, including wire products, sheets, tubular goods and tin plate, otherwise they would have experienced little difficulty in striking a low point in price and then rebounding. A demand would help both movements. A decline would be facilitated, for when there is open competition it is through large inquiry, not by miscellaneous carload buying however extensive, that prices are pushed down, while when mills become reasonably well filled up prices rebound with no effort.

For a couple of weeks past it has been evident that some of the producers, including the Steel Corporation, have been making a particular effort to round up tonnage in bars, shapes and plates in the hope of so strengthening their position that they could put up prices. It looks now as if the movement will be a success in the very near future. Repeatedly in the past few months the Steel Corporation has officially stated that it is meeting competition, and thus it cannot have formal prices, rigidly adhered to. For it to do that would be simply to "hold the bag" for independents. A peculiar announcement was made as to the Steel Corporation on September 26, to the effect that its prices were 1.65c on bars and $1.75c on shapes and plates. The peculiarity was that it was not plain whether such prices meant an advance or a reduction. There had been no formal statement as to prices since the corporation announced 1.75c on bars and 1.85c on shapes and plates. From this viewpoint the new prices would be a reduction of $2 a ton. From prices the corporation and others had actually made on sales, 1.60c and occasionally less, the newly announced prices would be an advance. At the moment the condition seems to be that the majority of sellers, including the Steel Corporation, are making a strenuous effort to book orders with the intention of firming up as soon as possible to 1.65c for bars and $1.75 for shapes and plates as absolute minimum. In most cases orders only are accepted, with specifications attached, though the seller is willing to distribute deliveries, not requiring the buyer to take deliveries, as fast as the mill could make shipment. While the fact is not admitted, it is possible that some of the independents would take business without the entire tonnage being actually specified at the time.

Turning Point in Prices

All that has occurred in the finished steel market lately is along the same line, that a turning point in prices has been rounded. The long decline is over and prices are getting on a better basis. It does not follow that a general and prolonged advance has begun. Prices may go up for a few weeks, possibly a few months. Then there may or may not be a slight reaction downward, probably to be followed by another upward reaction. The long swing downward had to come to an end, despite the views of many buyers that prices could go only one way, and a swing upward would probably have to come to an end also in less time than have some upward swings in the past like, for instance, the one that began in 1904 and had plain sailing for about three years.

Hoops and bands, a minor commodity, had a turn recently, being now well established at 2.25c. Finished steel prices are now quotable as follows: Bars, 1.60c to 1.65c; shapes and plates, 1.60c to 1.75c; blue annealed sheets, 2.50c; black sheets, 3.00c; galvanized sheets $4.00; tin plate $4.75 to $5.25; plain wire 2.60c; galvanized wire, 3.10c; wire nails, $2.90; cement coated nails, $2.45 hoops and bands, 2.25; standard steel pipe, 68½ per cent basing discount.

Mill Operations

In the last week before the sheet advance of $5 a ton became effective the American Sheet & Tin Plate Company (Steel Corporation) had the largest sheet bookings for any week in its en-

tire history. The independents had also had large bookings As a result, while the sheet market is naturally quiet now with the higher prices ruling the sheet industry is operating at about 75 per cent of capacity, its best rate for nearly a year, and the best rate shown for any finishing branch of the steel industry. The various wire mills, also aided by a recent advance which had brought in tonnage at the old prices, are running at 50 to 75 per cent. The pipe mills in most cases are running at 40 to 50 per cent. Tin plate mills are running at 50 to 60 per cent, or at fully double the rate of last July, when there were large stocks of tin plate at mills, also large stocks of various goods packed in tin plate containers.

With percentage rates like these obtaining it is nevertheless the case that steel ingot production is running at only 33 to 35 per cent of capacity. The rate of steel production is held down by the low production of bars, shapes, plates and rails, which count much more from the mere tonnage standpoint than do the lighter lines.

Expectations are that steel production will continue to increase during the next few weeks. Much ground has really been covered already, since ingot production dropped just under 20 per cent at the middle of July, and an increase to 33 per cent is good enough for a trifle over two months. By the end of November the rate should be between 40 and 50 per cent. Unless there are unexpected developments in railroad buying and buying for large construction jobs generally the rate will hardly go above 50 per cent this year, and a little backset in December and January, which are usually dull months in the steel market is to be expected. Then, by early spring, a general and important further revival in steel demand and mill operations is confidently expected.

Pig Iron

Each month Messrs. W. P. Snyder & Company compile average prices of Bessemer and basic pig iron from actual sales of valley iron reported as made in the month in lots of 1000 tons and over. The September averages were $20 for Bessemer and $19.25 for basic. At about the beginning of September there was a general advance in the asking price on basic iron from $19 to $20, but it seems all the sales were made at $19 25, neither at the old price nor at the new asking price.

The Standard Sanitary Manufacturing Company, which has been operating practically full time of late, has brought 15,000 tons of foundry iron for fourth quarter delivery, 5,000 tons for each of its three plants, Louisville, Ky., Pittsburgh, Pa., and New Brighton, Pa. For the Louisville plant southern iron was bought at $19, Birmingham, while for the other two plants valley and Western Pennsylvania iron was taken, chiefly at $21, valley, though it seems a little iron was picked up at a concession The market is now quotable at $20 for Bessmer, $19.25 to $20 for basic and $21 for foundry, f. o. b. valley furnaces, freight to Pittsburgh being $1.96.

POINTS IN WEEK'S MARKETING NOTES

During the past ten days a renewed confidence has made itself felt in the iron and steel market. One large steel merchant reports that if the next two weeks continue to be as good as the ones which have passed, it will be the best months business in over a year.

Very little British steel is being imported. Canadian and American mills seem to be furnishing the trade successfully. Some small rush orders for steel have been shipped to Europe, but such a condition is not expected to last long.

In the Montreal market, second hand tools are more active than new machines. The prices on machine tools have been cut somewhat recently, and it is expected that such machines will move faster in the near future.

Bars, Shapes and Plates are now the center of interest in the matter of prices. The demand for these products, in proportion to the productive capacity, has been much smaller than the demand for lighter products.

The finished steel market seems to have rounded the turning point. Prices are getting on a better basis and some think that prices will go up further in a few months from present date.

Hoops and bands are now well established at $2.25. Bars are quoted at $1.60c to 1.65c; shapes and plates 1.60c to 1.75c, blue annealed sheets 2.50c; black sheets 3.00c; galvanized sheets 4.00c, and tin plate at $4.75 to $5.25.

Boiler tubes are down in price this week. The changes are shown in our quotation sheets.

The sheet industry is now operating at about 75 per cent capacity. This is its best rate in over a year, and the best rate shown for any finishing branch of the steel industry.

TUBES AND DRILLS SHOW DROP IN PRICE

TORONTO, October 6th.—In spite of the fact that no large orders are being closed, one cannot complain regarding general market conditions. Even the dealers themselves admit they have no reason to kick, for all things considered, business is fair. The only point which causes concern is the lack of stability. One week business will pick up in such a way that everybody gets their desk cleared for the general rush, but alas the very next week business has dropped into a rut once more. Judging from the number of enquiries floating around, there is business to be had. Several firms, according to some dealers, must be on their last legs so far as supplies are concerned, and are holding out to the very last minute hoping for a still further drop. As one dealer puts it: "those type of buyers are due for a drop themselves, for they will find, much to their sorrow no doubt, that prices are as low as they possibly can be, taking all productive costs into consideration. When they do come into the market they may be held up for delivery, where by placing the business now they can be assured of receiving their goods within a reasonable length of time."

This holding off policy seems to be existent in practically all trades of the market. Machine tool dealers, perhaps more than any others, feel the brunt of this movement. "We know some firms at the present time who know they require equipment, and who also know we can supply them efficiently, yet refuse to buy, until the very last moment." Another dealer claims that his line of remanufactured machine tools are selling much better than new machines. Second hand tools, which are almost the same thing, are moving at a fair rate of speed. In fact we know of one concern that frankly admits they make more profit out of such sales than they do on new tools. "Our prices on new machines are so low" says this dealer, "that the margin of profit is hardly worth while."

The Steel Market

The steel market continues to show seasonable improvement in many lines. The increased price on sheets of $5 per ton, which was announced last week, is making itself felt in the Toronto market. Some dealers have in turn stiffened their prices to cover this increase, while others again have held off until they see if any further advancement takes place. Speaking on the matter one dealer remarked to Canadian Machinery that although he had not so far advanced his price he intended doing so. "It is my contention" he said "that the moment prices go up at the mills, our's should increase automatically. When prices drop suddenly, customers naturally expect us to drop our prices at once, and we have to doso, so that it is also reasonable to say that we should stiffen our lists just as quickly."

While sheets went up, tubes came down, and these new prices are included in this week's quotation pages. The lap-welded tubes are the ones affected, the reduction varying according to the size of tubing. The reason given for the reduction, is that tubes have been slightly higher in level than they should have been, and this downward movement now brings them to their proper level.

Small Tools

The small tool market also shows some changes this week. Carbon and high speed drills have dropped roughly 10 per cent., these changes being all recorded in this week's quotation list. Business in small tools remains much the same as last week. Plant owners have not got away yet from the hand to mouth policy, so that the orders placed are by no means large. In another portion of the present issue we mention the possibility of a large automotive concern placing a good sized order for small tools. More than likely this business will be scattered around the country, rather than placed with one or two concerns.

When we speak of the scrap metal market, we refer to a very sick party. Not only is the market weak, but there is no present indication that things will improve before the next market letter is written. Nobody seems to take an interest in this section, and buying of scrap is almost unknown. The best thing to do is to leave this market alons, and look to the other sections for encourage- West reports better conditions and say West rep s etter nd t ns and ay that farmers are out to buy. It may seem a large stretch of the imagination from the farmer's purchases to our own market, but indirectly this movement will have its uplifting effect. The movement for a new machinery hall at the Toronto exhibition is still under way, and the various manufacturers have been asked to guarantee the reserving of certain space for the necessary length of time. Once they do this, and go into the cost of such a building in detail, we can expect something definite. So far, the approximate cost has been stated, and we can look for some further development in the near future. We badly need such a building, and it is to be hoped manufacturers will get behind the movement.

IRON AND STEEL MARKET IS ACTIVE DEMAND FOR PIG IRON GETTING BETTER

Special to CANADIAN MACHINERY.

MONTREAL, October 6th—From practically all sources comes the report that, during the last ten days a renewed confidence in the iron and steel markets has appeared. The poor business conditions of the last year, sometimes described as the "buyer's strike," seems to have disappeared. Inquiries for quotations for a variety of lines are coming in with a regularity that seems to convey the unmistakable impression that confidence in the iron and steel market has been restored. Inquiries have resulted in orders in many cases. One large firm of steel merchants state that if the next two weeks continue to be as good as the past two, it will be by far the best month's business they have had in more than a year. The volume of business, however, is only fair, and if judged by standards set up in the last five years, it is only small, yet it is a distinct improvement over business conditions of the last ten or twelve months.

It is hard to assign a reason for this change of conditions, but the change is here nevertheless. Some say that the consumer has realized that prices are at last down to the low level. In many instances iron and steel quotations are practically made at production costs. Stores of materials have been depleted and buying has been of the "hand to mouth" variety and not for store purposes. In a few lines, such as pig iron, prices have increased lately as the demand grew greater. Thus as liquidation in many lines has been completed, stability is being attached to price lists, and no doubt the next change in price of many lines will be an upward revision.

The non-ferrous metals have not responded to the general conditions in as great a measure as the iron and steel trades. Very little British steel is being imported. Canadian and American mills seem to have been furnishing the entire trade. One English firm having a branch office here, states that there have been instances lately where some European rush orders could not be taken care of by British mills and that the steel has been shipped from Canada. This is hardly a condition that will be permanent and in most cases the orders have not been large. It is, however, gratifying to know that we are taking advantage of such opportunities to develop our export trade in steel. Eventually there is little hope of exporting our steel to Europe, but an export trade to other points in the British Empre is possible of development. In summing up the market conditions one seems assured that steel will be much more active in the next few months.

Pig Iron

Pig iron shows no change in price during the past week. The demand has been somewhat better, and it has been interesting to note some comments of consumers on the various merits of machine cast, and sand cast pig. Many producers are now manufacturing the machine cast article and are very successful in disposing of same although they have received many objections from foundrymen. Experiments seem to show that the irons are equally serviceable and it will eventually resolve itself into a problem of the cost of production. The foundries locally are doing only a small business and the recovery here seems to be slower than in other lines.

Machine Tools

The machine tool market has not shown a great deal of improvement, although inquiries seem to be coming in more freely The sale of rebuilt machines, however, appears to have been taking the place of the sale of new machines.Good values along these lines are being offered. Prices naturally are not stable. Recently, machine tool manufacturers have shown a tendency to cut prices, and, as soon as general conditions improve machine tools will start to move. However, the conditions in this line of trade are so dependent upon general commercial conditions that the future is hard to forecast.

Small Tools and Supplies

There is a distinctly better tone to the small tool market. Drills to be used in railway shops are fairly active at present. Other lines are moving in a more encouraging way. Liquidation of the war time supply seems to be gradually becoming a factor of less influence in this business. Price lists are being stabilized and the general impression is that manufacturer and consumer are getting "squared away" for normal conditions.

Non-Ferrous Metals

Very little change in prices in this line have occurred during the past week. The market has been dull. The brass foundries have not come into the market yet and the electrical companies are getting some of their copper from the United States as the present customs arrangement rather favors the consumer purchasing direct as against purchasing from the jobber, who has to pay a higher rate of duty. Canadian mills rolling copper do not seem to have been getting their share of the local business. The mill at Trail, B. C. is closed.

Lead and spelter are quiet, also antimony and aluminum. The foundries not having responded to the general improvement in the same measure as some other branches of the metal business, the scrap metal market is still inactive. From week to week conditions do not alter. Until the foundries become an active factor the scrap metal market is bound to languish.

EQUIPMENT WANTED

W. H. Johnson, who operates a machine shop, at Barrie, Ont., is in the market for a 20 inch drill with an automatic feed to be used for boring cylinders. Mr. Johnson informed Canadian Machinery that a good second-hand machine would do for this purpose, and that he would be glad to receive quotations on same.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electrolytic copper	17 00	17 50
Castings, copper	16 75	18 00
Tin	34 00	39 00
Spelter	7.25	7.50
Lead	7 50	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 9 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	8 00
Red brass turnings	7 00	7 50
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 0
Nuts, square, tapped	add 2 2
Nuts, hex., blank	add 2 2
Nuts, hex., tapped	add 2 7
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 5
Structural rivets, as above	8 4
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40
Square and hexagon head cap screws	Less 30
Round head cap screws	Plus 10
Fillister head cap screws	Less 10
Flat head cap screws	Net li
Button head cap screws	Plus 10
Studs	Less 20
Semi-finished nuts up to and including 1-in.	Less 35
Semi-finished nuts 1⅛ to 1½"	Less 30
Semi-finished nuts 1⅝ to 2 in.	Net li
Coupling bolts	Plus 10
Taper pins	Less 40
Planer bolts without fillet	Plus 40
Planer bolts with fillet	Pus 50
Patch bolts	Plus 80
Hollow set screws	Plus 20
Thumb screws	Less 35
Thumb nuts	Less 65

BILLETS

F.O.B. Pittsburgh.

	Per gross t
Bessemer billets	$43
Open-hearth billets	43
O.H. sheet bars	39
Forging billets	48
Wire rods	48

NAILS AND SPIKES

Wire nails, base	$4
Cut nails, base	5
Miscellaneous wire nails	50

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10
Packing, square braided	0 38
Packing, No. 1 Italian	0 4
Packing, No. 2 Italian	0 3
Pure Manila rope	0 2
British Manila rope	0 2
New Zealand hemp	0 2

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Ne

"MONEY TALKS"

Time and again it has been proven that Geometric Self-Opening Die Heads and Collapsing Taps effect a saving of fully 50 per cent. over the slow and troublesome methods of producing Screw Threads.

One of the Highest Rated Manufacturing concerns in the United States has an equipment of at least 100 Geometric Die Heads and Collapsing Taps. Two of the Die Heads, they tell us, have been in use about 20 years.

For an estimate, we will say that on one Screw Cutting Job a saving of $10 a day resulted by using a Geometric Screw Cutting Tool. That is putting it very low.

Considering 313 working days a year, gives 6,260 days in the 20 years. Putting the saving at the low mark of $10 a day for each of the two 20-year-old Geometric Die Heads, represents a saving of $125,200 in the 20 years.

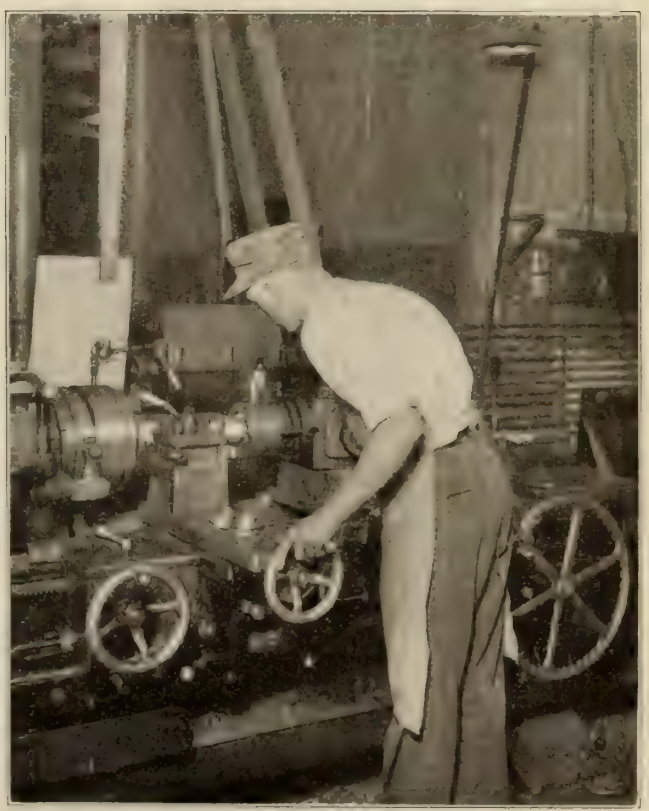
Right on the Lead

Yes, Sir, Money Talks!

and

GEOMETRIC

Self-Opening Die Heads and Collapsing Taps are Production Tools That Make It Talk



Geometric Die Head Threading Crank Shaft Packing Nuts, 2" - 12 U. S. F., 3" long.

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Vancouver, B.C., St. John, N.B., and Halifax, N.S.

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus 10	
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 50	6 00
Can. plates, all bright	7.75	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	8.00	
Fleur-de-Lis, 28 B. W. G.	7.50	
Gorbal's Best, No 28		
Colbornes Crown, No. 28.		
Premier, No. 28, U. S.	6 75	6.00
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.	.....	34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21	Atlas	.19
Peerless	.22	X Empire	.15
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.13½
X L C R	.16½		

Colored

Lion	.13½	Popular	.10½
Standard	.12	Keen	9
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.17	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ....10% Best grades..15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

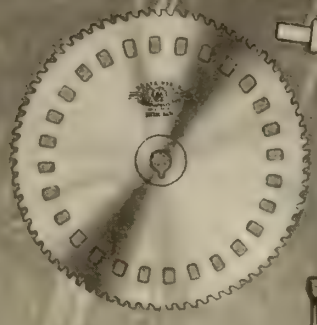
PLATING CHEMICALS

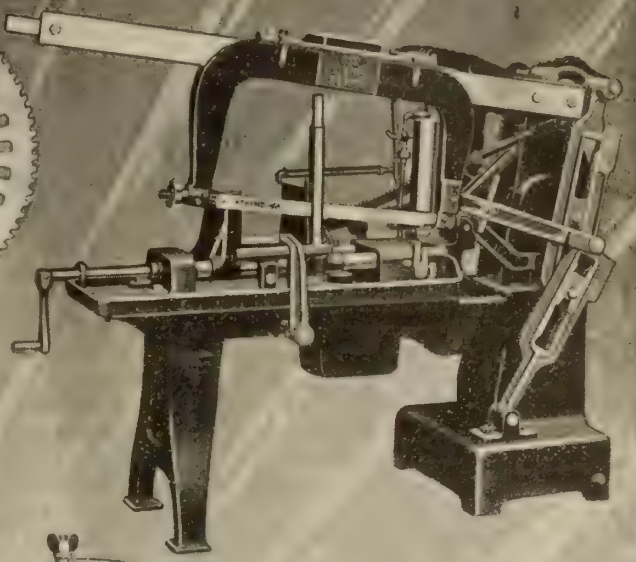
Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated

ATKINS STERLING QUALITY SAWS







O'er Land and Sea
North South East West

Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

"A Better Saw For Every Use"

Write for Catalog

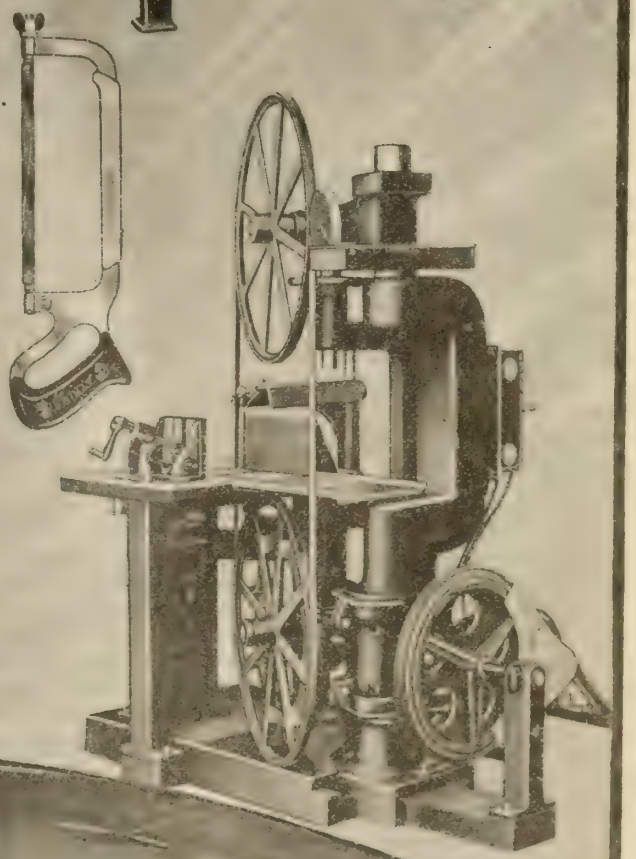
E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT.

Branch: VANCOUVER, B. C.

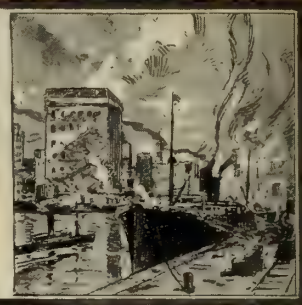






INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS PERSONAL AND TRADE NOTES



Industrial News

Sault Ste Marie, Ont.—The Espanola mills of the Spanish River Pulp & Paper Co., Limited, which have been closed for the past ten days, have resumed partial operations, one paper machine being put in operation.

St. George, N.B.—The Bonny River Lumber Company's mill, and the Wilson Box Company's mill have resumed work after being closed for six weeks. They employ about 125 hands.

The Town of Barrie has installed a 225 h.p. sterling engine, and a DeLaval Pump of 1,500 gallon capacity as an auxiliary to replace the present steam equipment.

Mr. J. H. Bennett, Light and Power Commissioner for Barrie, says that they will shortly install a 500 gallon DeLaval electrically-driven centrifugal pump to supplement the present electrical equipment. Mr. Bennett states that the substitution of the gas driven centrifugal pump as an auxiliary to replace the steam equipment will effect a saving of approximately $2,000 a year.

Sealed proposals will be received at the office of Mr. W. Thorburn, secretary of the Walkerville School Board, Walkerville, Ontario, until noon Wednesday, October 12, 1921, for furnishing all labor and materials and for the performance of all work required for the construction and completion of a Continuation School for the Town of Walkerville, Ontario, in accorance with plans and specifications already prepared. Copies of plans and specifications may be obtained at the office of the architects upon a deposit of $25.00, which sum will be refunded upon return of plans and specifications in good condition within ten days after contracts are let.

The semi-annual fall meeting of the American Gear Manufacturers Association will be held in the Powers Hotel, Rochester, N. Y., Octoger 13, 14 and 15. Interesting reports will be offered by the various committees on standardization and a strong program has been prepared including "Gear Tooth Wear" by Warner Gear Company, Muncie, Indiana; "Duraluminum as a Material for Worm and Other Gearing" by R. W. Daniles, Bausch Machine Tool Company, Springfield, Mass.; "The Grinding of Gear Teeth and It's Future in the Industry," by J. F. Barr, Secretary, The Gear Grinding Machine Company, Detroit, Michigan; "Tooth Forms" by E. W. Miller Chief Engineer, Fellows Gear Shaper Company, Springfield, Vt.; and "First Hand Impressions of Europe," by E. S. Saltelle, Assistant General Manager of the Tool Steel Gear and Pinion Company, who has recently returned from an extensive trip through Europe studying conditions there.

During the past week the feeling of the dealers, manufacturers, etc. in the Toronto District seems to indicate a marked improvement of outlook generally.

The Custom House returns for the Port of Toronto for September show an increase of entries and shipments of approximately 20% over the previous month. This certainly indicates a substantial increase in general trade, which at the present time is most encouraging.

There has been a general cut in prices of agricultural implements ranging from 15% to 30%. Almost immediately following this announcement comes the most cheering report that Massey-Harris Co. are re-opening the Toronto plants which have been closed for some time. The International Harvester Co. of Hamilton are also reported as taking on more men, while the Cockshutt Plow Wks. expect to gradually reach normal production again at no distant date.

It is reported that the English Electric Co. which recently entered the Canadian field are considering the erection of a large plant in the Ashbridge Bay Industrial district, Toronto. This company is now operating the Crocker-Wheeler plant, St. Catharines.

In Hamilton and district, the general feeling is much more optimistic than it has been for some time past. Many Hamilton plants have announced improvements in trade and are re-opening. In other cases where plants are running short time now they are getting back to full time and taking on more men. The most notable items in this respect are annuoncements that B. Greening Wire Co. are re-opening with complete staff on full time, International Harvester taking on more men and two large textile plants, Zimmerman-Reliance, and Canadian Cottons, going back to full time.

Johnson Bros., 1536 Dundas W., Pattern makers, Toronto, were burnt out completely last week. They have since moved to the factory of the Canadian Rumley Co., 48 Abell St., where they are starting operations at once.

Mr. MacIntyre the owner of the Empire Tool Works, rear 100 King W., has just had two special machines installed for the manufacture and grinding of piston rings. He says these machines work at particularly high speed, and are of late patented design. He also states that there are only two places in the U. S. operating this type at present, and none in Canada other than his own.

A. G. Milton, 67 Frederick St. machinery dealer says that he had a better month during September for the sale of electrical motors (used) than any other during the year.

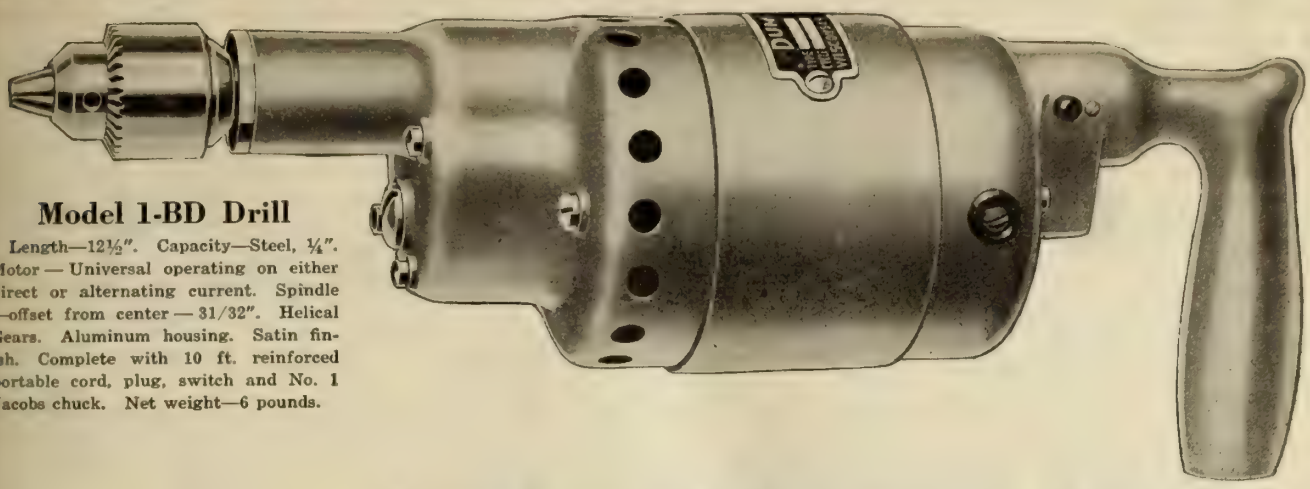
Engineering News

IF there is one thing more than another which has contributed to a feeling of confidence among manufacturers during the period of "returning normalcy," it is the number of inquiries that are being received for goods and equipment. While it is a fact that but few of these have developed into actual business, still they are taken to indicate an underlying vitality which must eventually work to the surface.

In Welland, B. J. McCormick, Industrial Commissioner, points out that the large plants which pulsated with business up to the middle of 1920, are now somewhat inactive. Some of them report, however, that, judging from inquiries, they will not long remain dormant. It is reported of one concern that should it land a certain contract on which it has been figuring it will be necessary to extend plant and buildings by 50 per cent.

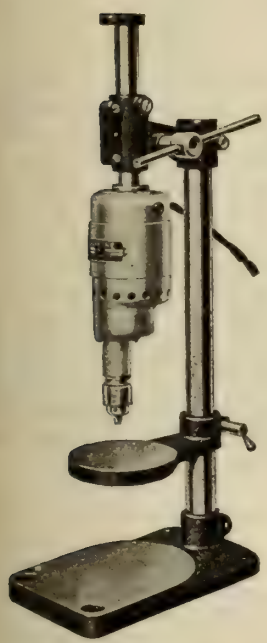
As previously announced, Welland is adding a barrel factory to her list of industries, while at Dain, two miles to the south, the Frost Fertilizer Co., is planning to locate. At Port Robinson, Hydro Appliances, Limited, will produce washing machines. In and about Welland, therefore, things move steadily onward to the time when the hum of industry will be creating again its wanted enthusiasm.

The Volta Manufacturing Co., Welland, has developed an electric water heater for domestic use. It has stood required tests and is now ready for the market. The water jacket is a solid casting with three chambers, which are heated by two elements fitted into seats in the centre of the jacket. An ordinary thumb button is used to turn the elec-



Model 1-BD Drill

Length—12½". Capacity—Steel, ¼". Motor — Universal operating on either direct or alternating current. Spindle —offset from center — 31/32". Helical Gears. Aluminum housing. Satin finish. Complete with 10 ft. reinforced portable cord, plug, switch and No. 1 Jacobs chuck. Net weight—6 pounds.



Model 2-BD Bench Drill

Motor specifications identical with Model 1-BD.
Height—20½".
Stroke—3¼".
Rack and pinion feed.
Capacity—Steel, ¼".
Drills to center of 7⅞" piece. Ball Bearing thrust. Aluminum housing. Adjustable table. Complete with 10 ft. reinforced portable cord, switch, plug and No. 1 Jacobs chuck. Net weight 21 pounds.

Handy—Efficient—Powerful

DESIGNED by men who know the practical advantages of small, light tools that get to the spot where needed without waste of time, Dumore Drills save time, money and energy. Equipped with perfectly balanced motors, Dumore Drills are accurately built and have an almost unlimited range of usefulness. For speed and accuracy on fine and sensitive jobs Dumore Drills will supplement the work of your big machines—adding to the capacity of your shop and cutting down production costs on many classes of work.

Send for details of how you can use Dumore Drills to advantage.

Wisconsin Electric Company

2940 Sixteenth Street **Racine, Wisconsin**

DUMORE GEARED ELECTRIC DRILLS

tricity on or off, or there may be thermostatic (atomatic) control, by which the water in the boiler may be kept at constant temperature as required.

Grey iron castings from an electric steel furnace now seem practicable at reasonable cost, according to Mr. Young of the Volta Co., Welland, who has been making experiments in Buffalo. Using cast iron borings, and not too clean at that, castings of fine grain which machine well, have been obtained at a cost of $20 a ton, when similar grades by cupola system run as high as $35 to the ton. The borings cost $5.50 a ton. Mr. Young says it is all a matter of lining and mixture of metal—and the method is quite marketable. It has been almost a matter of conviction that electric grey iron castings were not as machinable as necessary, but this difficulty seems to have been overcome. A grain that is ideal for piston rings or other jobs requiring fine fabric is said to be obtainable.

This has been one of the best years on record for the Pollard Manufacturing Co. Niagara Falls, Ont. They manufacture units for flour mills, and the demand has been increasing, not only in Ontario, but throughout the West. Each unit is a compact piece of equipment, with capacity of 50 barrels a day, by roller process. Many old mills are being dismantled and new machines installed, while in other cases millers of experience have set up independent plants, to serve local or country requirements. In addition to flour mill equipment, the Pollard people marble cutting machinery and are now also marketing a planer of open side design.

One of the busiest plants in Buffalo at the present time, is that of the Buffalo Steel Car Co. This is the result of an arrangement they have entered into with the railways to handle all repairs. Formerly this was done in car shops, which are now practically idle. One object behind the present plan is to secure definite data as to actual cost of such repairs. This is said to have been almost impossible before, or where some reliable information was obtainable the cost was shown to be excessive. It is understood similar plans are being carried out in Canada.

Some improvement is reported in the demand for woodworking machinery, although there is said to be considerable used equipment still in evidence.

A decision on tenders for $50,000 worth of small parts for motor cars, for Canadian Products, Walkerville, is expected early in October.

A public utilities building is being erected in Galt. This will house electric gas, water and other departments of public service. Many men have found employment in Galt this summer on pavement work which has been so long required on two of the more important approaches to the city. Water street pavement is now completed and is now a splendid thoroughfare.

The Semet-Solvay Company may establish a gas and coke oven plant in Hamilton next spring. The proposed unit will cost $3,000,000 and will take over 12 months to construct. The company officials believe that both material and labor costs will be lower next year, and a site in the eastern section of Hamilton is likely to be chosen if this company definitely decides to establish in that city.

Marine News

Work on the raising of the G. G. M. M. steamer Canadian Recruit, which sank near Stone Pillars on August 18 after collision with the steamer Maskinonge, is now progressing rapidly and it is hoped to have the vessel afloat again inside of two weeks, according to officials of the Canadian Government Merchant Marine. Two iron tanks, each approximately 24 feet by 18 feet, are now under construction by Lachance, Limited, of Quebec, who have charge of raising the vessel, and when these are finished they will be taken by barge to where the Recruit lies, then filled with water, one sunk on each side of the steamer and then lashed in place. It is expected that by pumping the water out of the tanks their buoyancy will be sufficient to raise the vessel easily. Mr. J. L. Lachance, is himself superintending the work, which is being rushed, as it is the desire of the firm to have the Recruit raised inside of three weeks, or at least before the cold weather sets in.

Personals

W. D. Ross, one of the directors and vice-president of the Nova Scotia Steel and Coal Co., says that there are evidences of a better demand for steel. Inquiries are more mumerous than for some time, says Mr. Ross, I believe that when the steel business comes back to its own the corporation will be in fine shape to take advantage of the market conditions. At present the rail mill and the wire mill of the Dominion at Sydney are operating, and some work is also being done by the Nova Scotia Steel plant at New Glasglow. In no case, however, are the mills operating to capacity. There has been a considerable improvement in the coal business, the mines of both the companies being busy. A good trade is being done in coal in the St. Lawrence this year.

Hon. Edward Brown, Provincial Treasurer of Manitoba, was in Toronto a few days ago, and amongst other optimistic statements, he said that the business outlook showed much improvement. "The wheat market is very satisfactory this year," he said. "The farmers are selling and there appears to be no disposition to hold. Money is circulating, and the outlook generally is more hopeful."

Obituary

James Edwin Frost, a director of the Frost & Wood Co., and a director and secretary of Smith Fall's Malleable Castings, Ltd., died recently at his home in Smith Falls. Mr. Frost has been in rather poor health lately and had to hand over his active part in the business some time ago.

Alexander Fleck, president of Fleck, Ltd., Vulcan Iron Works, died recently at Ottawa. Mr. Fleck was 54, and early in his career he started a foundry and machine business with his father. Later on he went into partnership with Thomas Stewart, and still later became sole proprietor of the above mentioned company.

RAILROADS WILL START REPAIR WORK

Will Soon Start Extension Repair Work —Will Purchase Steel for Spring— Co-operation of C.P.R. Will Be Asked

Hon. J. A. Stewart, who has just returned to Ottawa from Montreal, says that he has spent a couple of days in conference with the chief Executives of the Grand Trunk and Canadian National Railways. The unemployment situation in its relation to the National Railways has been thoroughly canvassed, also the possibility of the railways so arranging their repair work and placing new orders so as to obviate, so far as possible serious unemployment during the winter.

Under normal conditions the practice is to place orders for steel rails and accessories in the early spring, but, in view of the existing situation, the department announces that the Government will authorize the Canadian National and Grand Trunk to place their orders in the immediate future.

In addition to repair work now being done in the railway shops, it is the intention of the Government to authorize the management to place orders for rebuilding and repair of freight equipment wherever it is feasible, providing the Department of Labor upon investigation, believes the local conditions may be thereby relieved. The Government will also bring the question of unemployment officially before the C. P. R. management with a view of having it act along similiar lines, and thus assist in steadying the industrial situation The Department of Railways states that it confidently anticipates the co-operation of this concern.

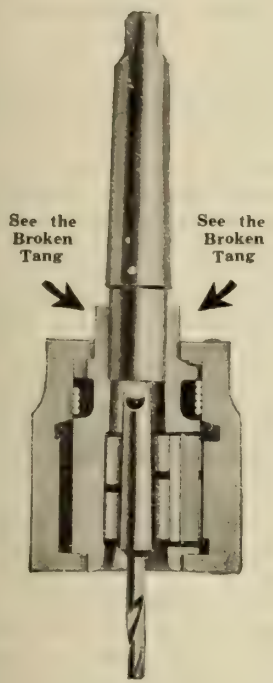
CANADA'S OUTPUT SHOWS DECREASE

Canada's pig iron output for August shows a considerable downward trend. The quantity of pig-iron and ferro-alloys produced during the month of August was nearly 4,000 tons lower than that of July. Pig-iron made by the firms for their own use dropped about 10 per cent., or 5,828 tons, below the previous month's figures. The output of basic iron was considerably higher, being 46,939 tons, as compared with 40,720 tons in July to 1,882 tons in Au-

Aikenhead's

The House That Sells You Quality

The lines of tools sold by Aikenhead's are not only extensive but they are chosen on a "quality first" basis. Keep these points in mind when you make out your next requirements.



The Wahlstrom Chuck

Grips the Entire Shank—Never Slips

If you want an automatic self-centering chuck, a chuck that is mechanically perfect, that never slips, choose the **Wahlstrom.** This quick-acting device is widely preferred because it works just as well with broken tangs as with good ones. The smooth, hardened and ground jaws grip on the **side** of the shank—a method that increases the life of the tools and at the same time reduces costs.

There's no time lost in waste motion with the Wahlstrom Chuck. It is automatic and instantaneous in action. It enables the operator to make tool changes in just two seconds, without stopping the spindle of the machine.

Made in two different styles. One style holds No. 1, 2 and 3 Morse Taper Shank Tools—with or without a tang. The other style is made in three sizes, which hold all sizes of straight shank tools from 1-4 to 1 inch.

Sent on ten days' trial.

Johansson

The World's Standard of Accurate Gauging

Johansson Gauges combine the advantages of both line and end measures. Like line measures they give all sizes within their range—like end measures they are convenient, solid, non-adjustable blocks of steel. The "Limit System" introduced by a set of Johansson Gauges to your shop will assure equal results on all work, even in the hands of unskilled operators.



Johansson Gauges save time, decrease costs and increase both the quantity and quality of the work. Made in twenty-one sizes, giving all dimensions from 0" to 12". They are readily set and sealed to any dimension within their great range.

Write, wire or call at

Aikenhead Hardware, Limited

17 Temperance Street, Toronto, Ont.

gust. This decrease was entirely in that which was made for the use of the producing firms.

The Algoma Steel Corporation reported only two blast furances in operation at the end of the month, one having been blown out during the period. This loss leaves a total of five furnaces operating and fifteen idle at the end of August. The blast furnaces active were as follows: Two at Sault Ste. Marie, one at Hamilton and two at Sydney.

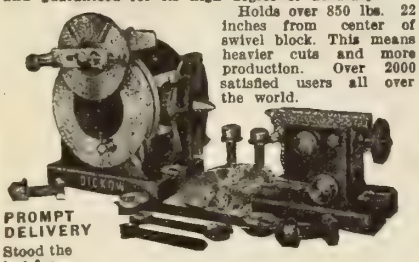
Steel Ingots and Castings

This month's production of steel ingots and castings, totalling 72,023 long tons, is the highest since November, 1920, being nearly ten thousand tons more than the amount produced in June, the previous record month of this year. The output of steel ingots showed an increase of 25 per cent., or 17,698 tons, over that of last month. Basic open-hearth steel accounted for the increase, this month's total being 70,088 tons, as compared with 52,111 tons in July, all of which was made by the producing firms for further use in their own plants. There was a falling-off in the output of electric steel ingots, 246 tons being produced in August, as against 523 tons in July.

The steel record production of steel during the current month raises the average monthly production from 50,000 tons to nearly 53,000 tons. The average for the first four months of the present year was 45,000 tons, while that for May, June, July and August is 25 per cent, higher or 60,000 tons.

Why Reduce Your Production

and waste money by using cheap, inaccurate Index Centers, when a few dollars more will buy a DICKOW INDEX CENTER, which is absolutely dependable, and guaranteed for its high degree of accuracy.



Holds over 850 lbs. 22 inches from center of swivel block. This means heavier cuts and more production. Over 2000 satisfied users all over the world.

PROMPT DELIVERY
Stood the test for 14 years.

Dependable and Accurate.

Write us to-day for complete description.

FRED. C. DICKOW MACHINERY CO. 3504 W. Lake St., CHICAGO, ILL.

"Maple Leaf"
BRAND
Stitched Cotton Duck Belting

"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.



Have us send you samples and see just why "Maple Leaf" sets the standard in economy, strength and durability.

Dominion Belting Co. Ltd.
Hamilton, Canada

Quebec Branch: 51 Duluth Bldg., Montreal

OUTPUT OF COAL IS MUCH LOWER

Value of Shipments Much Lower Output of Mines is Given Comparisons by Provinces

The coal output from Canadian mines during the first six months this year declined to 86 per cent of the amount produced during the corresponding period last year. It was however, five per cent in excess of the output for the same period during 1919, according to the Dominion Bureau of Statistics. With the exception of New Brunswick, none of the province showed an output equal to the 1920 record. New Brunswick produced 104 per cent. of its 1920 output and the other provinces follow in the order named: Saskatchewan, 94 per cent.; British Columbia, 91 per cent.; Nova Scotia, 87 per cent.; Alberta 79 per cent.

The total value of coal shipped during the period amounted to $32,882,953, and the average selling price reported ranged from $2.43 a ton for lignite coal from the different coal producing areas in Saskatchewan to $8.53 a ton for anthracite in Alberta. The average for the Dominion was $5.75. Following is the rate and value per province:

Provinces:	Output	Shipm't	Total Value	Aver. Value per ton
Nova Scotia.				
Bituminous—	2,750,319	2,257,261	$14,536,760	$6.44
New Brunswick.				
Bituminous—	69,230	65,768	377,508	5.74
Saskatchewan.				
Lignite—	145,394	136,670	332,108	2.43
Alberta.				
Anthracite—	46,402	10,357	88,419	8.53
Bituminous—	1,261,080	1,172,804	5,711,555	4.87
Lignite—	1,125,312	979,021	4,405,594	4.50
Total for Alberta—	2,432,794	2,162,182	$10,205,568	$4.72
British Columbia.				
Bituminous—	1,385,323	1,094,405	$ 7,431,009	$6.79
Total for Canada—	6,783,060	5,716,285	$32,882,953	$5.75

TRADE IN MACHINE TOOLS HAS INCREASED

Despite a heavy falling off in tonnage of general machinery imports and exports of Great Britain in 1920 and 1921, as compared with 1915, the trade in machine tools has actually increased according to figures compiled by the American Consulate in London, England. Imports of machine tools during the first six months of 1921 says the report, were 10 per cent above the figure for the first six months of 1913, while in exports the corresponding increase was 5% per cent.

Machine tool imports were 3.63 per cent of the tonnage of all machinery imports in 1913; 16.8 per cent, in 1920 6.36 per cent in 1921. Similar figures for exports show 2.47 per cent in 1913 4.95 per cent, in 1920; 4.69 per cent, in 1921. In value, these figures would be slightly increased, due to the fact that machine tools average higher in unit value than the balance of the machinery entering into British imports and exports.

Textile machinery formed the largest 18,007 tons and 4,911 tons respectively Agricultural machinery provided the largest tonnage of imports in 1913 and 1921, with 18,007 tons and 4,911 tons respectively; and, with 4,685 tons in 1921 stood second to machine tools with 7,1[illegible] tons.

According to the Canadian Pulp and Paper Association, the pulp trade is back to the level of 1919. The exports from Canada for the four months of 1921 are far below the 1920 figures.

These figures show a total value of $5,796,155 for 1921 (July) for paper against $6,877,014 for July, 1920. Total value of pulp was $2,870,401, against $9,137,733 for July, 1920. Pulpwood to the value of $995,039 was exported to the United States in July, 1921, compared with a value of $1,545,906 in July, 1920. Returns for four months to July, 1921 of paper, pulp and wood, as compared with the two preceding years, are: 1921 $34,035,576; 1920, $56,555,423; 1919 $30,327,477.

ENGINEERS PLANNING POWER TRANSMISSIONS
Secure Data and Estimates of "MORSE" DRIVES
SAVE Construction, Space, Light, Fuel. Producing More with Less.

MORSE CHAIN CO., - ITHACA, N.Y.
Engineering Service, Assistance, Bulletins

Atlanta, Baltimore, Boston, Charlotte, N.C., Chicago, Cleveland, Detroit, Kansas City, Minneapolis, Montreal, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis

New Catalogues

The Heald Machine Co., Worcester, Mass., have issued a book on "Cylinder Mass.,have issued a book on "Cylinder Grinding," which is very complete. The subject has been covered not only from the stand-point of the advantages in regrinding, together with the proper equipment to use, but problems have also been discussed which are likely to come up with every concern going into this business. The book contains 120 pages, and is worth while as a handy reference alone.

* * *

The Williams Tool Corporation, Brantford, Ont., have published a book entitled "Don't let it happen to you." The book is really written for the man who operates or owns a pipe threading machine, and contains many hints of value. It takes up the care and repair of dies; machine troubles and their remedies, and other important matters.

* * *

The B. F. Sturtevant Co. Hyde Park, Boston, Mass., have sent us their catalogue No. 278 which explains their air conditioning apparatus. The matter is gone into very thoroughly, and the 48 pages are well illustrated throughout.

* * *

The Greenfield Tap and Die Corp., have issued their catalogue No. 46 which takes up almost 400 pages. All their lines of small tools are shown, and the back portion of the book is devoted to several data charts and tables of considerable value.

Book Reviews

The D. Van Norshand Co., 8 Warren St. New York, have published a book on "Elementary Machine Shop practice" James A. Pratt. M. E. the author, has divided the chapters into the following headings:—Bench and bench work; supplies and miscellaneous tools; hardening and tempering, machine adjustments, equipment and general tools. Next comes lathe tools; the lathe back rest; follow rest; compound rest; eccentric turning, etc. Then follow drill press work; shaper work; the slotter; grinder; milling machine; planer; gearing, and machine shop calculations. A machine glossary together with various tables, course outline, etc., closes the book. Taken as a whole this book should interest all those who are anxious to grasp the fundamentals of machine shop practice. The price is $2.50.

* * *

John Wiley and Sons Inc., New York, have issued through their Canadian representatives the Renonf Publishing Co., 5 McGill College Ave., Montreal, a book called "Elements of Mechanism." This is the third edition, and it has been rewritten, enlarged, and reset. Three authors, Peter Schwamb S. B; Allyne L. Merrill S. B., and Walter H. James S. B. are responsible for its contents, and each of these gentlemen hold responsible positions with the Massachusett's Institute of Technology. They have arranged the chapters as follows:—Revolving and oscillating bodies; belts, ropes and chains; transmission of motion by bodies in pure rolling contact; gears and gear teeth; wheels in trains; epicyctic gear trains; inclined plane, wedge, screw, worm and wheel, also cams. Next follows four bar linkage; linkwork; straight line mechanisms, parallel motions; and other various combinations of motion.

The book goes into the various subjects very clearly explaining the various problems and illustrations in detail. It is not a book for a beginner but rather for the student or designer of equipment who has a fairly good mathematical training. Various problems complete the reading matter, and if readers have been following carefully the instructions given previous to these problems, they should be able to solve them easily. The book is 6 by 9 and contains 427 illustrations, and 372 pages. The price is $3.50. Several colleges are at present using this book for study purposes.



DOMINION CHUCKS

STEEL OR CAST-IRON BODY
BUILT FOR HEAVY DUTY



All Screws Are Reversible

SCREWS are made of the best grade steel. Both ends are broached and are heat treated after machining. They are reversible, so that either end may be used, are large enough in diameter to stand the torsional strains applied by operator when setting up his work. They are made to give the best service—and may be depended upon to stand up under the hardest usage.

DOMINION STEEL PRODUCTS CO. LIMITED

Engineers • Manufacturers

BRANTFORD, CANADA

MAY SOON HAVE LARGE CEMENT PLANT

Owen Sound may have a large cement plant. At present the matter is being held up until the Ontario Government decides what it will do regarding the erection of a Government owned plant. For several months there have been rumors that the Government was lkely to choose Owen Sound as the centre of its operations in the manufacture of cement. The City Council of Owen Sound has been making efforts to learn the attitude of the Government, and it appears likely that the Provincial enterprise will not be launched. On the other hand American capitalists are contemplating the erection of such a plant, and in fact this syndicate was considering the proposition a year ago. The purchase of the Sun cement plant on the west side of the harbor was contemplated, and it was proposed to build additions that would make possible a 3,000 to 4,000 barrel production daily.

Since the first move was made by the Government the price of cement has dropped considerably, and it is understood that the excessive cost of entering the business has been another deterrent for the Provincial undertaking.

If definite assurance is forthcoming that a Government enterprise will not be started the privately owned business may still be started. Owen Sound men working on the project with a view to securing outside capital.

3238. **Trade with the Straits Settlements.**—The London office of a firm dealing with the Straits Settlements is desirous of receiving catalogues and other particulars intriplicate from Canadian exporters of products suitable for the Middle East.

Classified Opportunities

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (ctfm)

AGENCIES WANTED

WOULD YOU LIKE TO OPEN A BRANCH office in your own name in Canada at the minimum expense. This is one of the features of our proposition of representing first class British manufacturers in the Canadian market. A few more agencies can be handled. For further particulars write to Emmanee Sales Co., Hamilton. c 14 m

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

Used Belting, Pulleys, Etc.

We carry right in stock a large quantity of used Belting, Pulleys, Hangers, Shafting, etc., in good condition, which we sell at half the price of new. Inquiries solicited. In writing mention sizes wanted. L. S. Tarshis & Sons, 92 Wellington St., Montreal.

SUNCLO BRAND

WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

FOR SALE

ELECTRIC STORAGE BATTERY LOCOMOtives for sale. Two. 36-inch gauge. Complete and in good condition. R. T. Gilman & Company, Dept. "E," 211 McGill Street, Montreal. (ctfm)

ACETYLENE GAS CYLINDERS FOR TRANSFER 18 Type W. K. Acetylene Gas Cylinders for Disposal. If you are contemplating leasing one or more get in touch with us at once. Present factory price of lease for these cylinders, $80.00; Our price of lease for these cylinders, $60.00. Apply Box 787 Canadian Machinery.

FOR SALE — 6 CUTTING TORCHES, 3 welding torches, 10 oxygen regulators, 4 acetylene regulators, and 1 50-lb. acetylene pressure generator, all of Davis-Bouronville manufacture. for sale at a bargain. This apparatus is as good as new. Will sell all or singly. Apply Box 788 Canadian Machinery.

LARGE QUANTITY OF VALVES—ALL SIZES, surplus stock of a Canadian shipbuilding company. Write for list, prices, etc. Box 789 N. Canadian Machinery.

SCREW MACHINE — "NEW BRITAIN" — SIX spindle automatic, 1⅝" bar capacity; condition new; never been used; located in Canada; low price for quick sale. Box No. 789M Canadian Machinery.

FOR SALE—OWING TO COMPLETION OF contract; one 25 h.p. steam tractor engine; in firstclass working condition; recently overhauled and refitted: no reasonable offer refused; apply Box 789 M E. Canadian Machinery.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

EXCELLENT WATER POWER CHOPPING mill, saw-mill and shingle mill and small dwelling in good locality; dam and machinery in good shape; an excellent proposition for the right man; will accept twenty-five hundred for the outfit. W. M. Sanderson, Farm Selling Agency, Caledon East, Ont.

FLOOR SPACE — SEPARATE ENTRANCE— Suitable for machine shop or light manufacturing, with power, reasonable rental with long lease if desired; also small foundry building, suitable for 4 to 6 moulders; in good manufacturing town; railway centre. Apply Box 789T, Canadian Machinery.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

What can we do for YOU?

Through these columns thousands of dollars of equipment are disposed of each year. If you are not using Canadian Machinery now, let us tell you what others have done—are doing.

CANADIAN MACHINERY
Classified Advertising Section
143 University Ave., Toronto

Surplus Machinery

Tool Room, Manufacturing Machines and Miscellaneous Equipment, for sale

Lathes.

2—12″ x 4′ Mulliner Tool Room, Taper.
1—14″ x 6′ Reed, Q. C. G., Taper and Relieving, oil pan, and collets.
1—14″ x 6′ Lodge & Shipley, Q.C.G., Taper, collets and oil pan.
1—16″ x 6′ Cisco, Q.C.G., Taper.
1—16″ x 6′ Hendey, Taper, collets and oil pan.
1—16″ x 6′ Hendey, Taper.
1—16″ x 6′ Pratt & Whitney, Taper, and collets.
1—16″ x 8′ Hendey, Taper.
1—16″ x 8′ American, Q.C.G.
1—16″ x 8′ Prentice, Taper, collets and oil pan.
1—16″ x 8′ Pratt & Whitney, Q.C.G., and taper.
1—18″ x 8′ American, Q.C.G., and Taper.
1—18″ x 8′ Hamilton, D.B.G., Q.C.G.
1—18″ x 8′ Walcott, D.B.G., Q.C.G.
1—21″ x 8′ Le Blonde, Heavy Duty, D.B.G. Q. C. G.
2—24″ x 10′ Lodge & Shipley, D.B.G., 2 C.G.
1—24″ x 10′ Can. Mchy. Corp. D. B. G. QCG
1—24″ x 12′ Can. Mchy. Corp., D. B. G. Q.C.G.
1—26″ x 10′ Lodge & Shipley, D. B. G., Q.C.G.
2—26 x 12′ Can. Mchy. Corp., D. B. G., Q. C. G.
1—26″ x 14′ Nile Bemont Pond, D. B. G., Q. C. G.
1—30″ x 14′ Niles Bemont Pond, D. B. G., 2. C. G.

Hand Screw Machines

30—No. 1 1/2 Star G.F.H., 1 1-2″ Cap., Power Feed Turret, oil pan and pump.
6—No. 3 Superior, Plain Head, 1 1-4″ Cap., oil pan and pump.
1—No. 4 Warner & Swasey, G.F.H., 1 1-2″ cap., Power Feed Turret oil pan and pump.
6—No. 4 Smurr & Kamer, G.F.H., 1 5-8″ cap., Power Feed Turret, oil pan and pump.
2—No. 4 Millholland, G.F.H., 1 1-2″ cap., Power Feed Turret, oil pan and pump.
11—No. 2 Smurr & Kamer, Plain Head, 1 1-16″ cap., oil pan and pump.
8—No. 2—Warner & Swasey, Plain Head, 1″ cap., oil pan and pump.
4—1 3-4″ x 7″ Gridley Multiple Spindle Automatics.
7—2 1/4 x 7″ Gridley Multiple Spindle Automatics.
8—3 1-4″ Gridley Single Spindle Automatics.
7—No. 55 Acme Automatic, Multiple Spindle.
12—No. 56 Acme Automatics, Multiple Spindle.

Shapers.

2—20″ Smith & Mills, B. G., Crank Shapers.
1—20″ Gould & Eberhardt Crank Shapers.

Milling Machines.

1—No. 3 Ford Smith Universal.
1—No. 2 Kempsmith Universal.
2—No. 3 Cincinnati Plain.
1—No. 2 Ford Smith Plain.
9—No. 1 Burke Bench Millers.

Drilling Machines.

2—Alfred Herbert 7″ overhang, ball bearing.
3—No. 1-2 Avey, Pedestal.
2—No. 1-2 Avey, Bench.
1—Leland Gifford, 6″ overhang, ball bearing, pedestal type.
1—Sipp, ball bearing, pedestal type, swing 16″.
4—Leland Gifford, 6″ overhang, ball bearing, bench type.
6—1-4 Rickert & Shafer, vertical tappers on pedestal.
1—5/8″ Rickert & Shafer, horizontal tappers on pedestal.
1—No. 1 1-2 Cincinnati.

Tool & Cutter Grinders.

1—No. 1 Norton.
1—Greenfield.
6—Stevens.
1—No. 2 Brown & Sharpe Surface Grinder.

Miscellaneous.

1—14 x 9 x 12 Can. Ingersoll Rand Belt Driven Air Compressor with receiver.
2—75 H.P. Crocker-Wheeler Motors, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
1—75 H.P. Can. Westinghouse, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
3—Gas Furnaces.
2—High Speed Hack Saws.
1—No. 2 Standard Double Acting Press.
1—2,500 Ampere Plating Dynamo.
1—No. 9 Buffalo Conoidal Fan.
1—No. 5 Sheldon Exhauster, Motor Drive.
1—No. 2 Garvin Screw Slotter.
1—No. 1 Garvin Screw Slotter.
1—No. 2 American Oil Separator.
1—14 x 24 C.H.V.W. Mechanical Plater.
6—No. 2 Garvin Screw Shaving Machines.
8—B. & S. Polishing and Finishing Machines.
Pulley, Shafting, Couplings, Hangers and miscellaneous small tools.

The above equipment open for inspection at our plant, corner of DUFFERIN and KING STREETS, TORONTO

RUSSELL MOTOR CAR CO., LIMITED

Machinery Sales Dept. **Address communication** **Phone Parkdale 6744**

MACHINERY FOR SALE

Lathes

1—26″ x 12′ Pond Lathe, S.B.G., C.R., P.C.F.
1—24″ x 12′ New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24″ x 12′ Can. Mach. Lathe, S.B.G., C.R., P.C.F.
1—21″ x 10′ London Lathe, S.B.G., C.R., P.C.F.
4—20″ x 8′ C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18″ x 8′ C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1—21″ x 10′ Butler Lathe, D.B.G., Q.C.G., C.R.
1—16″ x 6′ McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18″ x 8′ C.M.C. Lathes, D.B.G., Q.C.G., C.R.

Shapers

1—24″ Rockford Shaper.
1—12″ Port Hope Shaper.
1—16″ Hendey Friction Geared Shaper.

Drills

1—No. D-1 H.D. Colburn Drill.
2—No 24 H.D. Foote Burt Drills.
1—28″ Barnes Drill, B.G., P.F.
1—22″ Barnes Drill, B.G., P.F.
1—26″ Back-geared Drill, lever feed only.

Miscellaneous

2—2″ x 26″ Pratt & Whitney Turrets.
1—No. 2 Gardner Disc Grinder.
1—3″ Acme Bolt Cutter.
1— No. 54 Perkins Sprue Cutter.
1—No. 320 Brown-Boggs Press.
1—10″x24″ Plain Landis Grinder, self-contained.
1—Union Triplex Hydraulic Pump, 1¼″x 4″

YEATES MACHINERY

HALE STREET
LONDON, ONT.

How to Plant an Advertising Crop

Until the advent of the Audit Bureau of Circulations, advertisers sowed their business seed in a vast but fallow field. Some of it grew and returned a fair harvest—much of it was cast upon barren ground and was lost. There was no standardized method of determining the fertility of a publication's field. Experimenting was expensive.

The A. B. C. has eliminated the barren spots of circulation. Planting an advertising crop is no longer an experiment. Advertisers **Know** the field through audit reports. They know whether it is fertile ground and sow their seed accordingly.

The Canadian Machinery circulation has been audited by the A. B. C. Advertisements placed in this publication are seeds well sown.

HINTS TO BUYERS

STEEL CASTINGS

ELECTRIC Steel Castings all kinds from 5 pounds to 5,000 pounds.

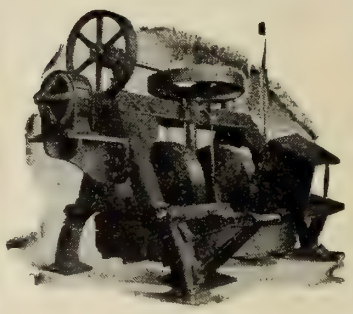
PROMPT DELIVERY

Manitoba Steel Foundries, Ltd.

1204 McArthur Building

Winnipeg - - - Manitoba

Canadian Steel Foundries Need Frost Improved Sand Mills



WINNING FEATURES

Heavy Mullers
Unloading Device
Motor or Belt Drive

The Frost Mfg. Co.
112 W. Adams St., Chicago

For Hardness Testing



THE PYROSCOPE

in shop and laboratory use the

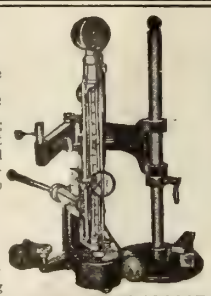
Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.

Heat Indication

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.



THE SCLEROSCOPE (Set)

Perfect constancy, inexpensive, no electricity used. Built to stand rough usage, and upon common-sense lines. Used by the Government and best firms.

The Shore Instrument & Mfg. Co. Van Wyck Ave. & Carll St. JAMAICA, N.Y.

A. R. Williams Machinery Co., Ltd., Toronto, Canada.



SPRING SHACKLE BOLTS



"D"

Complete Line of Oilers, Oil Cups, Brass Dowel Pins and Pressed Steel and Brass Grease Cups All Types

Write for catalogues and prices

THE CANADIAN WINKLEY CO.
Limited
WINDSOR - ONTARIO



PLAIN

FOR SERVICE ON

Jigs, Fixtures, Gauges

SPECIAL MACHINE TOOLS
SPECIAL MACHINERY

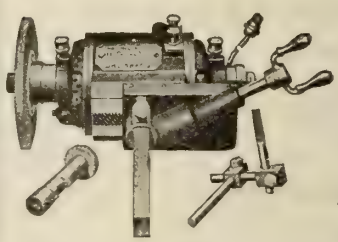
General Machine Work and Repairs

Write

The Crescent Machine Co.
LIMITED
20 Longueuil Lane Montreal, Que.

"CINCINNATI"

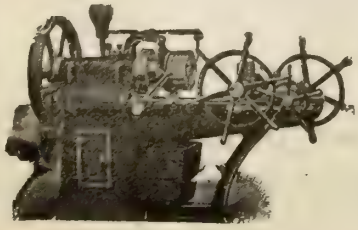
Portable Electric Tool Post Grinder



A long-life tool capable of a tremendous range of work. Have you received our catalog?

The Cincinnati Electrical Tool Co.

Dept. C-7. CINCINNATI, O.



BOLT, NUT, FORGING AND WIRE NAIL MACHINERY

"National" Bolt Cutters, "Wedge Grip" Bolt and Rivet Headers, Forging Machines, Nut Machines, Roll Threaders and Wire Nail Machines are used by leading Railroads and Industrials.

THE NATIONAL MACHINERY CO. TIFFIN, OHIO, U.S.A.

CANADIAN AGENT
H. W. PETRIE, Ltd.
TORONTO, ONT.
MONTREAL, QUE.
VANCOUVER, B. C.

IMPORTERS OF
WHEEL TRUEING TOOL CO.
MANUFACTURERS OF

INDUSTRIAL DIAMONDS



DIAMOND POINTED TOOLS

Goods Submitted on Memorandum if Desired
EASTERN ONTARIO BRANCH
James Street, ST. CATHARINES, ONTARIO

All Mountings Fully Guaranteed
Office and Factory:
88 West Pitt Street, WINDSOR, ONTARIO



Gear Cutting Machines

Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
THE D. E. WHITON MACHINE CO.
NEW LONDON, CONN., U. S. A.

PRESSES and SHEARS

Sheet Metal Working Machinery
THE D. H. STOLL CO., INC.
26 Lansing St., BUFFALO, N.Y.

DIE-CASTINGS

ACCURACY—SERVICE
Fisher Motor Co., Ltd.
ORILLIA - ONTARIO

DARLING BROTHERS, LIMITED

Engineers, Manufacturers and Founders
120 Prince Street, MONTREAL, P.Q.

Pumps for any Service—Steam Appliances—Freight Elevators—Webster Vacuum Heating System.

DAVIS-BOURNONVILLE

Hand and machine torches for cutting wrought iron, steel and cast iron.

Torches for shipyards, boiler shops, bridge works, and forge plants. Costs of fabrication greatly reduced by the intelligent use of modern torch equipment. Special cutting tips for cutting off rivet heads and staybolts.

Style 82 tip for cutting cast iron fits all D-B style C heads.

WELDING AND CUTTING DAVIS APPARATUS DAVIS-BOURNONVILLE CO.

Davis-Bournonville Company
Jersey City, N.J.

Branches in Principal Cities

PRESSES

HYDRAULIC SCREW AND FILTER

Hydraulic Wheel Press



Made in Canada

WILLIAM R. PERRIN, LIMITED
TORONTO, ONT.

CASTINGS

MALLEABLE AND GREY IRON
FITTINGS Limited, OSHAWA

Miller Bros. & Sons, Limited

Founders, Machinists, Millwrights and Engineers
120 Dalhousie St., Montreal

VICTORIA Special Machinery

DESIGNS PATTERNS
CASTINGS FORGINGS

Send for Catalogue

Victoria Foundry Co., Limited, Ottawa, Canada



NORTON JACKS

FOR ALL KINDS OF HEAVY LIFTING
Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
Made only by A. O. NORTON, Limited
Coaticook, Prov. Quebec, Canada



WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller

PARMENTER & BULLOCH CO., LTD.
GANANOQUE, ONT.

SPECIAL MACHINERY

36" Fellows Gear Shaper indicates the complete and modern equipment throughout our Gear Department. Send your custom work to us.

MADE IN BR·EN·CO CANADA

Brown Engineering Corporation
LIMITED, TORONTO
415-419 King St., W. Tel. Adel. 425

"THISTLE" BRAND RUBBER BELTING

"Maintenance of Quality"
is our motto, and our experience in the manufacture of belting since the year 1856 should be invaluable to you. Let us tell you all about this friction faced belting. The price will appeal to you.
Write to-day.



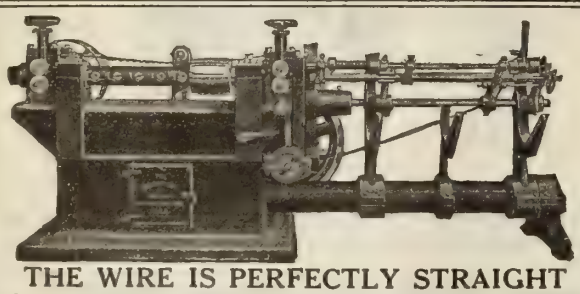
J. C. McLAREN BELTING CO., LTD.
TORONTO, MONTREAL, WINNIPEG

NOVO-SUPERIOR
HIGH SPEED STEEL
Tool Steel for Every Purpose
Twist Drills, Music Wire, Steel Balls
Pilot Steel & Tool Co., Ltd
332 St. James. - - - Montreal

THE STANDARD FOR EXCELLENCE
"CUSHMAN" CHUCKS 1862
Known Everywhere
YOUR DEALER WILL FURNISH THEM

MORTON MANUFACTURING COMPANY
Muskegon Heights, Mich., U.S.A.

Heavy Duty Draw Cut Shapers, Special Heavy Duty Draw Cut R. R. Shapers, Special Locomotive Cylinder Planers, Traveling Head Planers, Special Roll Wobble Planers, Portable Planers, Stationary and Portable Keyway Cutters, Finished Machine Keys. See our full page advertisement in the first issue each month of "Canadian Machinery."



THE WIRE IS PERFECTLY STRAIGHT
and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

The F. B. SHUSTER COMPANY, New Haven, Conn.
Formerly John Adt & Son. Established 1866.
Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.



Model B Gear Counters
will give you your accurate production. Tested 20,000 per hour.
SEND FOR CIRCULAR
Model B (Fivewheels)
Model B-6 (Six wheels)
R.A. HART MFG. CO., 31 WILSON COURT BATTLE CREEK, MICH.

Monel Metal Castings
For Anti-Corrosive and Superheat Service
Made in Canada by
CANADIAN DRIVER-HARRIS CO.
WALKERVILLE, ONT.
American Office and Works
Chicago-Detroit Harrison, N. J. England-France

UNION DRAWN STEEL CO. LTD.



Manufacturers of
Bright Finished Steel Shafting and Shapes.
Large stock of all sizes.
Send for Price List
HAMILTON, ONTARIO

OAKITE CLEANS
Put your Cleaning Problems up to us.
OAKLEY CHEMICAL CO
44 THAMES STREET, NEW YORK

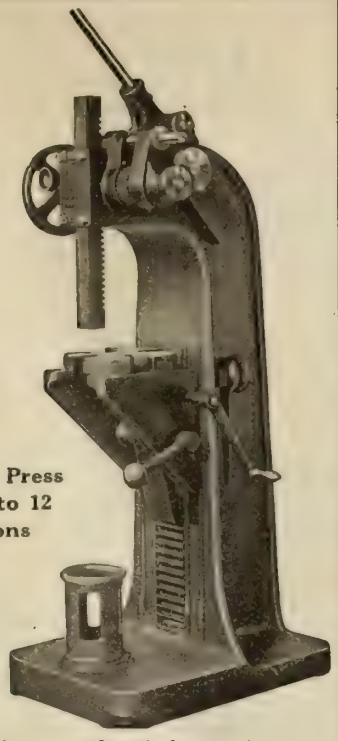
PATENTS

Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

Rubber Mill MACHINERY
BERTRAMS LIMITED
SCIENNES EDINBURGH

SPECIAL MACHINERY
Dies, Tools, Jigs, Repairs
Speedy Service—Phone Adelaide 2
HENRY C. THOMAS
887 King St. West, TORONTO, Ont.

Your Wants
are many here below. Use the Want Ad. page and get rid of a few of them.



No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger Co., Windsor, Ont.

"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators. Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd
Brantford, Canada

HAMILTON ENGINEERING SERVICE LIMITED
Consulting and Designing — Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
915 KING WILLIAM ST. HAMILTON

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156 YORK ST. TORONTO

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THE
TRADE K—T MARK
FOUNDRY
GALT, ONT.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25 per cent.; a different method of molding them might double your production at no increase in molding cost. We can advise you and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us. Ask us.

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

BREAKING INTO POLITICS

BY "BOB" ROGERS

The Hon. Robert Rogers, admittedly one of Canada's shrewdest politicians, tells in this first of a series of articles which will appear in early issues of MACLEAN'S a number of highly interesting incidents of his early political history; how he secured railway concessions from Sir William Van Horne and Sir John A. Macdonald, by astute diplomacy, before he was twenty-one years of age; how the Hon. John Norquay, "notwithstanding the fact that he weighed more than three hundred pounds, could dance the Red River Jig by the hour"; and how the future Federal Minister of Public Works was defeated in his first election, 1886, by thirteen votes, because some "wicked Liberal" had a conductor delay a train on which a score or so of Mr. Rogers' supporters were scheduled to arrive.

The first of these articles will appear in

OCTOBER 1 MACLEAN'S



This pen and ink sketch of the Hon. Robt. Rogers was made a few weeks ago in Winnipeg, by H. Weston Taylor, the famous illustrator, at a special sitting accorded MACLEAN'S artist by the former Minister of Public Works.

Arsene Lupin Returns

This famous French detective, who ranks in fiction with Gaboriau's Lecocq and Conan Doyle's Sherlock Holmes, has returned to appear in a series of eight stories, from the fertile pen of Maurice Le Blanc. Each story is separate in itself, and is amazingly swiftly-flowing and dramatic in its action.

OTHER BIG FEATURES IN THIS ISSUE:

The Hole in the Wall—by G. K. Chesterton

A piece of masterly short fiction, Number 6 in the series of tales revolving about "The Man Who Knew Too Much."

The Yellow Streak—by Valentine Williams

The second instalment of an amazing murder mystery involving a war millionaire, a fascinating English girl and a young barrister.

The Valley of Gold—by David Howarth

The concluding instalment of the best by all odds all-Canadian serial published this year, an epic of the Qu'Appelle Valley.

Dafoe, Political Pivot—by "Domino"

A biographical sketch which gives a vivid pen-portrait of the Editor of The Manitoba Free Press, who is such a power behind the scenes in Western affairs.

Dean of the Trailsmen—by Charles Christopher Jenkins

The story is here told of Canada's oldest guide, Henry Alfred Braithwaite, who for two-thirds of a century has been a prominent figure in maritime woods life.

Little Theatres of the West—by Mary H. T. Alexander

An interesting account of what several Western districts are doing in connection with the "Little Theatre" movement.

War Brides Eagerly Making Good—by Miriam Green Ellis

Some pathetic and some humorous incidents in the adventures in settling down of brides who return to Canada with khaki'd Canadians.

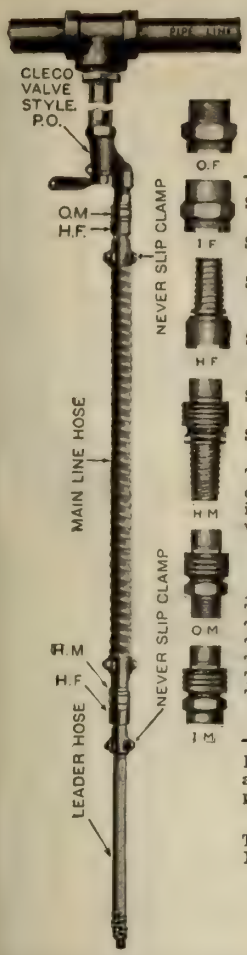
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Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps — Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

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STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO AIR VALVES.



Style R.A. Style P.O. Style A.

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style R.A.—Right Angle Valve, made in sizes ¼ in., ⅜ in., ½ in., and ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lightening Hose Clamp Tool illustrated applies wire clamps at a cost of 2 cents each.

In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.



Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 46, 48 and 51. mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. 337 Craig St. W., MONTREAL, QUE.

How to Test Advertising

THE man who doubts the power of advertising belongs in the same class with the man who refuses to believe that the world is round simply because he can't get off somewhere at a distance and see its roundness for himself.

The merchant who fears to attempt advertising because he figures it as an "expense" is blind to his own interests. I personally know several men who, because they once tried advertising to the extent of a cheaply printed hand-bill and didn't find it necessary next morning to call on the police to keep the crowds of eager buyers from swamping their store, loudly and solemnly aver that "advertising doesn't pay."

Advertising *does* pay.

The most successful merchants are the merchants who believe most thoroughly in advertising and who practice their belief.

But advertising, in order to pay, has got to be *intelligent* advertising.

The day of hashed-over superlatives — "best goods," "lowest prices," "best stock in town," "greatest bargains ever heard of," and so on—has passed.

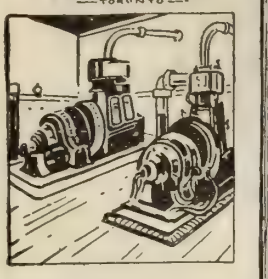
People have learned to distinguish the *truthful* advertiser from the blatant behind-the-times storekeeper who believes that, so long as *he* claims to have the best goods on earth, or under the earth, or within wireless distance of the earth, people will break their necks trying to get to his counters in the forefront of the crowd.

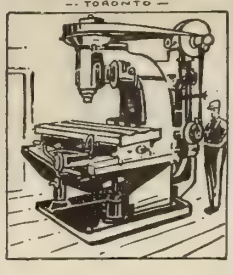
Put some *brains* into your advertising.

Don't let the office boy write your announcements in between his other duties.

Don't doubt the business-getting and business-building power of intelligent and informative publicity — and you will find that advertising *does* pay.

—Jerome P. Fleishman.









For

Self-Promotion And Sales Promotion

Are you interested in any of these fields—power—metal working—marine? As a manufacturer, or purchasing agent, as a superintendent or foreman, as an ambitious mechanic or engineer?

Use These Publications

They will keep you strictly up-to-date in all branches of mechanical engineering. Edited by practical men. Cheerful, inviting, instructive, authoritative.

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Twice a month—$2.00 per year.
Serves the power plant engineer—Steam, Electric, Refrigeration, Hydraulic.

CANADIAN MACHINERY

Weekly—$4.00 per year.
Covers the metal working field—serving shop executives, purchasing agents and owners. First-class mechanical paper and market paper combined.

CANADIAN FOUNDRYMAN

Monthly—$2.00 per year.
A paper for the foundry owner, superintendent and foreman. Claimed by its readers to be unexcelled.

MARINE ENGINEERING

Monthly—$2.00 per year.
Interprets marine engineering in its broadest sense, serving the shipbuilders, navigation companies and their officers. (The editor holds an extra first-class B.O.T. certificate.)

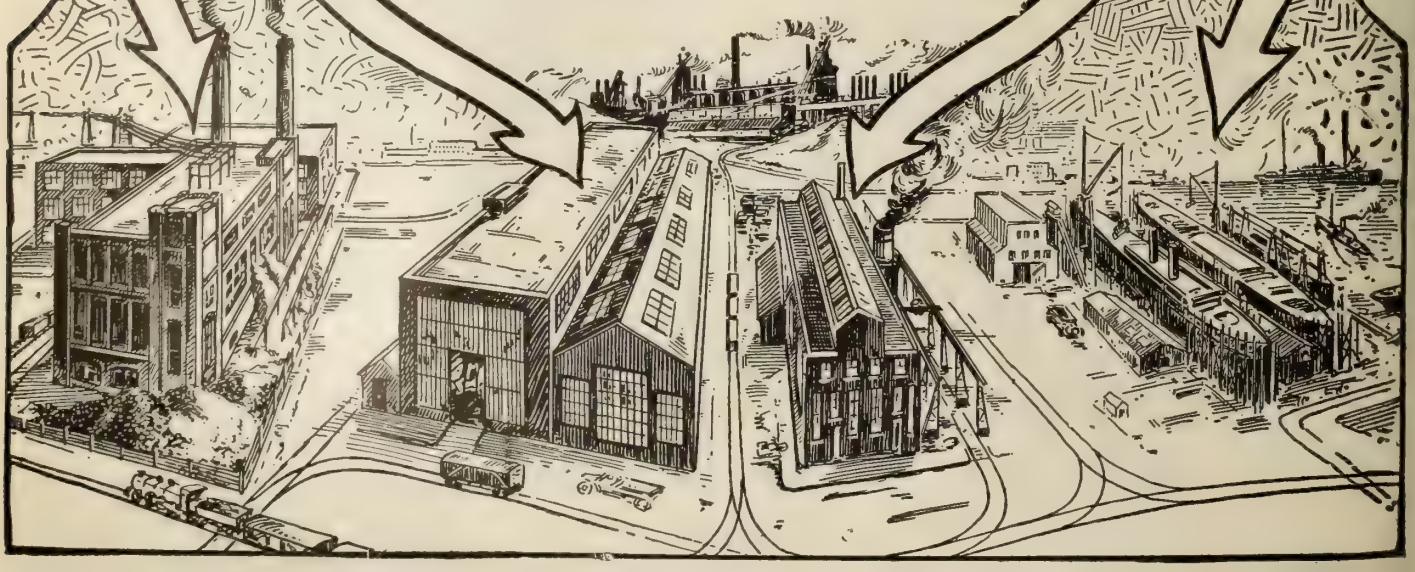
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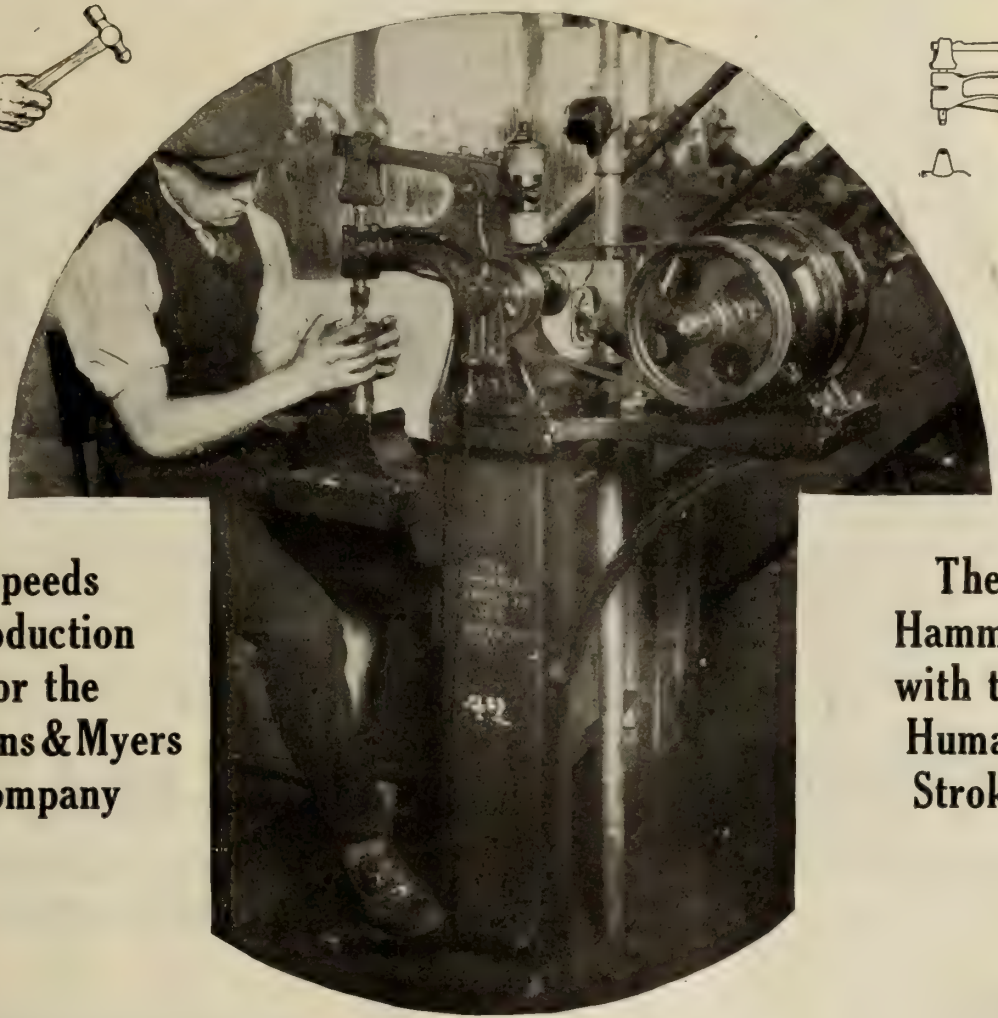
A company whose idea of service has made it the largest concern of its kind in the British Empire.
Thirty years' experience and dozens of practical men in your own line, stand ready to serve you. Let them! Subscribe for your paper to-day.

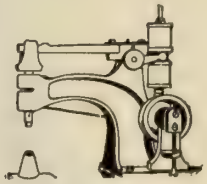
Men with selling problems will find a profitable tip in the statement made by a prominent manufacturer recently, "I use MacLean Publications because I am satisfied that papers with such a high standard of editorial excellence, **MUST** have an influential following."



HIGH SPEED
RIVETING HAMMERS







Speeds Production for the Robbins & Myers Company

The Hammer with the Human Stroke

AN immediate production increase was the result of installing a High Speed Riveting Hammer in the plant of the Robbins & Myers Co., Brantford, Ont.

The work caught by our camera man is Riveting Formed Fan Punching to hub. It demands neatness and speed—to conform to the high standards of this plant.

It takes just half a minute for this work — no comparison with the laborious method of hand sledging. Send us samples or blue-prints and we will quote production figures.

Besides often as much as quadrupling production, High Speed Hammers also better the quality. Hand work cannot approach them for uniformity and fine finish.

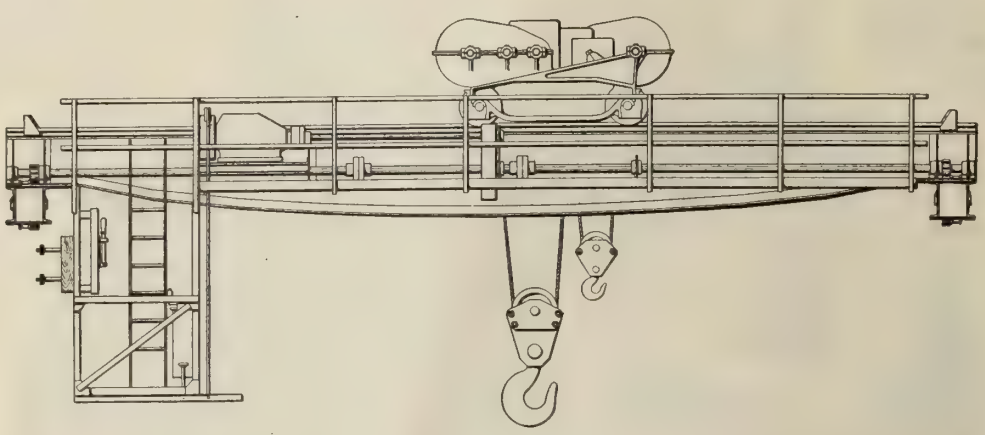
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ROCHESTER, N.Y., U.S.A.

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ELECTRIC AND HAND OPERATED

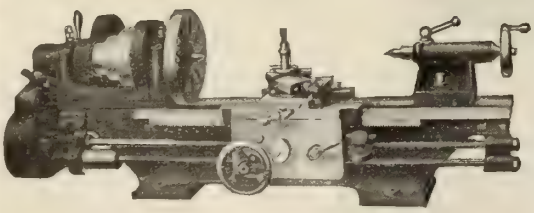


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Type B-6



"The Small Lathe for the Big Job"

Actual Swing - - -	8¼ inches
Between Centers - -	18½ inches
Collet Capacity - - -	¾ inch

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REAMERS, "SOLID ADJUSTABLE"
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BORING BARS
With Adjustable Cutters

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Send for the ones you want

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DODGE



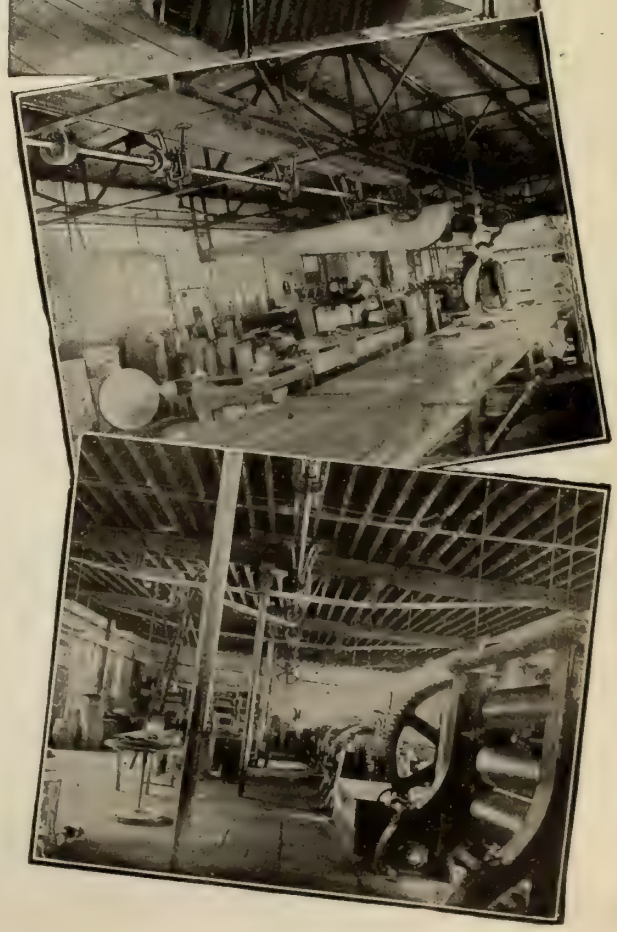
You can always depend on a Dodge Rope Drive

Dodge Rope Drive dependability is not spasmodic. Time-tested in hundreds of plants, Dodge Rope Drives have always stood up to every demand that continued hard service can make.

And service-assurance is not the only reason why a Dodge Rope Drive is the logical prime mover in any shop.

The economy of buying rope by the pound against replacing belt of excessive width is of equal importance—as is also the fact that the rope delivers more nearly 100% of the engine power than does the belt.

However short the center-to-center distance; however complicated the problem of carrying power around corners or from floor to floor, a Dodge Rope Drive may be depended upon fully and continuously to be the simplest and most economical means of accomplishing the desired results.

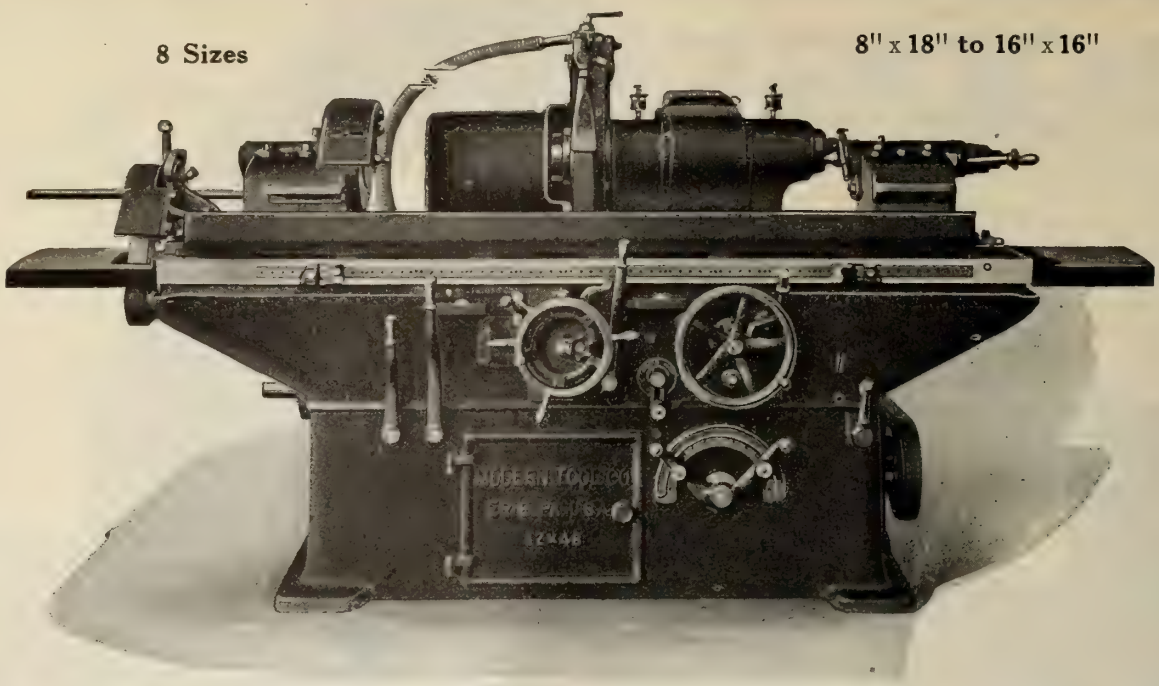


Dodge Manufacturing Company of Canada, *Ltd.*

Works and Head Office, Toronto, Ontario
Eastern Branch, Montreal, Quebec

8 Sizes

8" x 18" to 16" x 16"



MODERN
Plain Grinding Machines

Main Drive

The shaft is ground, and mounted on anti-friction bearings; runs at constant speed. Power can be applied from a line shaft or direct from motor. All parts are balanced to eliminate vibration.

Wheel Drive

More powerful than other types of same rating. A 4 in. endless belt carries the full power from main shaft direct to wheel spindle, giving constant smooth drive.

Gear Case

All speeds and feeds are secured from one gear box, a separate unit, which may be readily removed for inspection or renewal of bearings. Gears are in mesh at all times, and are engaged with shaft by our patented positive ball drive clutch, which permits instant change. Gears of steel with hardened bushings run in grease.

Send Us

—Blueprints and specifications, and we'll tell you what a Modern will do on your job.

Motor Drive

A constant speed motor may be attached to the main drive shaft of the machine by belt, silent chain, or flexible coupling.

All Modern Plain Grinders are specially designed for most convenient connection to motor.

Table Drive

This is through worm and worm wheel insuring smooth, uniform travel. Four table feeds, 22 in. to 104 in. per minute are secured by lever on front of machine.

Wheel Side

Travel is on "V" and "Flat" ways, giving true, accurate movements and long life. A gib prevents raising of slide when heavy cuts are taken.

Bearings

Wheel spindle has bronze bearings with outside taper. Quick take-up for wear without dismounting is provided.

Main drive has anti-friction bearings.

Headstock has ball bearings.

Gear box has phosphor bronze bearings.

All provided with proper lubrication.

All shafts are ground.

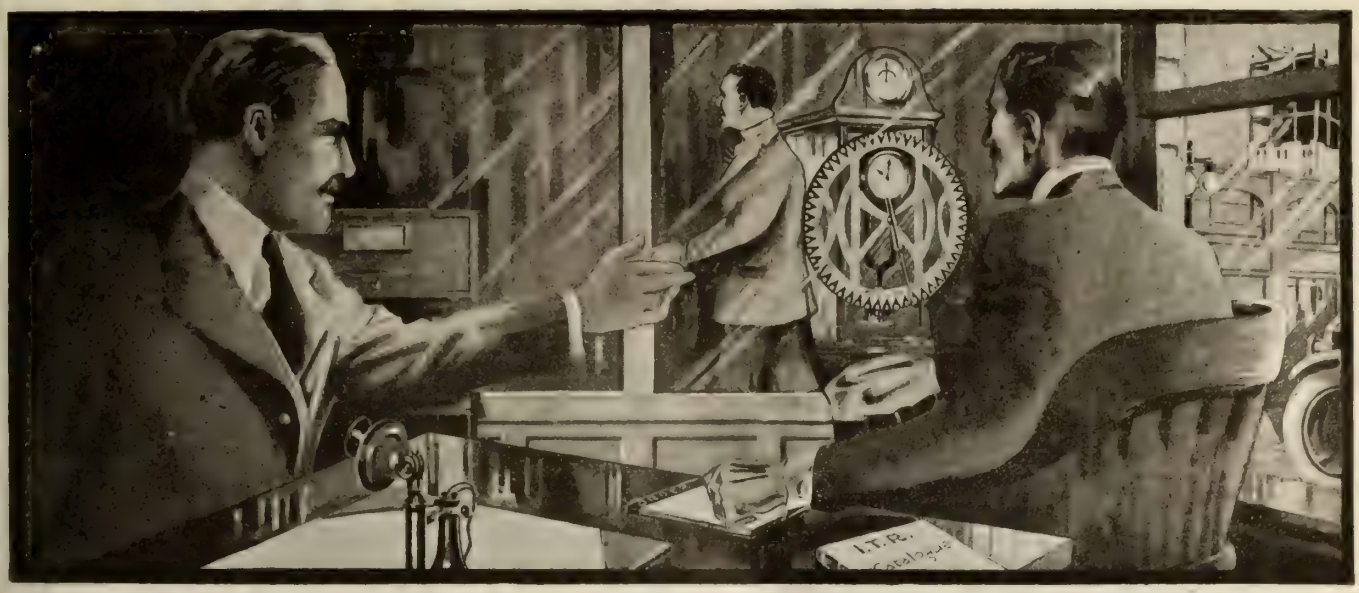
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**Stands for Order and Method instead of "Rule of Thumb"—
It is saving time and money in Canada's Largest offices—
Is it at work in yours?**

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To the Time-Keeper or Cashier the Time Recorder is an agency for the rapid and errorless registration of working time.

To the Cost Accountant it is an instrument for the rapid compilation of reliable cost data.

To the Management the Time Recorder opens up wider considerations than those attaching to any **ONE** department of specialized work. Accurate Time and Cost keeping are recognized essentials of successful business method but business practices to demonstrate their soundness to-day must pass this additional test: How do they operate upon the lives and personalities of the employees? Do they strengthen those personal qualities which must run parallel with increased efficiency? The Time Recorder, by establishing the principle of fairness and justice in the registering of working time, promotes good will and pleasant personal relationships. It encourages habits of punctuality and carefulness which play so large a part in the development of character.

The staff which has learned to think and work in terms of Time Values has gone a long way on the path to efficiency.

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The punctual employee is glad to have the Time Recorder convey to the management every day the record of his punctuality.

He knows that the mechanically-made printed record cannot be tampered with, neither can it err. He knows that, to obtain recognition of his merits, he is not compelled to parade it noisily; and that when the day comes for promotions, selections are not made by guesswork. He knows that he is protected against favoritism or unfairness. He knows that he is not penalized for the tardiness of a co-employee.

Where is the employee who believes that his own best interests—his hope of stable employment and of advancement would be better safeguarded by haphazard "Rule of Thumb" than by order and method?

Order and Method in office and factory begin with the Time Schedule—the systematizing of working time for the greatest possible efficiency.

The clock is the Supreme Taskmaster in the World's work. Is it not logical that the record of the world's work should be written by the unerring steel hands of the clock itself?

Internationals are adaptable to any line of business. Let us send you particulars.

INTERNATIONAL BUSINESS MACHINES CO., LIMITED

Frank E. Mutton, Vice-President and General Manager
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Genuine British Oak Tanned LEATHER BELTING

Service Shows a Belt's Pedigree

If it's a cheaply made belt—poor leather, slipshod methods—it commences by slipping on the pulley. And it finishes mighty soon too, after that. Wears out and costs you twice as much as it should.

But if it's a good belt, like D. K. McLaren's Leather Belting, you get belt slippage reduced to a minimum plus length of service that makes D. K. McLaren's Belting the cheapest on the market.

D. K. McLaren's Belting is made from only the flawless backs of the hides of choicest steers, oak-tanned by the genuine British Oak Tanning process, which preserves every bit of the hide's natural strength.

Write for list of users.



Oak-Tanning
The most approved process known for preparing belts that last.

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The "Long Service" Belting

That's the one I want



It tells me just the facts I need to know.

THE ELLISON CATALOGUE
of Electric Control Gear.

The STANDARD for SIMPLICITY and CORRECT DESIGN

The Ellison Catalogue is a practical text book on Electric Motor Control Gear. It consists of separate lists, each complete in itself, dealing with a particular piece of apparatus and illustrated by photographs and diagrams. The lists give precise information concerning the apparatus with prices and shipping data. Overseas Engineers should lose no time in obtaining a copy of this useful Catalogue.

Also ask for HINTS BOOKLET "C"

GEORGE ELLISON

Mechanical and Electrical Engineers. Makers of Electric Control Gear.

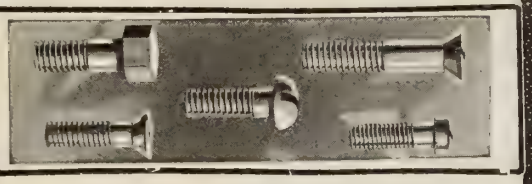
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Series



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

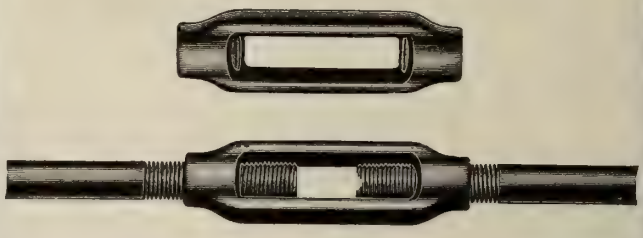
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Hartford, U.S.A.
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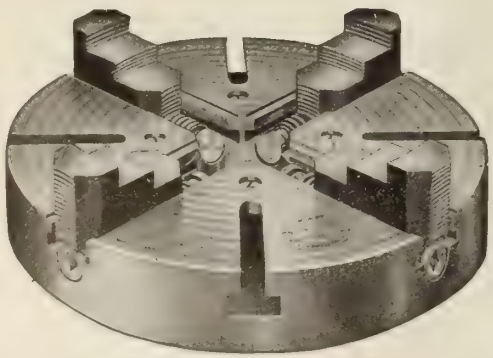
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SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.



We make a complete line of steel chucks, including **Geared Scroll Chucks and the Geared Scroll Combination.** These types are conceded to be unparalleled for heavy work and hard usage. **Write for our illustrated catalogue.**

ALL STEEL
INDEPENDENT CHUCKS

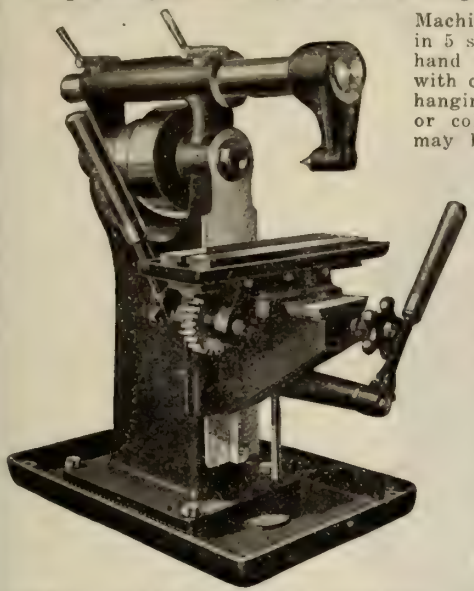
will put your work on new standards for accuracy and fast production. Independent Chucks are built for abnormally hard wear—the kind of usage that calls for great strength and long wearing qualities. Independent All Steel Chucks have proven so satisfactory that they are almost a necessity wherever high-speed cutting tools are used.

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New York Office: 26 Cortlandt St.
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Bench Milling Machines

For Accuracy, Convenience, Power, Rigidity, Economy

And the ability to handle any work within the range of the Machine



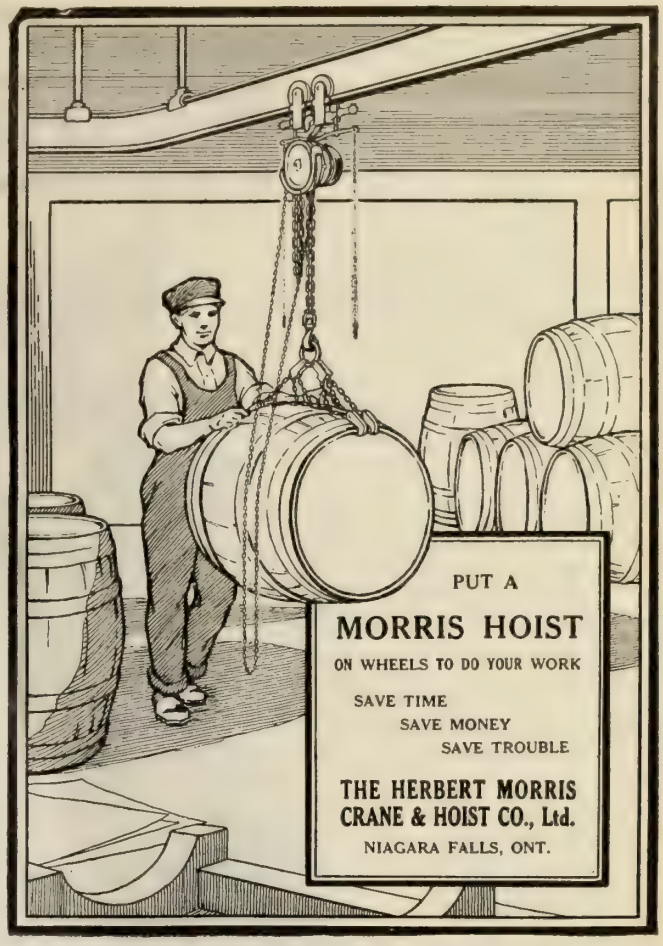
Machines are built in 5 sizes with either hand or power feed, with or without overhanging arm, bench or column type, and may be fitted with complete set of attachments. Catalogue gives complete description of machines and attachments, also Tapping Machines and Drill Presses.

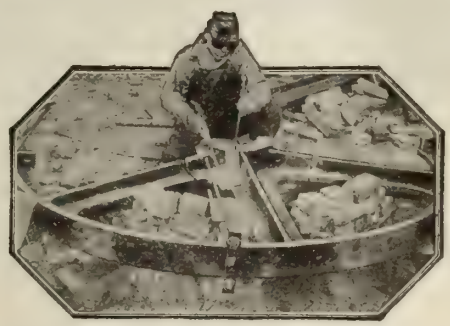
Cut shows the No. 3 Bench Type Machine. Price $155. With column $173.

THE BURKE MACHINE TOOL CO.

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It was lots easier to bring Prest-O-Lite and the oxy-acetylene flame to this mammoth wheel than to haul the wheel five miles from a mountain mine to a repair shop.

That's one of the advantages of Prest-O-Lite. Its ready portability makes oxy-acetylene welding possible and everywhere.

And a chain of plants and warehouses assure a constant supply of Prest-O-Lite, the Universal Gas with the Universal Service.

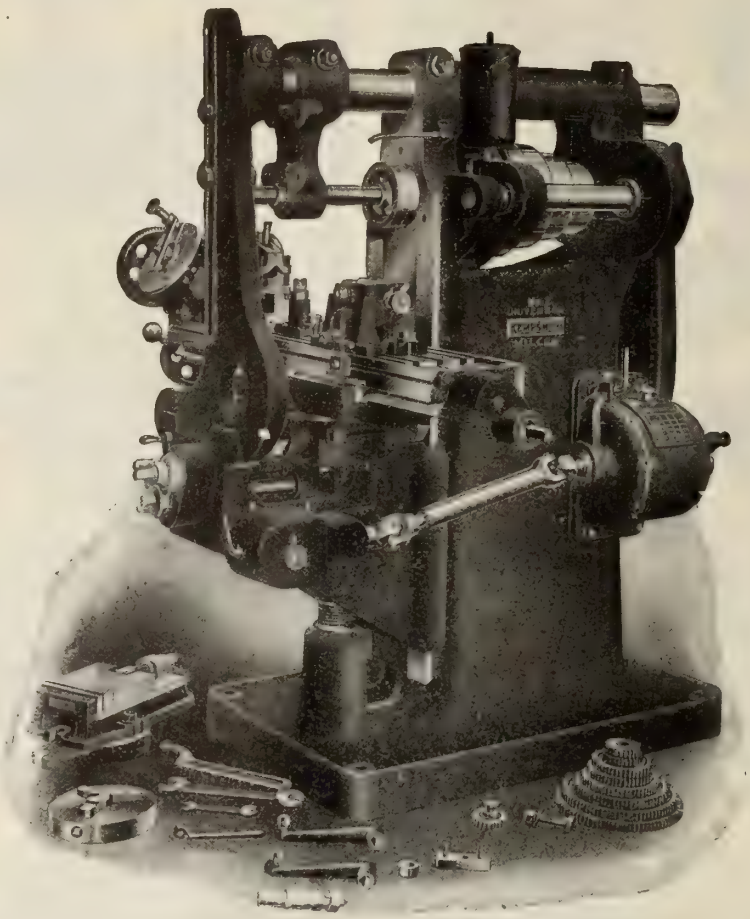
All of which means a Nation-Wide Service which you will be interested in knowing all about.

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No. 2 UNIVERSAL

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It has always been, and will continue to be, the purpose of the Kempsmith Company to produce machines of the highest quality only, suited to the most advanced practice.

Every machine, whatever size or type, is put to test under cuts and conditions purposely more severe than it will encounter in even the most progressive shops, and when it leaves our factory it has our positive and definite guarantee back of it.

Literature will be gladly sent upon request.

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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

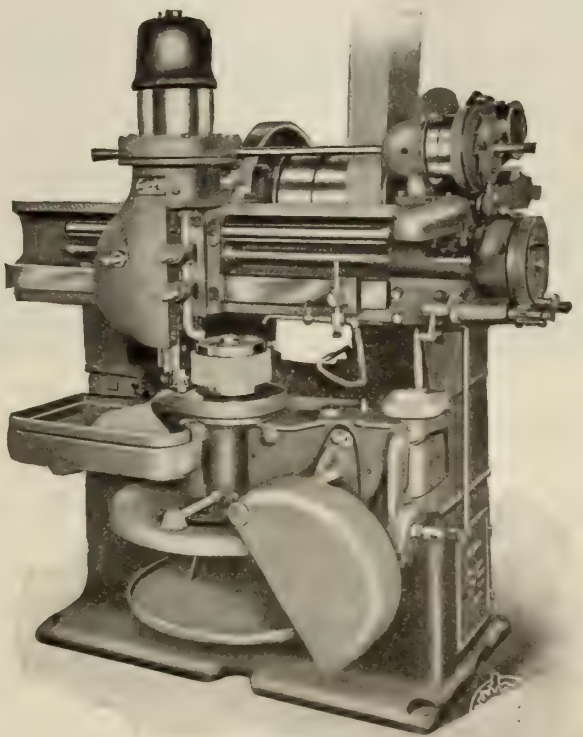
A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this little word "IF."

When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of Gear Cutting with the "IFS" Left Out.

Send for your copy to-day

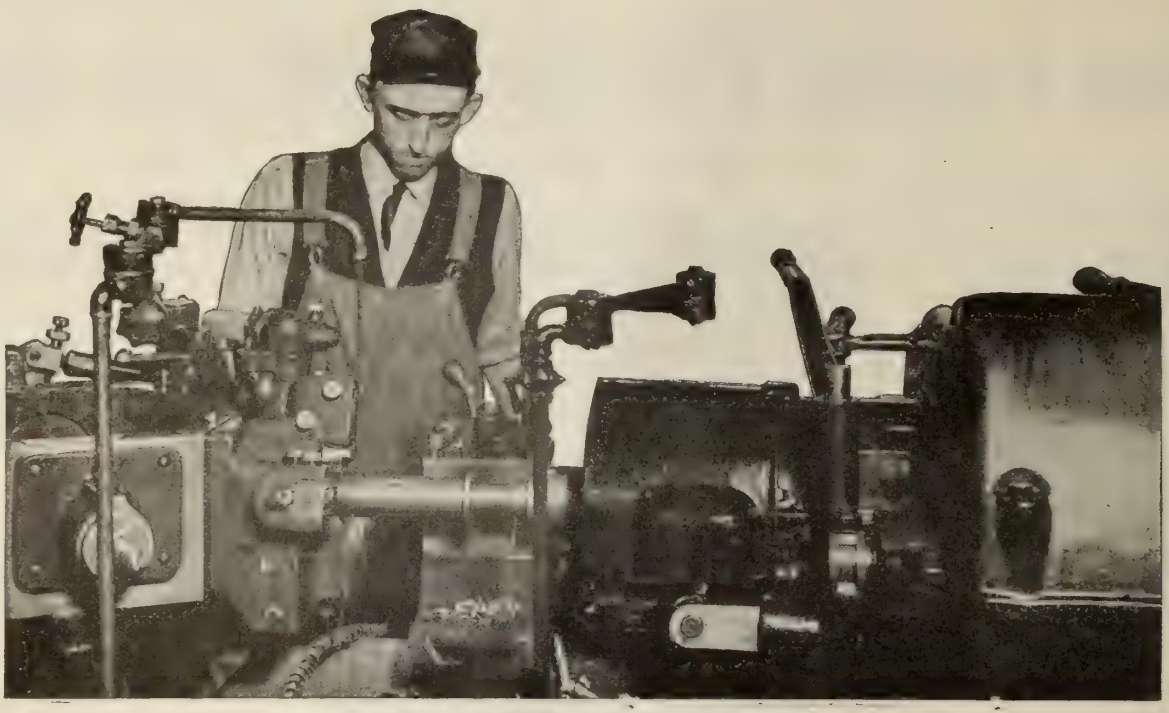


The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

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To Decrease Operating Costs

The side carriage is an important part of the W.& S. turret lathe. It reduces operating costs, often by as much as one-half. It operates simultaneously with the turret and independently of it. The side carriage has a separate feed rod.

Take some of the simplest bar jobs; by cutting off with the side carriage while the turret tools are finishing their work, you save most of the cutting off time.

Here is the picture of a W.& S. 2-A. in a railroad shop. This machine makes bolts, pins, oil cups, valve parts, piston rods, and many other parts used in the repair of locomotives and cars.

On all these parts both turrets operate together.

Take this feature and the fact that the machine operates easily and accurately, and you know why the machine is popular with the shop men. It delivers the goods.

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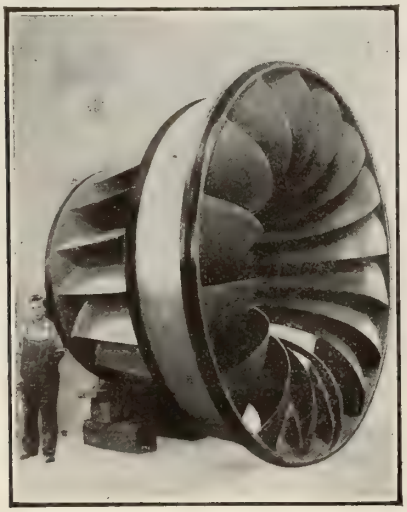
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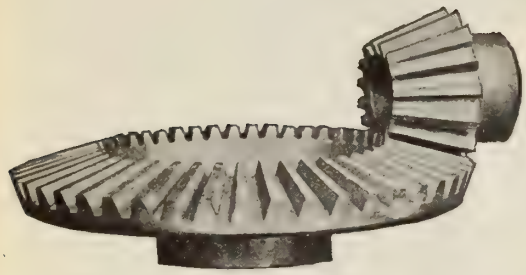
88 Broad Street, Boston. 19 South LaSalle Street, Chicago. 7 Dey Street, New York City. 1102 North American Building, Philadelphia. 429 Monadnock Bldg., San Francisco, 700 Tenth Street, N.W., Washington. Executive Office: Providence, R.I.

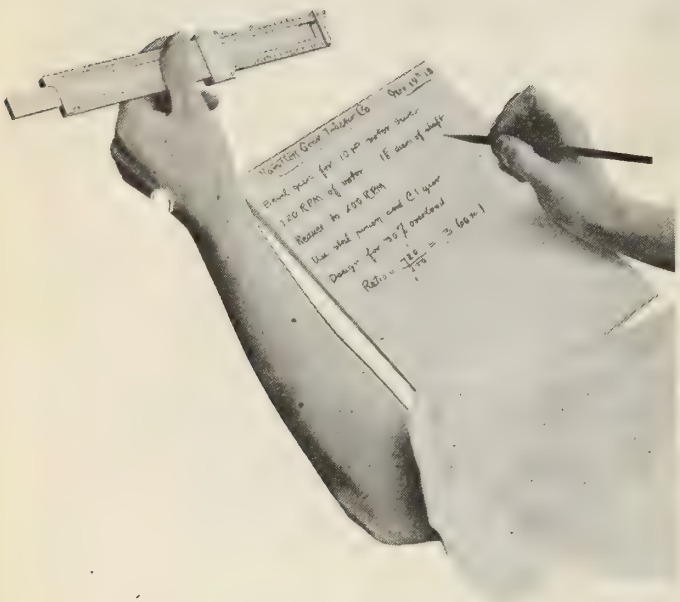
AGENCIES: Alfred Herbert, Ltd., Coventry, England; Paris; Milan; Brussels; Amsterdam; Calcutta; Yokohoma; Sydney. Graham Brothers, Stockholm.

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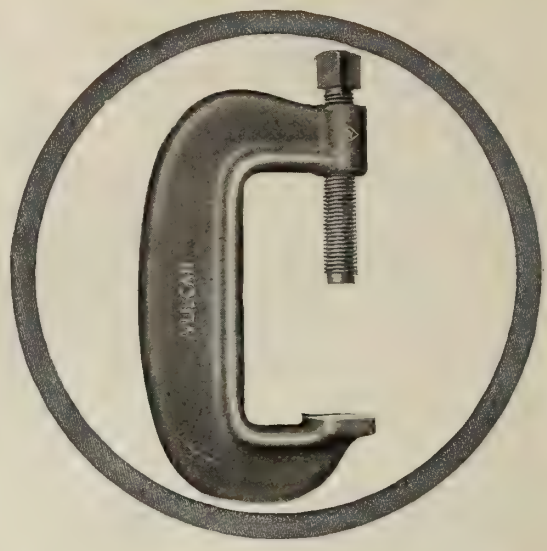




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CLAMPS and **LATHE DOGS** are essential tools in all machine shops; they form an important part of the foundation on which is built economical production. Build *your* foundation strong and sure—use the dependable, sturdy strength of Williams' Superior Drop-Forged Clamps and Lathe Dogs. They'll never fail you and will last a life time.

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The result is loss of efficiency, wasted time and effort.

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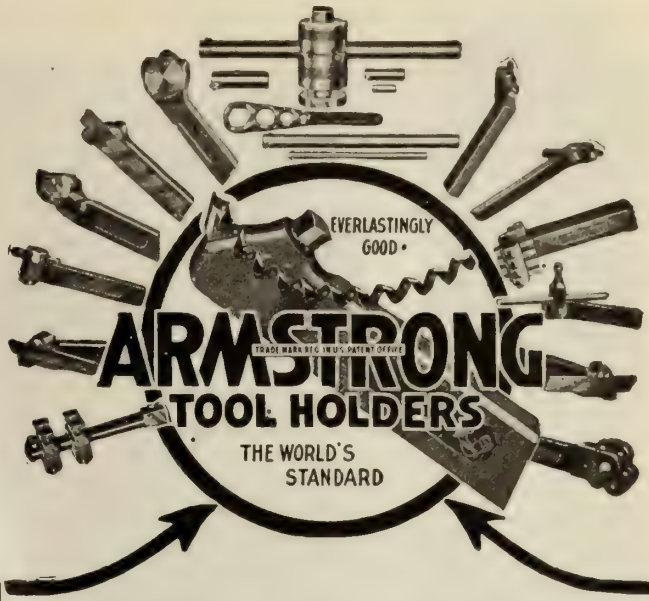
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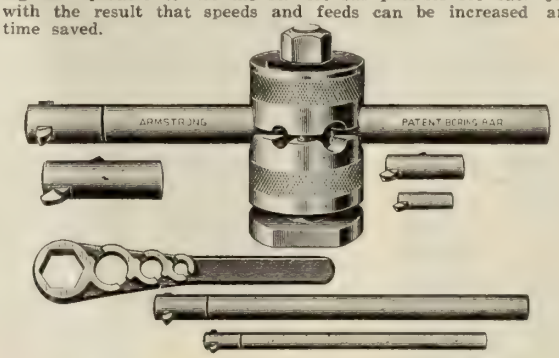
Port Hope - Ontario



Armstrong 3-Bar Boring Tool

A slight turn of one nut releases or fastens both Bar and Holder.

Bars can be changed as needed almost instantly, thus allowing the operator to use the stiffest bar possible for each job, with the result that speeds and feeds can be increased and time saved.

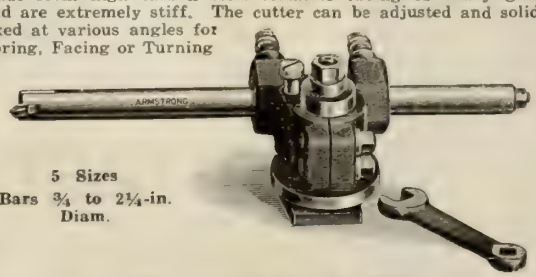


No. of Tool	1-B	2-B	3-B	4-B
Diam. Bars.	½, ¾, 1 1/16	9/16, 15/16, 1 5/16	¾, 1 1/16, 1 ½	15/16, 1 5/16, 1 13/16
Length Bars	8, 11, 16	9, 13, 18	11, 16, 21	13, 18, 24
Size Cutters.	5/16, ¼, 3/8	3/8, 7/16, 7/16	¼, 3/8, ½	5/16, 7/16, 5/8
For Lathes.	14 to 16	16 to 18	20 to 22	24 to 32

Adjustable Boring Tool

Patented

This tool combines Convenience, Adjustability and Rigidity to a remarkable degree and is well adapted to a very wide range of work. The holder is easily adjustable to different heights and will hold bars of various diameters. The Bars are made from high carbon steel seamless tubing of heavy gauge and are extremely stiff. The cutter can be adjusted and solidly fixed at various angles for Boring, Facing or Turning



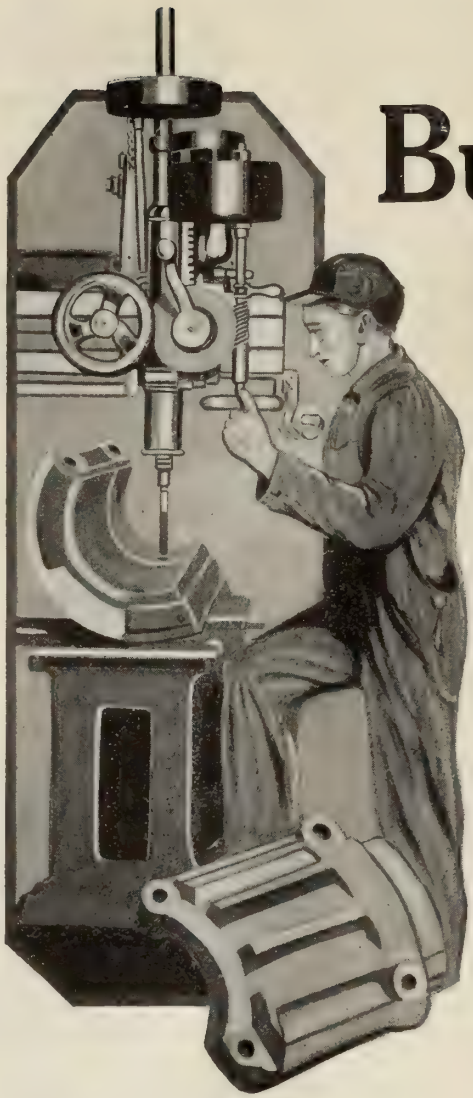
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Bars ¾ to 2¼-in. Diam.

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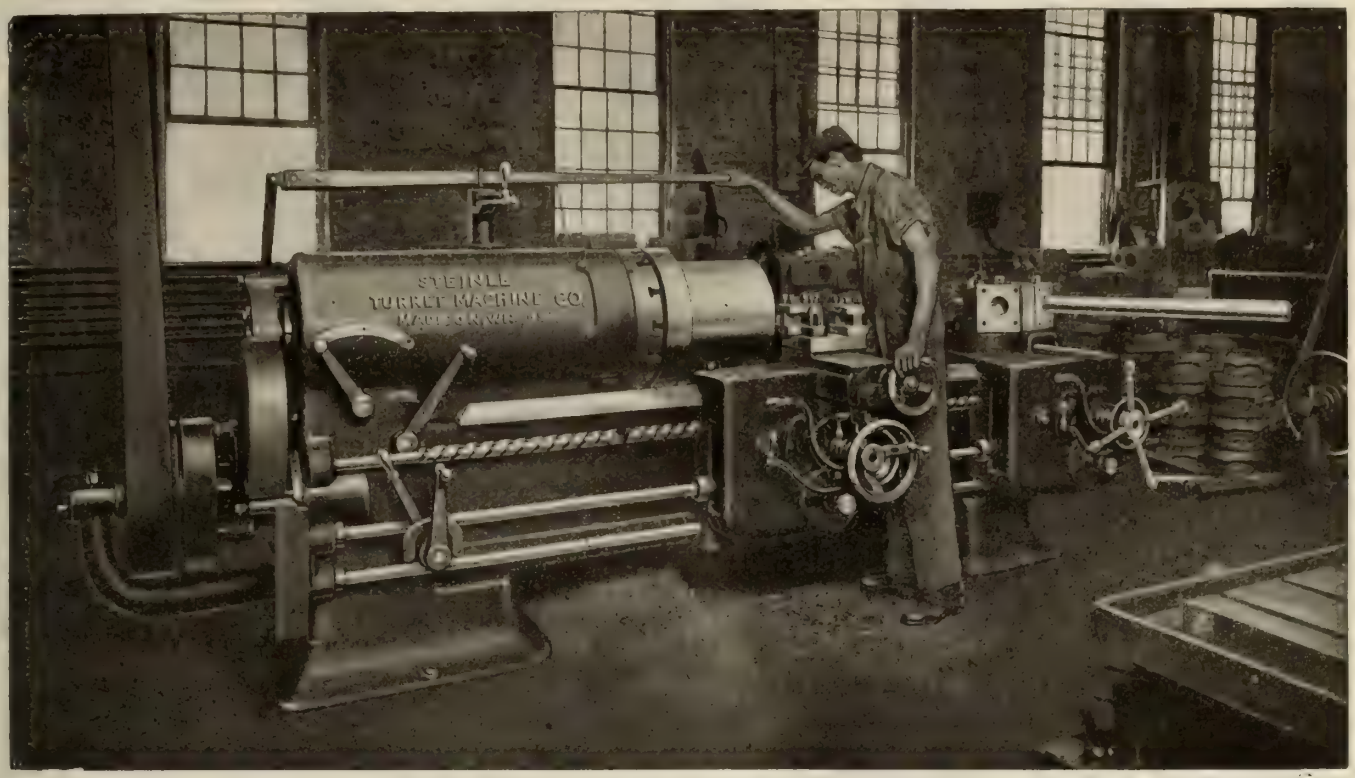
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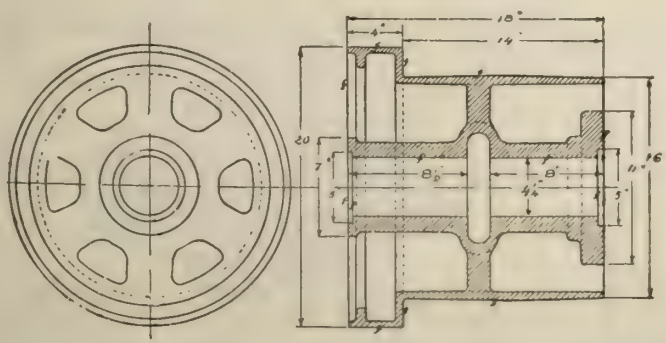
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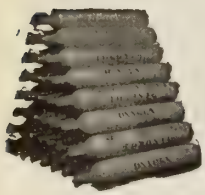
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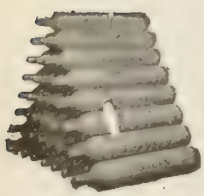
The Torch for Welders PUROX (OXYGEN / HYDROGEN) Who Want the Best!

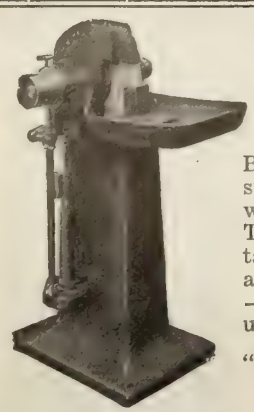
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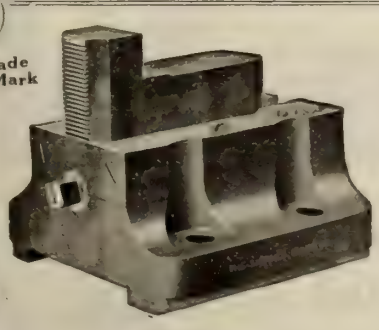
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SKINNER BORING MILL JAWS

Note the powerful compact construction of these sturdy jaws. For heavy duty work on boring mills and large lathes these jaws, fitted to the parallel slots in the face plate or table by means of the double rib, insure a most positive grip.

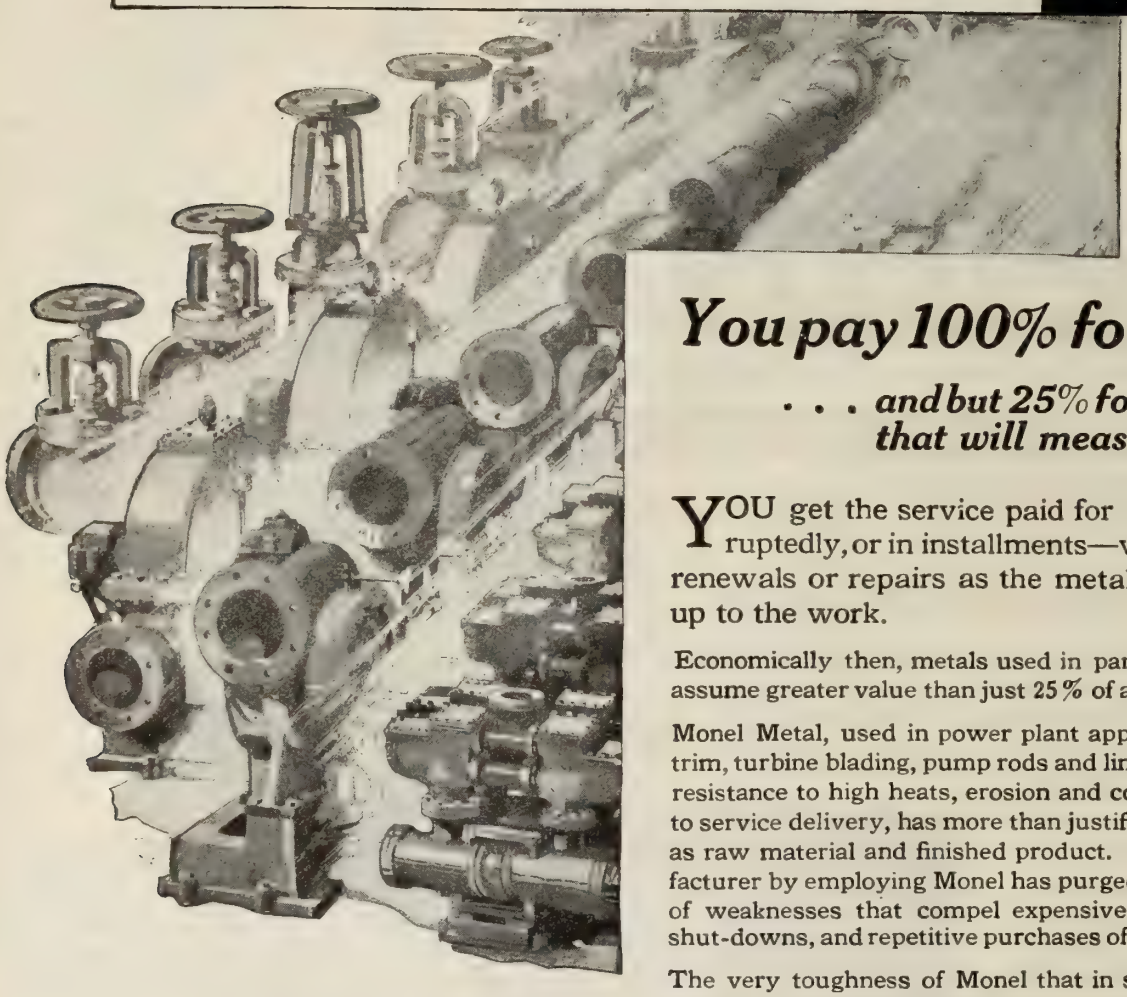
Furnished in iron or steel body—single or double rib as desired

THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN U.S.A
Established 1887

New York Office: 94 Reade Street. San Francisco Office: Rialto Building. Chicago Office: 552 West Washington Blvd.
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Design-time and Production costs 75% **Metal costs 25%**



You pay 100% for service

. . . and but 25% for the metal that will measure its life

YOU get the service paid for . . . uninterruptedly, or in installments—with repeated renewals or repairs as the metals used stand up to the work.

Economically then, metals used in parts manufacture assume greater value than just 25% of apparatus costs.

Monel Metal, used in power plant apparatus as valve trim, turbine blading, pump rods and liners, etc., where resistance to high heats, erosion and corrosion is vital to service delivery, has more than justified its cost both as raw material and finished product. For the manufacturer by employing Monel has purged his apparatus of weaknesses that compel expensive repairs, costly shut-downs, and repetitive purchases of new machines.

The very toughness of Monel that in some cases will slightly raise manufacturing costs is pledge of its ability to deliver service continuously.

Monel Metal is absolutely untouched by rust, is strong as steel, resists the eating action of most alkalies and acids. Monel retains its strength under high heats that break down the very structure of most metals and successfully withstands the eroding action of high pressure and superheated steam.

The name Monel is given to a line of metal products produced by The International Nickel Company from a natural nickel alloy—67% nickel, 28% copper and 5% other metals. These products include Monel blocks, Monel rods, Monel castings, Monel wire, Monel strip stock, Monel sheets, etc. The name Monel identifies the natural nickel alloy as produced by The International Nickel Company.

The International Nickel Company of Canada, Limited

Harbour Commission Building
Toronto, Ont.

INCo Monel metal

Machine parts

THE INTERNATIONAL NICKEL COMPANY

INCo MONEL METAL INCo NICKEL



The Main Thing for Maintenance

HUNDREDS of repair jobs that formerly kept rolling stock idle for weeks, and even months, are now speedily, economically and permanently effected by the oxy-acetylene process.

And Dominion Oxygen, because of undeviating purity and rapid deliveries, is constantly employed in railroad maintenance as well as in all those industries where time is the vital factor and only the proven product can qualify.

Shipped in portable, high-capacity cylinders, equipped with the leakless Wedge Valve, Dominion Oxygen is delivered anywhere and in any required quantity.

North, East, South or West—your order forwarded to the nearest of our six centrally located plants and distributing stations means that your oxygen travels by the quickest route.

And all orders are filled on the day they are received.

DOMINION OXYGEN COMPANY, LIMITED

Hillcrest Park, Toronto

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Canadian

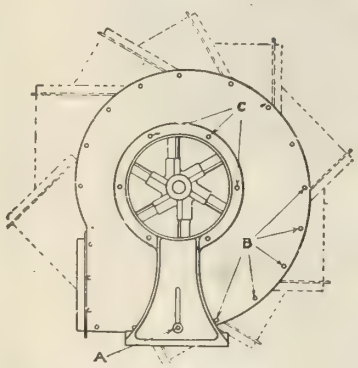
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

Insurance companies reduce the premiums where adequate precautions have been taken to prevent fires.

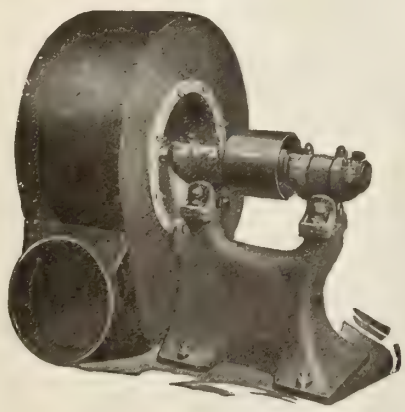
Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





The Canadian Standard Planing Mill Exhausters have reversible housings so that the outlet can be adjusted instantly to any angle desired.

This eliminates necessity of crossed belts. Simplifies changes on alterations in piping or building.



The housing is of heavy rolled steel plate securely bolted together with angle irons, round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

Every fan carefully tested by running test at speeds in excess of that required.

Write for Catalog No. 16.

Canadian Blower & Forge Co.

Kitchener - Ontario.

THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

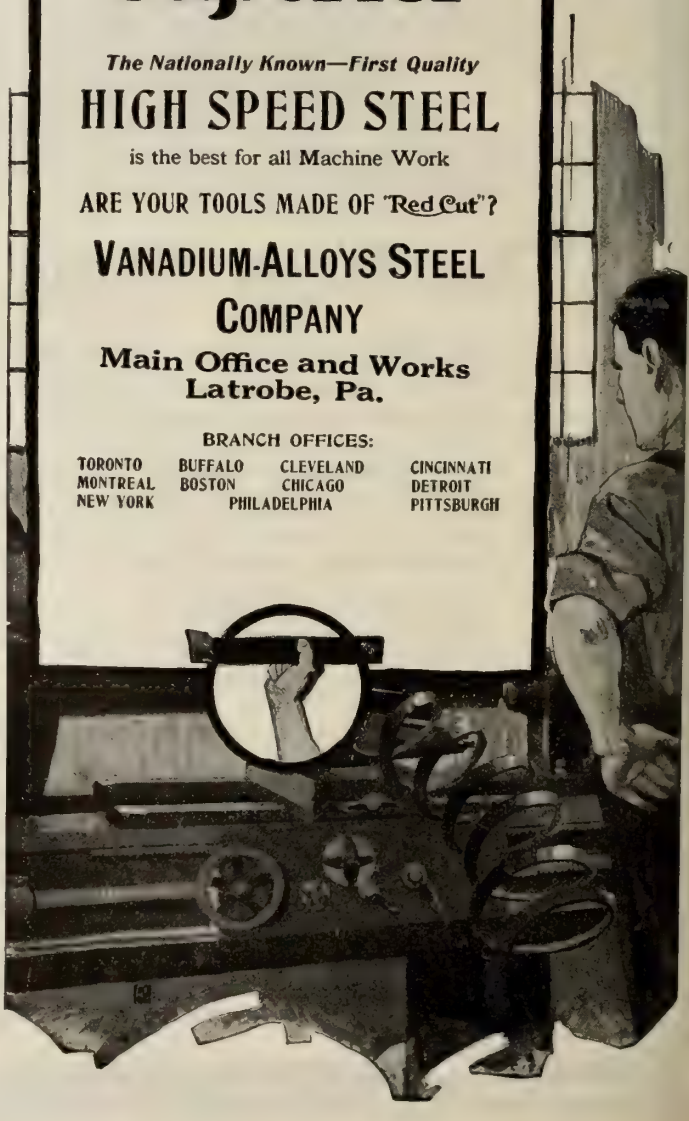
ARE YOUR TOOLS MADE OF "Red Cut"?

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Cement Mill and Mining Machinery, Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

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"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.

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DIAMOND FIBRE RECEPTACLES

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Trucks	Doffing Cars
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They are practically indestructible.

They will not dent, crack, splinter, or corrode.

They are wonderfully strong yet light and easily handled.

They have a smooth surface finish which protects goods from injury.

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Visit our new showrooms at 235 Carlaw Avenue, Toronto, and see these wonderful receptacles, or write for fuller particulars. Our experts will be glad to advise you on any special needs you may require.

Diamond State Fibre Company of Canada, Limited.

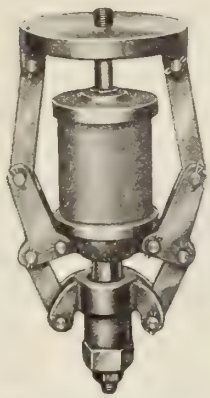
Head Office and Works

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FIBRE

New Bliss Spring Pressure Attachment For Combination Dies

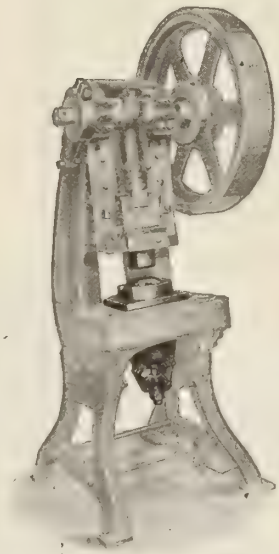
Eliminates Accumulative Spring Pressure.
Reduces Compression and Saves Power.
Insures Uniform Pressure for Entire Draw.
Produces More Uniform Edge. Reduces Breakage.



Patents Pending

The combination spring pressure attachment shown presents to users of combination dies advantages not to be had in those now in general use. It insures uniform drawing pressure on blank during entire draw. The application of the toggle motion giving a uniform pressure reduces total rubber or spring compression materially.

It will be immediately recognized that the strain on the press is reduced and a decided saving in operating power effected. A further power saving is made by the elimination of accumulative spring pressure. The reduction of compression adds considerably to the life of the rubber or spring. The uniform pressure increases efficiency by giving a more uniform edge and reducing breakage. Reduced compression allows the economical manufacture with combination dies of shells deeper than heretofore practical. You can do in combination and reducing dies certain work which formerly required double action dies. The attachment does not interfere with the operator and dies can be removed the same as with the old style attachment.



Patents Pending

Regularly built in four sizes for standard Bliss presses. Depth of draw obtainable on the various sizes is as follows:

No. 18 Press 1¼" depth of draw	**No. 19 Press 1½" depth of draw**
No. 20 Press 2" depth of draw	**No. 21 Press 2½" depth of draw**

To obtain maximum draws given, presses must have same stroke and die space as necessary with old style pressure attachment.

While it is possible to draw in one operation a shell of greater depth than with the old style attachment, it should be understood that to get the maximum depth of draw, correct working proportions between diameter and depth of shell must be maintained.

PRICE F. O. B. BROOKLYN, N. Y.

No. 18—$65.00 No. 19—$75.00 No. 20—$90.00 No. 21—$100.00

Prices subject to revision.

Order today and prove to yourself the advantages to be gained. In ordering specify size of tap hole for spring barrel stem. Also whether it is to be fastened to bolster or die. If fastened to die, give thickness of bolster and size of opening.

BLISS 1857

E. W. BLISS CO.

BLISS 1921

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No. 169

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We roll the ingots down into blooms and then into billets, slabs and bars, subject to rigid inspection standards.

And we---*anneal---heat treat---cold draw* to our customers' specifications.

All operations in connection with our manufacture are performed in one large plant and all details receive thorough attention.

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It is our aim and earnest desire to serve our clients in every way a steel manufacturer can.

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Dominion Engineering Works, Limited, Montreal, Que.

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Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

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Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

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Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

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Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., B. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis I
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis,

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Mont.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd. Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Brown & Sharpe Mfg. Co., Providence, R.I.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
ohannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting
Hobs
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can. Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Alkenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Imperial Oil Ltd., Toronto, Ont.
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co , Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthe, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. B., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison Wis
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R. Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal. Q

Screens
Can. Wire & Iron Goods Co., Hamilton

BUYERS' DIRECTORY

Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto, Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
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Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
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Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
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Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, nt
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis
Charles Parker Co., Meriden, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
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Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

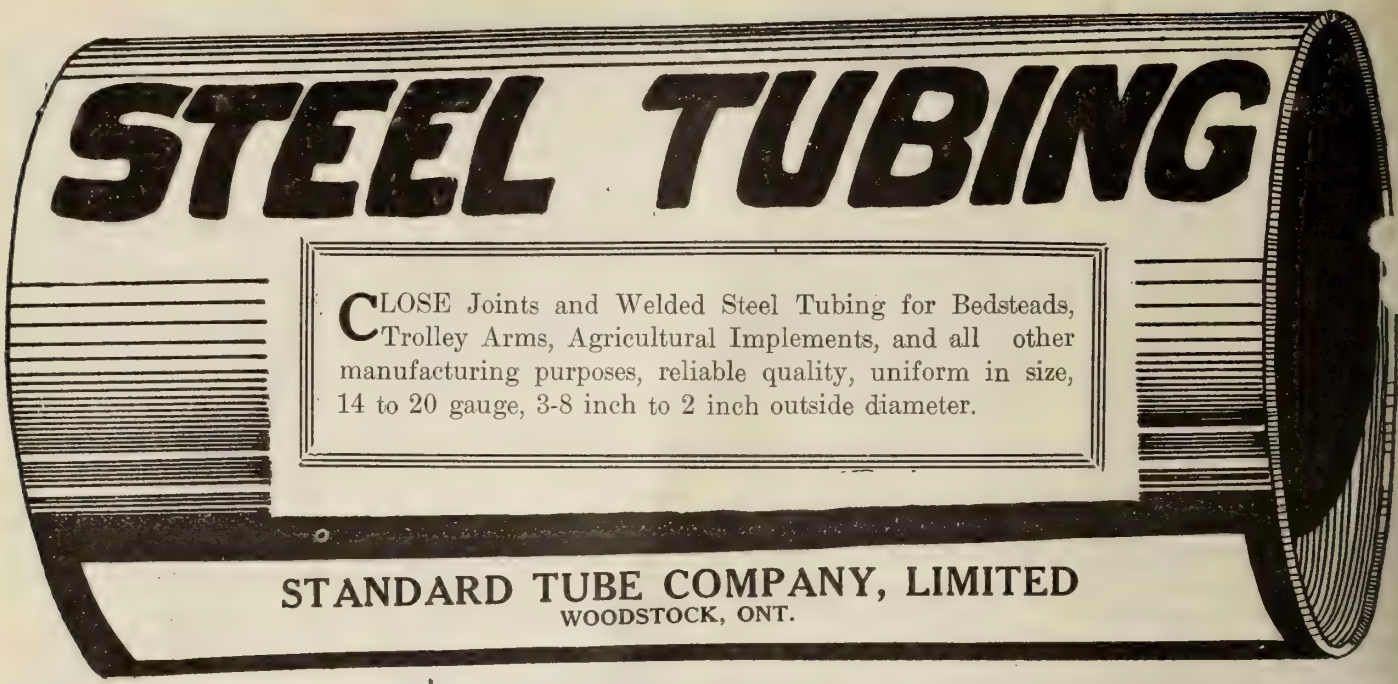
The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co. Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
A. R. Williams Machinery Co., Montreal, Que.

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The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
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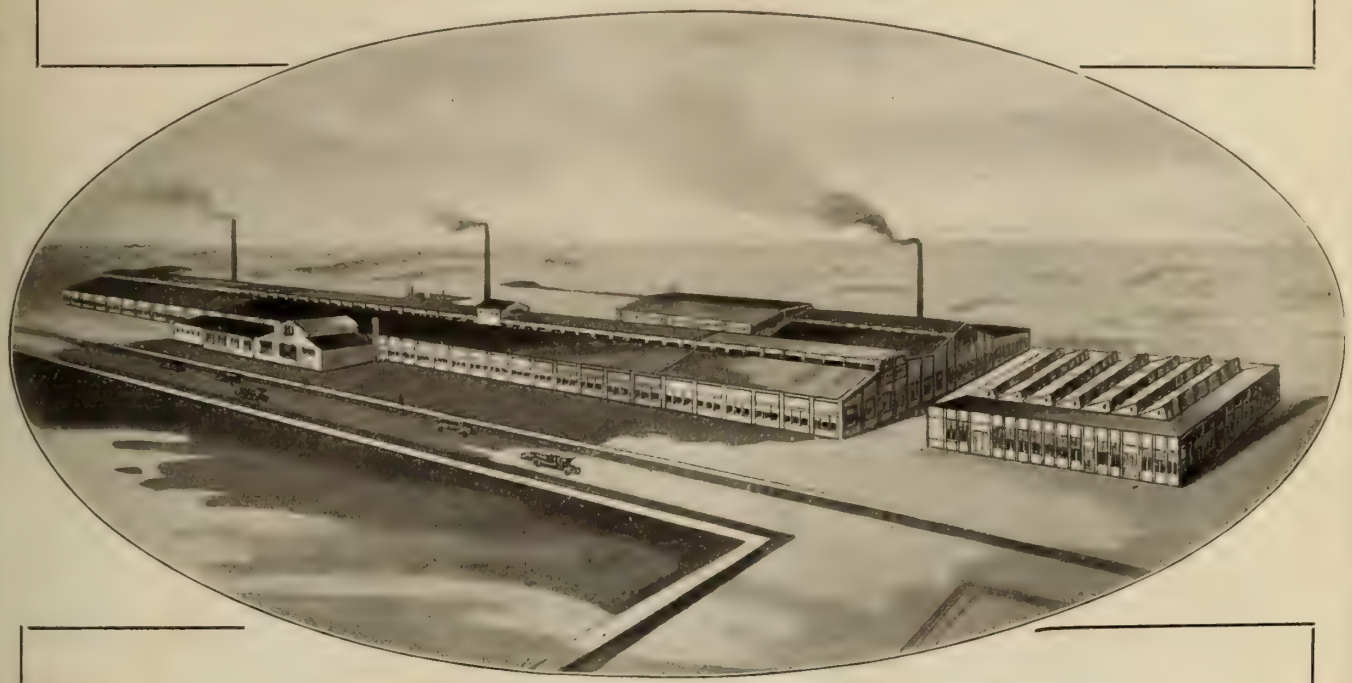
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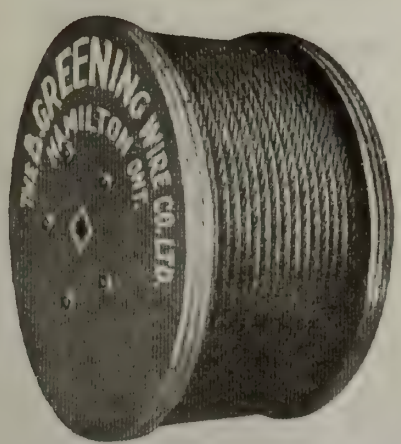


CANADIAN MACHINERY AND MANUFACTURING NEWS

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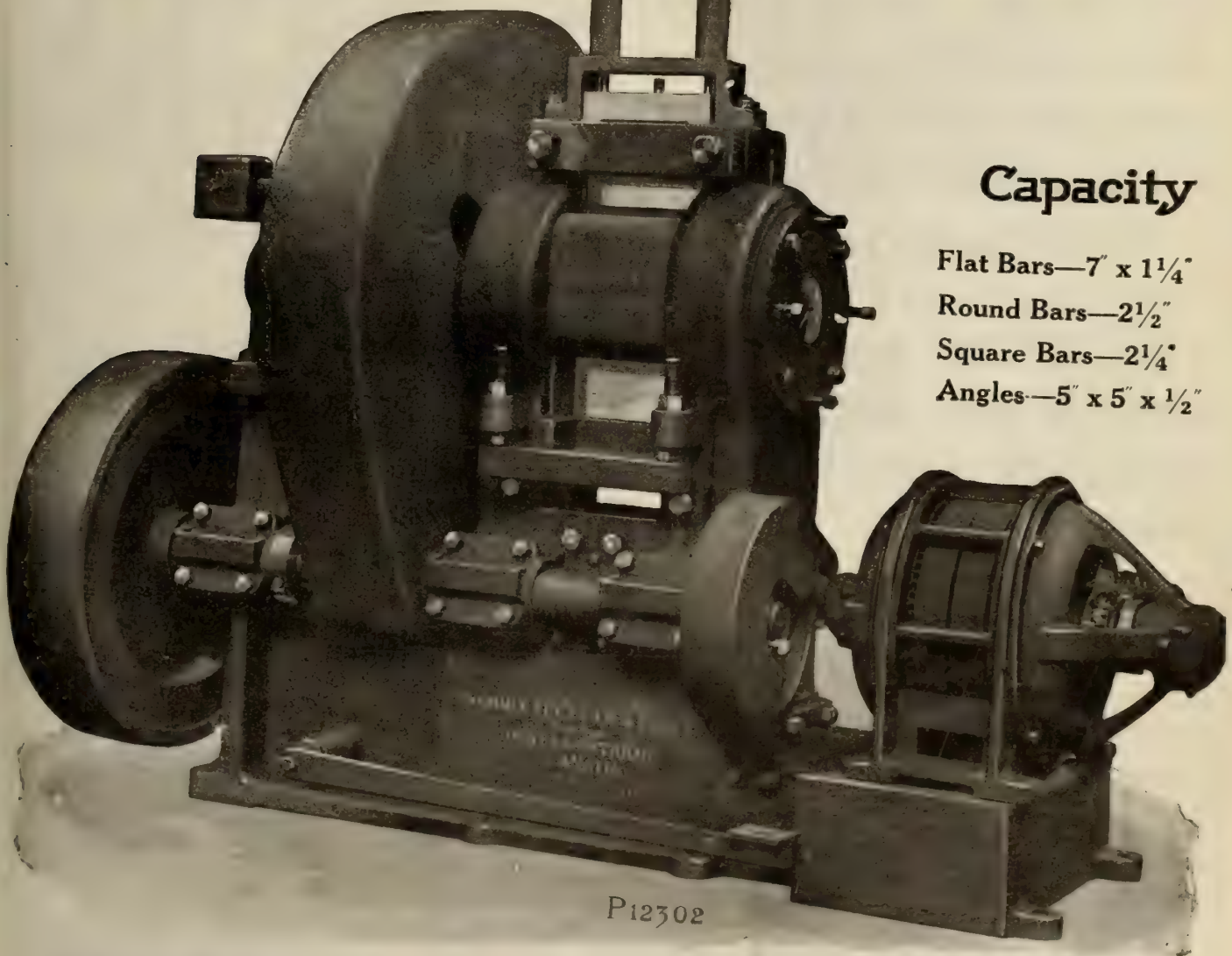
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The BERTRAM Page

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Motor Driven 10 H.P. Motor



P12302

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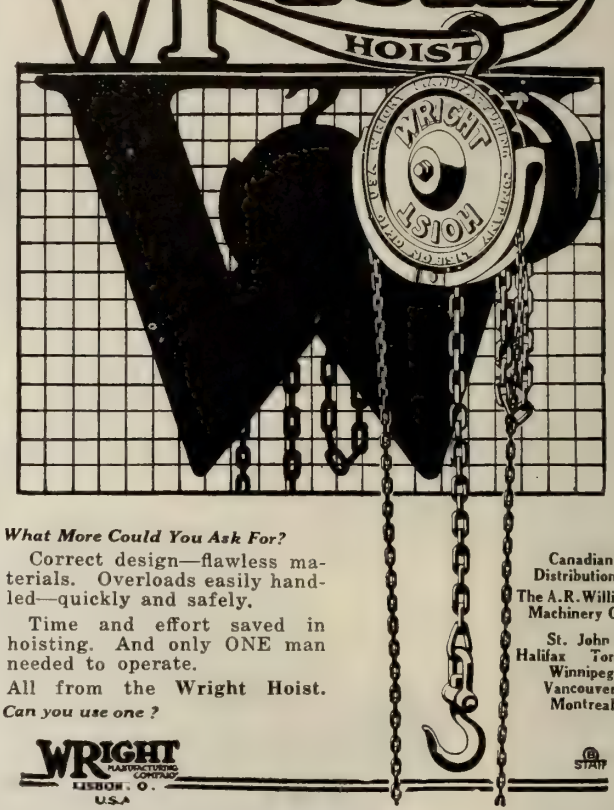
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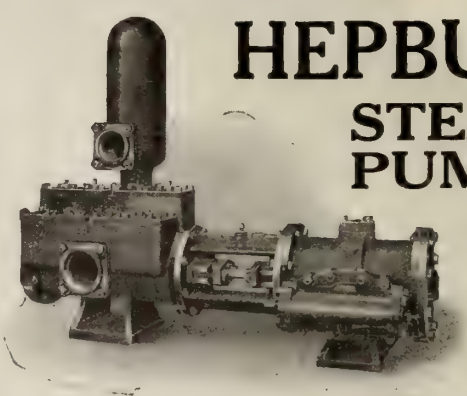
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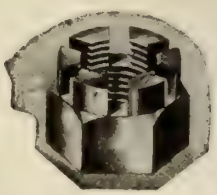
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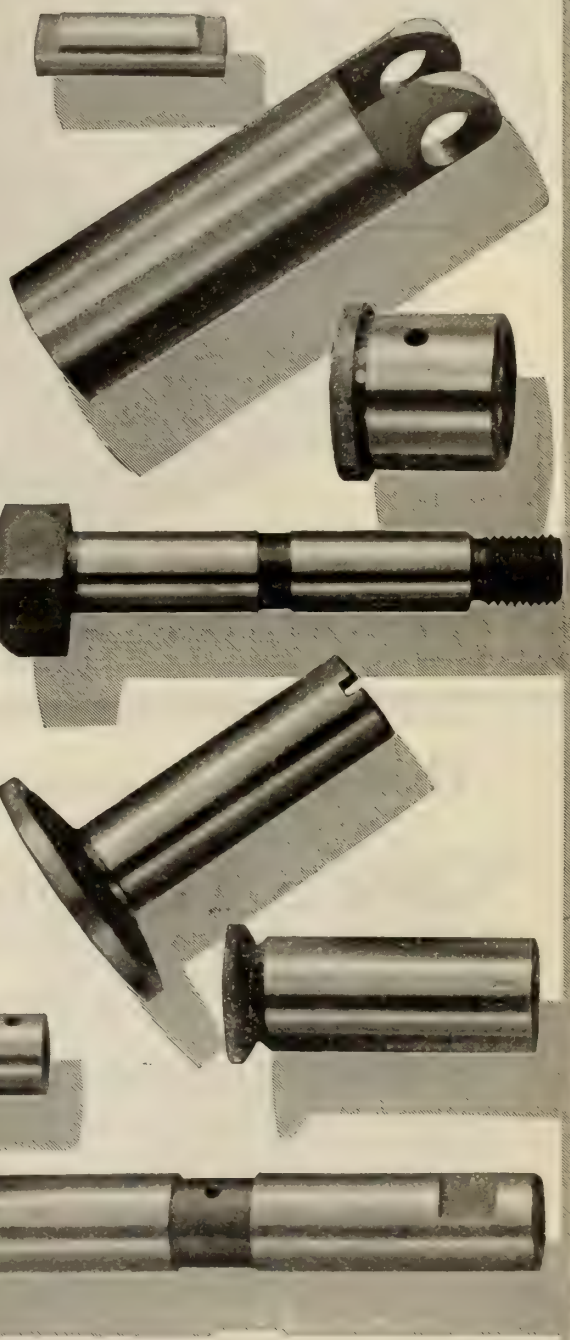
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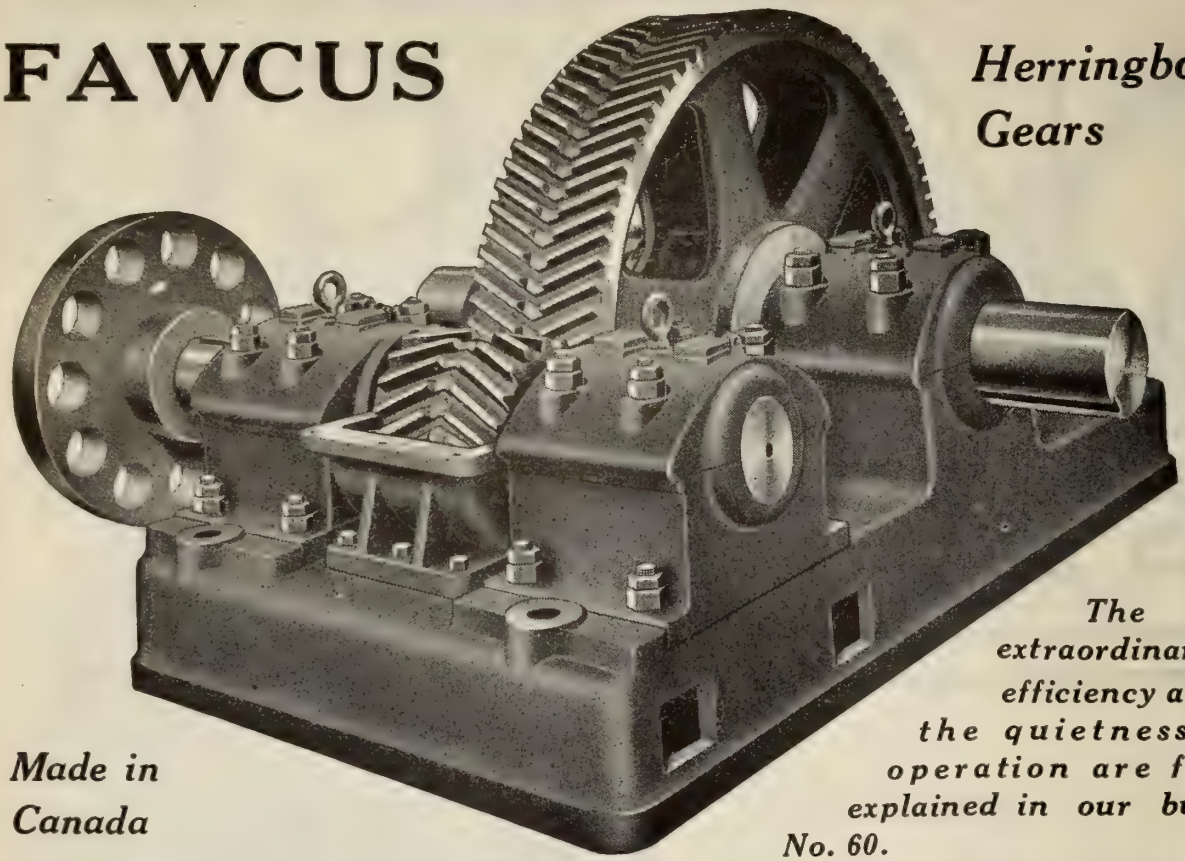
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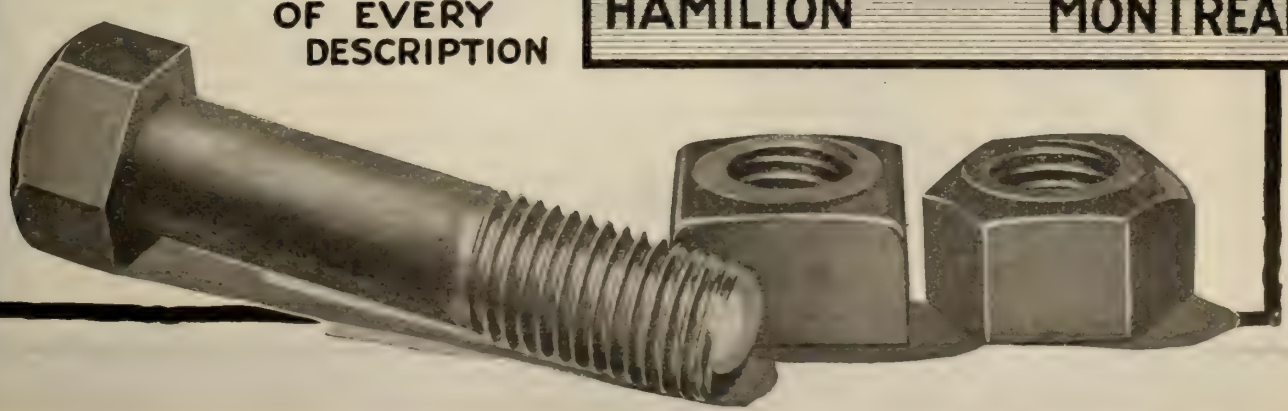
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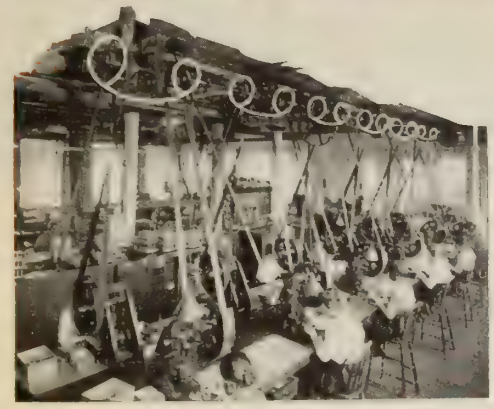
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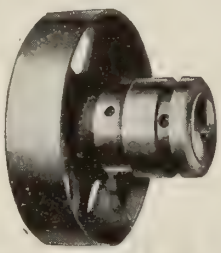
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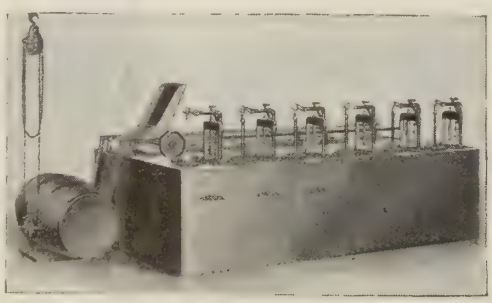
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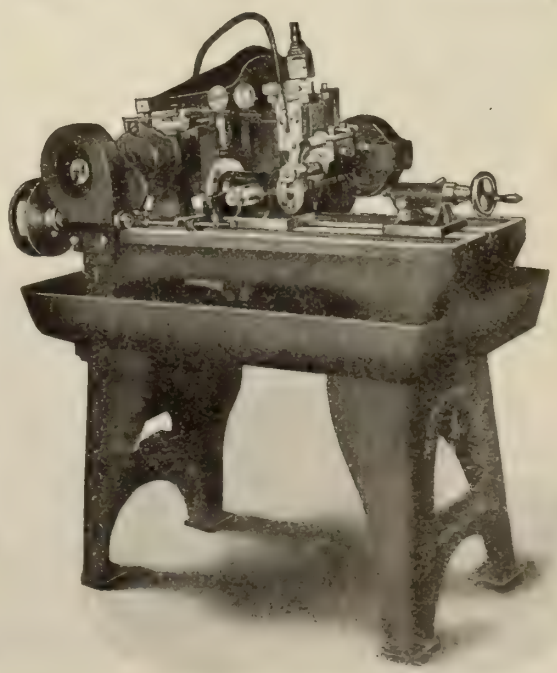
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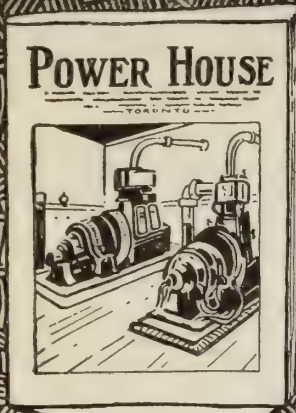
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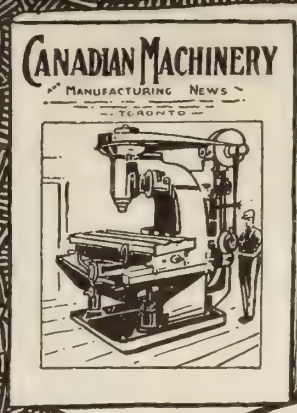
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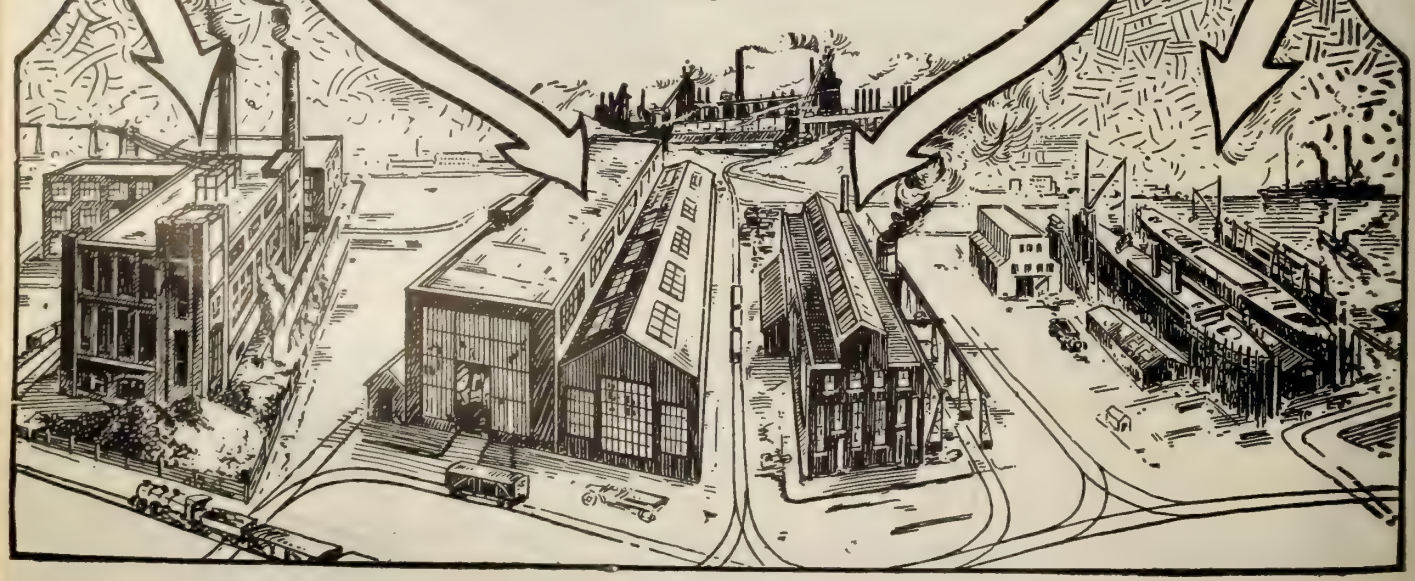
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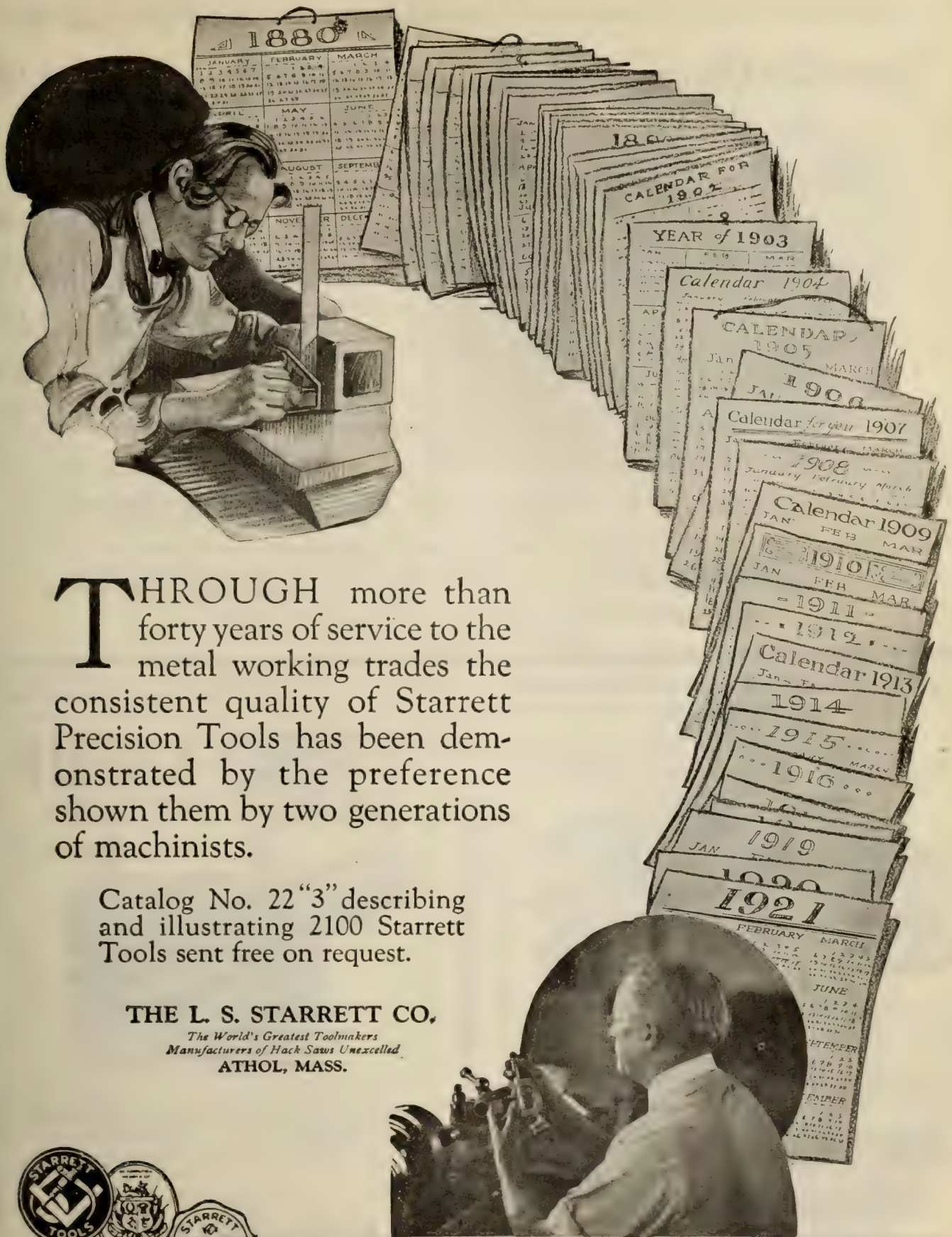
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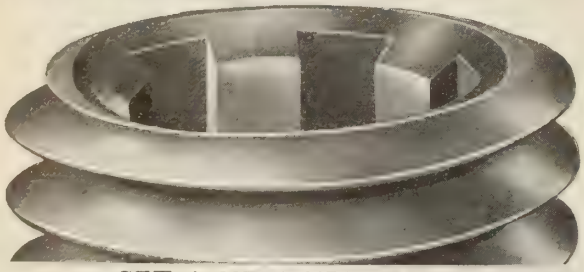
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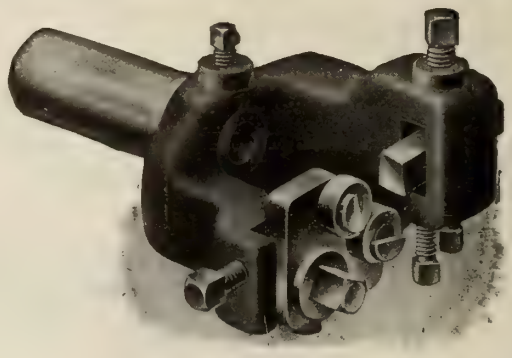
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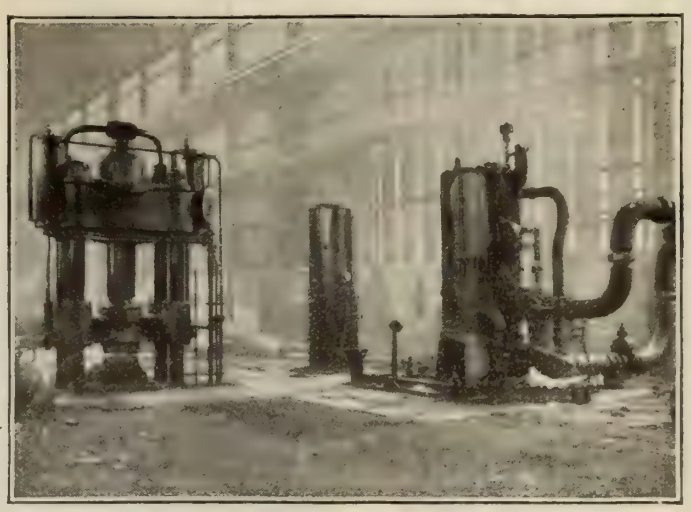
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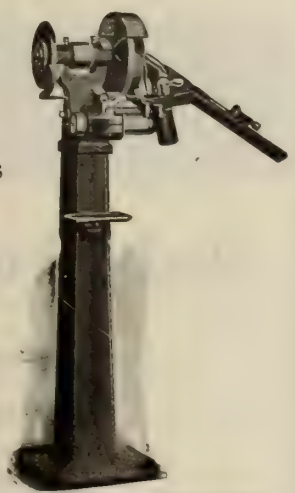
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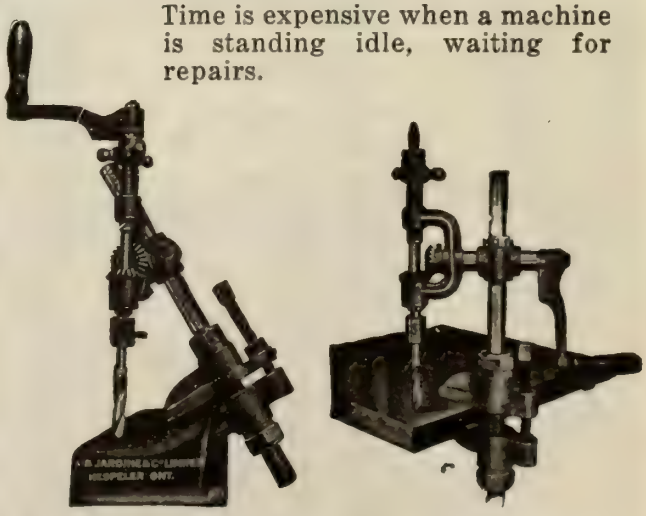
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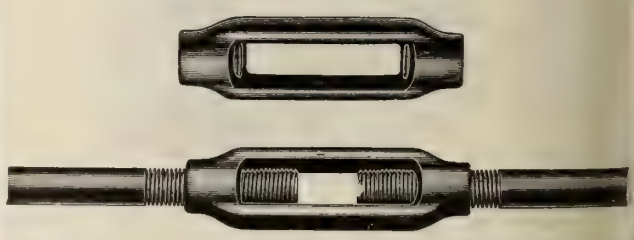


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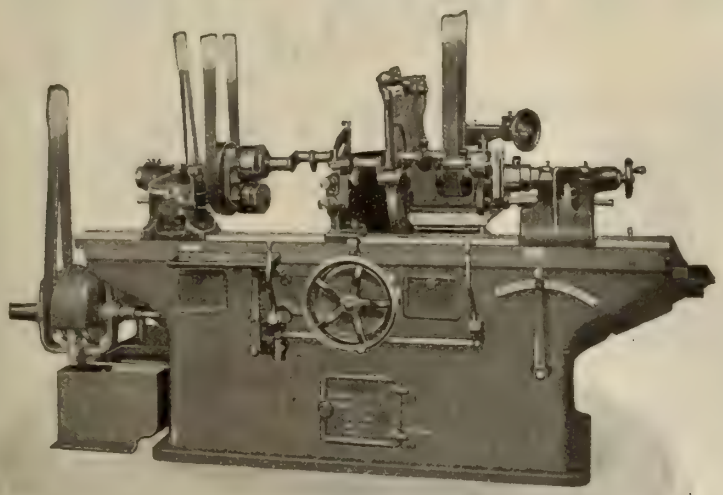
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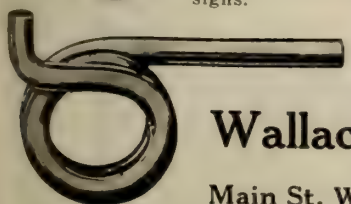
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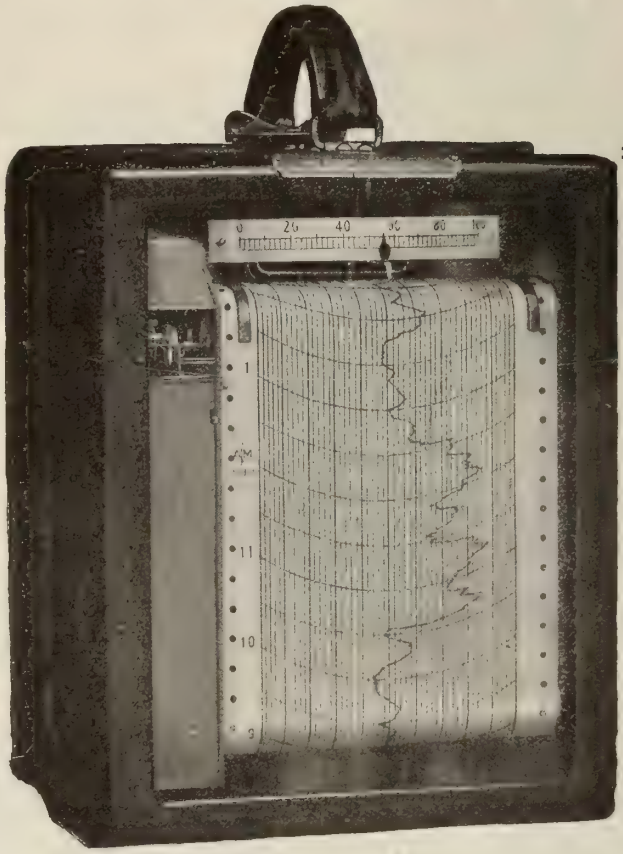
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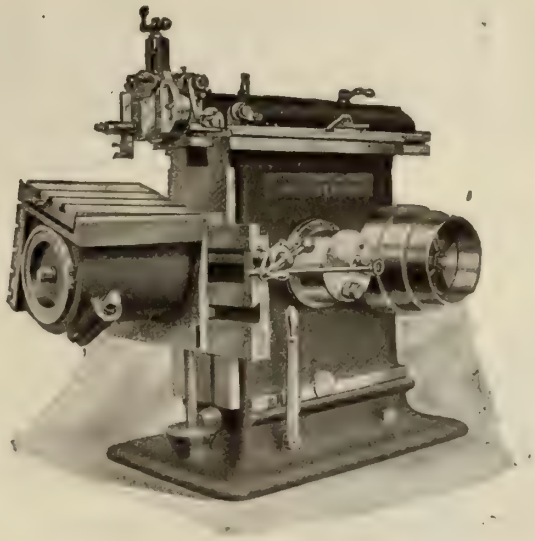
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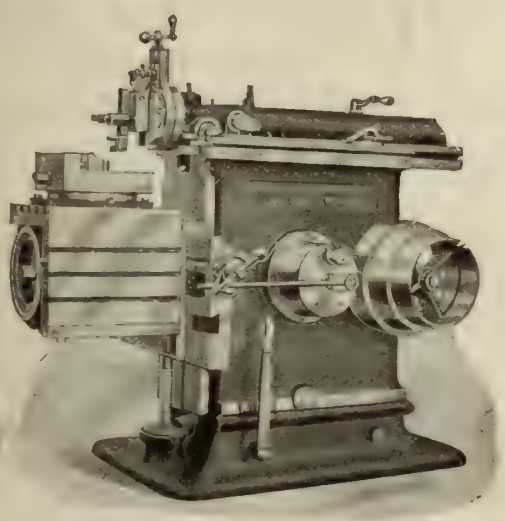
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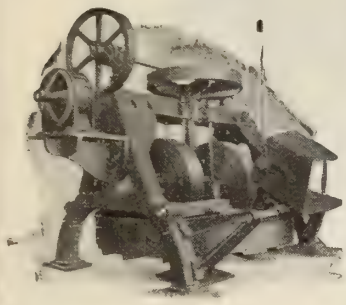
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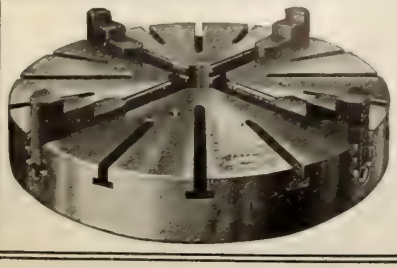
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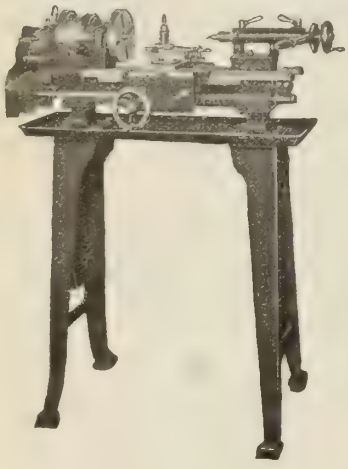


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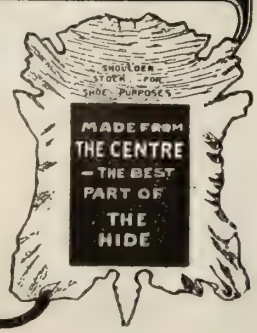
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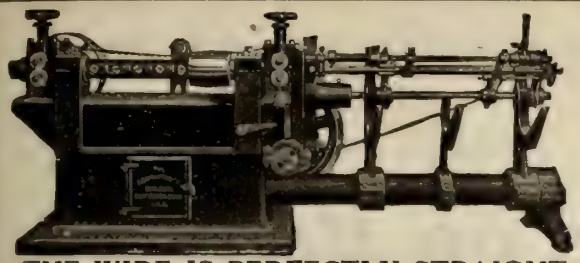
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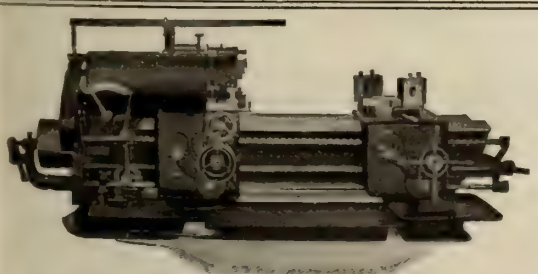
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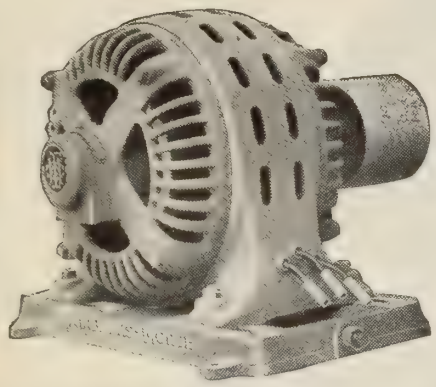
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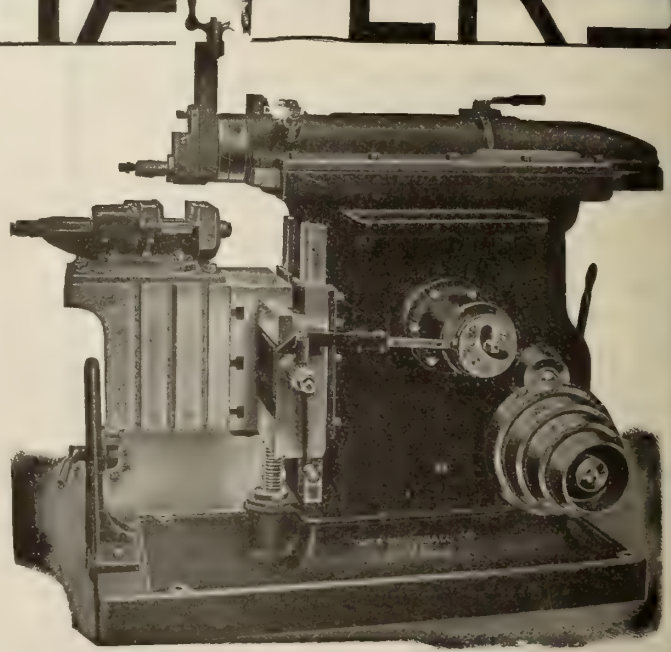
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VOL XXVI NO. 15 October 13, 1921

The Proper Selection of Grinding Wheels

Development and Advantages of Modern Artificial Abrasives—Grain and Grade—Manufacturing Processes—Production Grinding—Relation of Work to Grain and Grade

*By P. N. Cooke

THE MODERN grinding wheel should be, if properly designed, an efficient cutting tool. If not properly selected, it will be just as inefficient as a lathe or planer tool incorrectly shaped or composed of material not suited to the particular operation. When there is a new machine job to be performed in the shop, the proper tool to use is the first thing to be considered after the job has been assigned to the machine. First of all it is necessary to decide whether a special alloy steel should be provided, or whether a high carbon steel hardened and tempered tool is sufficient, or whether perhaps a stellite tool is warranted. Then there are other factors to be considered; the shape of the cutting edge, the amount of clearance and the heat treatment to be specified before applying the tool to the work. Today, the grinding wheel manufacturer has practically these same things to consider and generally speaking it should be left to him to supply the correct wheel for the machine and for the work in question.

Development and Advantages of Modern Artificial Abrasives

Not so many years ago artificial abrasives were unknown. Until about forty years ago the only tools in common use for the shaping of metallic objects by grinding or abrading were the grindstone and whetstone derived from natural rock. About 1880 the natural emery and corundum were first employed as cutting agents in a manufactured wheel for grinding. The abrasives after being crushed to small particles and screened to practically uniform sizes were bonded together with pottery mixtures into grinding wheels of any specified diameter and thickness. Grinding wheels of these natural abrasives soon found their way into machine shops for sharpening tools and for other operations, because they had certain distinct advantages over the grindstone. It was found that they could be made more uniformly and that they would cut much quicker and wear much longer than any natural stone that could be found. Emery and corundum contained like any mined material impurities which, of course, varied in different sections of the mine and in different parts of the world, but which detracted from the hardness of the abrasive. It was aluminum oxide in the product which gave it its hard quality and good grades of emery rarely ran higher than 65 per cent of this oxide.

Consequently, to produce an abrasive that was free from these varying substances, it was either necessary to refine the natural product at high expense or to make an abrasive by producing a material synthetically. With the invention of the electric furnace, it became possible to manufacture from soft mineral clay, known as Bauxite, an abrasive ranging from 90 per cent to 97 per cent pure aluminum oxide, and which today is known under a number of trade marks, as Alundum, Aloxide, Borolon, Allowalt and other. The electric furnace has also made it possible to manufacture this abrasive with different physical characteristics. The hardness sharpness and toughness of the product is within the control of the abrasive manufacturer. To satisfy the requirements of a grinding wheel under different operating conditions, the abrasive manufacturer has developed aluminum oxide abrasives of several different tempers, each of which is especially adapted for certain purposes.

Years back, when only natural abrasives were known, one abrasive alone had to satisfy all conditions; and the variation in the natural mineral, as previously stated, made it exceedingly difficult to standardize the grinding wheels to employ for any operation. Modern artificial abrasives have revolutionized the grinding industry and have made it possible to duplicate a satisfactory grinding wheel as needed. The electric furnace has still further contributed to modern grinding practice by the discovery of an entirely different artificial product. A chemical composition of sand and coke, with sawdust and salt, under special electric furnace control, results in a silicon carbide abrasive known commonly by such trade marks as Crystolon, Carborundum, Carbolon, Carbowalt, and so forth. Hence, in addition to the different aluminum oxide abrasives for the manufacturer to use in making grinding wheels, there is this later development for certain classes of work for which it is generally known now that the Aluminum oxide materials are not as well suited.

So far as our present knowledge goes, the tensile strength of a material usually decides whether an aluminum oxide or a silicon carbide abrasive is correct. Recent experiments, however, indicate that there may be other physical properties which exert a strong influence in the determination of the abrasive.

Theoretically each grain in a grinding wheel must be so constructed that when the particular material ground is brought in contact with it, it will cut continuously until it has lost its cutting edge and then immediately fracture, ejecting the worn part and exposing to the work a new cutting edge. It is important today that each individual grain be designed to stand up under the grinding pressure for the longest possible time and yet to remain in the wheel after it has lost its cutting power.

To illustrate this more clearly, two distinctly different operations may be cited. Consider a heavy casting, which has been taken from the foundry and which is "cleaned" by a grinding wheel. The mould leaves small fins and gates on the casting, which must be removed and which modern practice has found to be most economically done by a grinding wheel. The man doing the work will exert all his body pressure against the casting and in turn the casting against the wheel face, which means that the grit must be extremely tough to withstand that pressure. Otherwise, it would fracture or shatter and wear away without doing any actual cutting. Contrasted to this operation, consider a job in the tool room where a hardened

*Author is Sales Engineer with the Norton Co. of Canada at Hamilton, Ontario.

steel surface must be carefully and accurately ground. It is plain to see that the abrasive in the first case could not compete with one that would have a tendency to break away as fast as the hardened surface dulled the cutting point or edge. Hence, instead of using universally one single natural abrasive, there are now specially designed and constructed materials which in every respect far excel any natural product. Whereas the foregoing is somewhat theoretical and technical, it is given in detail to emphasize the importance of correct abrasive selection for the grinding operation before any other factors are considered.

Manufacturing Processes

After the abrasive has been determined, which is known to satisfy the conditions that will be imposed on it, the next problem is to decide the process by which that abrasive shall be made into the finished wheel. There are four common methods today, vitrified, silicate, elastic or shellac, and rubber.

The vitrified wheel is best known and is the one used for the majority of the work in the shop. It is the wheel known to be best suited for the usual cylindrical grinding, internal grinding, off-hand grinding and snagging, saw sharpening and tool sharpening. The vitrified wheel is the fastest cutting wheel and longest lived wheel for most work. The dimensions of this wheel are limited. When a large 36 x 10 in. for instance, or some similar size is required the silicate method of manufacture is followed. Silicate wheels are usually used where a cool cutting quality is essential. High grades of steel already hardened and tempered are best ground with silicate wheels to insure preservation of the heat treatment. Knife grinding of all kinds and surface grinding, where the contact between the wheel and the work is large, and where excessive heat will be generated, call for the silicate wheel.

Elastic of Shellac process is followed for extremely thin wheels such as 1/16 in. or 1/8 in. Some saw filers prefer this type of wheel to any other. This particular class of work is done by both the vitrified and shellac wheel with excellent results. It is more a question of personal preference as to which type is chosen.. It is known, too, that for some work a finer finish is possible from an elastic wheel than from any other. And if the wheel is specified to grind in a slot or groove to cause side strain and bending, the elastic or possibly rubber wheel should certainly be mounted. As the process implies, such wheels will "yield" slightly to strain. Such is not the case with the vitrified or silicate wheel. Wherever the conditions surrounding a grinding job would be too severe for the hardest elastic wheel that could be made, the rubber process of manufacture should be recommended. Rubber wheels can be made considerably harder than elastic wheels and will at the same time fulfill the other requirements of the elastic wheel.

It may be said that the nature of the operation will for the most part determine the process for manufacturing the wheel.

Grain and Grade

The grain size of a wheel is determined usually by the mesh through which it is passed before it is ready for wheel manufacture. To illustrate, a size 14

INFORMATION DESIRED FOR PROPER SELECTION OF NORTON GRINDING WHEELS

PLEASE FILL IN BLANK SPACES AND GIVE INFORMATION AS ACCURATELY AS POSSIBLE CROSSING OUT WORDS NOT APPLYING — IT WILL ENABLE US TO INTELLIGENTLY MEET THE REQUIREMENTS

Firm _____ *Date* _____

Address _____ *Delivery:-* *Parcel Post* *Express* *Freight*

TO BE FILLED IN BY CUSTOMER						TO BE FILLED IN BY NORTON CO.			
Quantity	Dia.	Thick.	Hole	Face	Remarks	Grain	Grade	Abrasive	Process

Machine — TO BE FILLED IN BY CUSTOMER — *Work*

Make _____ Name of Part _____

or
Description _____

Wheel Speed _____ R. P. M. _____ Constant Variable — Material _____

Work Speed _____ R. P. M. _____ Constant Variable

Hardened - Soft - Chilled - Annealed

Operation:- Precision Grinding { Cylindrical Surface Internal — Size or Weight _____

Stock to be Removed _____

Free Hand Grinding with without rest. — Wheel Previously used _____

Snagging with Swing Frame or Portable Machine. — Grain _____ Grade _____

Wet or Dry Contact Broad or Narrow. — Was it too Fine - Coarse - Hard - Soft?

Remarks (State finish desired - etc):- _____

Attach your Order - Use Separate Sheet for every operation of different nature

grain would be that which has passed through a wire screen with 14 meshes to the lineal inch. The grain size is determined partly by the finish specified by the shop where the wheel is to be used. On precision grinding, where dresser fixtures are provided and the machine, a fairly coarse wheel can be "dressed" to give a fine finish. The dressing tool, probably a diamond, will cut away the points of the grains and leave the effect of a fine wheel. But for general off-hand grinding, the finish required will play a large part in deciding the proper grit. If there is very little metal for the wheel to remove and if it is desired that the surface be as smooth as possible from a grinding wheel, the grain chosen would necessarily be comparatively fine. On the other hand, if there is considerable material for the wheel to grind away and the finish is not of importance, a coarse grit would answer the purpose far better than a finer one.

Grade is used to denote the hardness of a grinding wheel. It actually represents the strength of the bond or the force exercised by the bond to retain the grain in its setting, With most manufacturers the letters of the alphabet are used to designate grade and practically every letter is used in the grinding wheel grade scale. A rather broad statement is sometimes made that for metals a soft wheel should be used on a hard surface and a hard wheel on a soft surface. This is, of course, only general; there are other factors to be considered with the hardness of the metal before the grade can be established. On a soft surface a wheel would retain its cutting qualities longer than on a hardened surface. In other words, a harder wheel, or one where the grit is held more securely, can be used on a soft metal than on a hard metal, other conditions being the same. The ideal wheel is one where the grade is so nearly perfect that practically no dressing is required. The pressure of the work against the wheel face with such a wheel will automatically break down the dulled particles exposing new cutting grit in the wheel. Dressing will then only be necessary to keep the face absolutely true. Wheels that are too hard for the job are often times used because they give long life, but where attention is given to the production from the wheel it is found that too hard a grade is most inefficient because of abrasive waste, but it usually is less costly to use a wheel that is too soft than to use one that is too hard.

Grain and grade must be considered together; and will be partly determined by the contact which the wheel will have with the work, partly by the design of the machine on which the wheel will be mounted, and partly by size, shape and physical characteristics of the substance ground. All of this information should be given in as much detail to the manufacturer as possible, in order that he may apply his experience and pick out what he knows will be best for that work. It is a great help to the wheel manufacturer if the wheel user, when specifying a new size for new work in his shop, will include with his order details such as are prompted by the information sheet, a sample of which is shown in the present article.

It is extremely simple for a man to jot down the details surrounding the particular grinding operation and the details which are suggested on this sheet, if given completely, will furnish the wheel manufacturer all he needs. He will be able to select the proper grade without any question. It will also enable him to comment, should he find that such items as speed of wheel or work are not best for the greatest efficiency from the wheel.

Relation of Machine to Grain and Grade

The machine used is exceptionally important. The wheel manufacturer is usually in close contact with the various machines on the market and from the Maker's name and model number he will be able to picture the machine and select a wheel for it. If he knows the machine is of light construction, he will expect a slight vibration in the wheel and, therefore, will furnish a grade a little harder than for the machine which is of heavier design. Portable machines, such as electric tool post attachments, pneumatically driven grinders and the like, require harder wheels than the machine made for a single purpose.

Relation of Speeds to Grain and Grade.

In cylindrical grinding practice, for instance, it is important to know the work speed. It is generally recommended that a wheel be operated at approximately 5,000 feet per minute on standard machines and where it is impossible to reach this speed, a little harder wheel would be supplied.

For some work, it is known that special speeds work best; and where the speed must be higher or lower than the one recommended, the wheel should be made respectively softer or harder. A wheel running slow will act softer and a wheel running fast will likewise act harder than at the normal speed. These different wheel speeds for different operations have been determined by the manufacturer and should be followed as closely as possible.

Relation of Work to Grain and Grade.

A general description of the parts to be ground, including their shape, size and especially their composition, is essential before the correct wheel can be selected.

Relation of Operation to Grain and Grade.

The method of applying the work to the wheel is equally essential. Such questions as the following should be carefully answered:—

.—What type of wheel is to be used? Where will the contact between the work and wheel be? In other words, what surface of the wheel will do the grinding? This is particularly important in the case of a countersunk wheel or cup type.

2.—How much material must be ground away?

3.—Is the part to be ground in the rough or has it been previously machined or ground?

4.—Do you propose to grind with water or other lubricants or do you propose to grind dry?

1. Selection of the Abrasive

Influential Factors:

A. Physical properties of the material to be ground .....

- Use Aluminum Oxide Wheels for materials of high tensile strength
  - Carbon steels
  - Alloy steels
  - High speed steels
  - Annealed malleable iron
  - Wrought iron
  - Tough bronzes
  - Tungsten, etc.
- Use Silicon Carbide Wheels for materials of low tensile strength
  - Gray iron
  - Chilled iron
  - Brass and bronze
  - Aluminum and copper
  - Marble
  - Granite
  - Pearl
  - Rubber
  - Leather, etc.

2. Selection of the Grit

Influential Factors:

A. Amount of material to be removed..... — Use coarse wheels for fast removal of stock.

B. Finish desired..... — Use fine grain for fine finish, except in machine grinding operations.

C. Physical properties of material to be ground ..... — Use coarse grain for ductile materials and finer grain for hard, dense, or brittle materials.

It should never be feared that too much information will be given to the wheel manufacturer. He is often blamed for shipping wheels that are not found as good as wheels that have been used before and in practically all cases it is found that insufficient information was given when the new wheel was requested.

Non-Production Grinding

In a great many shops there are grinding machines in use of one kind or another where the wheel is not being operated continuously. It will be used only when occasion demands, such as in the machine or forge shops. It is rather difficult in such cases for the foreman to determine whether or not he is using the most efficient wheel on each of his machines. General observation of the wheel must govern the selection on such classes of work; the finished product, the heat that is generated, the life of the wheel and the amount of dressing points. If it is found that a dresser must be used to remove the glaze from the face of the wheel every few minutes, it is safe to say that the wheel is probably too hard or too fine. Similarly, if the dresser is hardly ever found necessary it may be possible that the wheel is a little soft and that there is some waste because of this fact. In many of these cases the grinding wheel manufacturers recommendations are probably as dependable as any source of experiment that could be made. It is usually wise in a case like this to have two or three wheels tried on the same machine under the same conditions and observe the results of each to determine which one is apparently the best. For this kind of work, the user of wheels should be ready to accept suggestions from the wheel manufacturer.

Production Grinding.

In the shop where there are a great many parts of one kind to be ground and where the wheel is in constant use from the beginning to the end of the day doing nothing but one operation on each part, it is extremely simple to determine the most efficient grinding wheel. Usually such parts are ground on a piece work basis or on a tonnage basis, or occasionally on a "metal removed" basis. For a complete test to determine the most economical wheel, it is possible to collect special data and thereby make the figures more convincing. Amount of metal removed per unit of time, labor cost for the same time and shop overhead as well are three factors necessary to allow complete solutions of such problems.

The following figures are taken from actual production reports:

Wheels Used:—Norton Alundum 12 x 1¼ x 1½ — 14—Q and 14—R

Total cost of wheel to customer at time of test..... $4.52

(Wheels can be used to 8 in. in diameter and discarded).

Wheel No. 1—14-Q

During test diameter reduced from 12 in. to 10¼ in., or cost of cubic inches of wheel used, based on total cost of ..... $4.52—$2.21

Time required—1 hr. 12 minutes

Metal Removed—9 lbs. (Actual loss in weight)

Wheel No. 2—14-R

During test wore from 12 in. to 11-9/16 in. diameter, or cost of cubic in. of wheel used based on $4.52—$ .60

Time required—3 hrs.

Metal removed—8¼ lbs. (Actual loss in weight)

Labor cost was 50c. per hour, shop overhead $1.25 per hour per machine Total grinding cost equals wheel cost, plus labor cost, plus shop overhead:

Wheel No.1—14-Q

Wheel Cost	$2.21
Labor Cost	.60
Shop Overhead	1.50
Total cost to remove 9 lbs....	$4.31
Cost to remove 1 lb.	.48

Wheel No. 2—14-R

Wheel Cost	$ .60
Labor Cost	1.50
Shop Overhead	3.75
Total cost to remove 8¼ lbs...	5.85
Cost to remove 1 lb.	.71

The 14-R Norton wheel is one grade harder than the 14-Q. This, of course, shows most strikingly what relative importance the factor of wheel cost, labor cost and overhead each have. The wheel with long life may be far more expensive to operate than the wheel with the short life, as brought out by the above deductions.

It cannot be claimed that grinding is an exact science. The wheel maker cannot determined the correct abrasive, grit and grade to supply and guarantee that it is the most economical wheel by mathematical methods alone. If he has figures similar to those above, taken from

(Continued on page 36)

3. Selection of the Grade (Degree of Hardness)

Influential Factors:

A. Physical properties of the material to be ground	Use hard wheels on soft materials and vice versa.
B. Arc of contact	The shorter the contact, the harder the wheel should be
C. Wheel speed	The higher the wheel speed, the softer the grade should be and vice versa.
D. Work speed	The higher the work speed, the harder the grade should be and vice versa.
E. Condition of Grinding Machine	Machines in poor condition require harder wheels than machines in good condition. Bearings must be kept adjusted. Foundation must be solid. Machine must be of rigid construction
F. Skill of operator	Skilful operator can use softer wheels than unskilled man—softer wheels mean more economical production. Piece-work grinding usually calls for harder wheels than day work.

4. Selection of the Process

Influential Factors:

A. Dimensions of wheel	Wheels subjected to bending strains should be made by elastic or rubber process. Extremely thin abrasive saws must be made by the elastic or rubber process. Wheels over 36" diameter are usually made by the silicate process.
B. Rate of cutting	Use vitrified wheels for most rapid cutting.
C. Finish desired	Use elastic wheels for highest finish, where rapid production is not a factor. Use silicate wheels to replace sandstones on cutlery, etc.

Valuable Hints on the Dismantling of Machinery

Dismantling is Harder Proposition Sometimes Than Assembling —Separating Rusted Parts—How to Loosen Rusted Bolts and Screws—Seized Parts—Forcing Methods—Specimen of Jack Design—Steady Pull Counts

IN MANY respects it is a much easier task to assemble a machine than to take one apart, especially if the construction is unfamiliar, or the parts have suffered misuse or neglect. The quality of the various fits is unknown, the presence of shoulders, and the handling of threads are often concealed, and damage through pressure and burring add greatly to the difficulty of separation. Of course if one has merely to break up the machine, these problems assume scarcely any importance, but when most of the parts require to be preserved without injury, much care and discretion are necessary. The choice has to be decided between blows or pressure, between twisting or straight pushing, between the application of oil, or of heat. The mind must be quick and the touch sensitive to know when the limit of safety has been reached. And often a decision is forced by the fact that it may be cheaper in the end to cut up or ruin a certain portion in order to get it away, than to waste many hours in a probable futile effort at removing it in good shape. Mostly these points are decided by the monetary question, and the value of the machine. And some pieces are difficult to replace, involving perhaps expensive patterns, or at least core-boxes, or awkward smithing, hardening, or machining.

The relative ease of dismantling is frequently a question of the tools and plant available. Shops that are accustomed to breaking up, or repairs, or re-conditioning of machines naturally buy or make various special appliances for forcing and other operations. This is especially true if the class of plant is fairly uniform. The men soon become accustomed to the best methods of procedure.The work is consequently speeded up, damage and waste are lessened, and the quality of the re-conditioned machine is better. The various difficulties may for convenience be mentioned under specific headings, commencing with the familiar rust problem.

This nearly always presents an awkward case, from the hard grip which the surfaces obtain, and the difficulty of softening or loosening the scales sufficiently without causing damage to one or other of the units, and hence a preliminary loosening has to be sought with the aid of kerosene or gasoline, or an expansive action may be obtained by rapping around the outer element, or warming it up rapidly by a fire, or a white-hot ring slipped over. Any of these devices will ease the fit and pave the way for successful blows or pressure. Oil must be allowed plenty of time to penetrate, and its spread is assisted by rapping with a hammer, while the application of heat also helps the diffusion.

Pressure, though powerful, is not always the best means of separation, because it lacks the disintegrating effect of the hammer. The shock of a blow not only snaps off projecting lumps of rust, and reduces them to less obstructive units, but causes a temporary springing apart of the walls, during which time there is an opportunity for the shaft or pin or other fitting to ad-

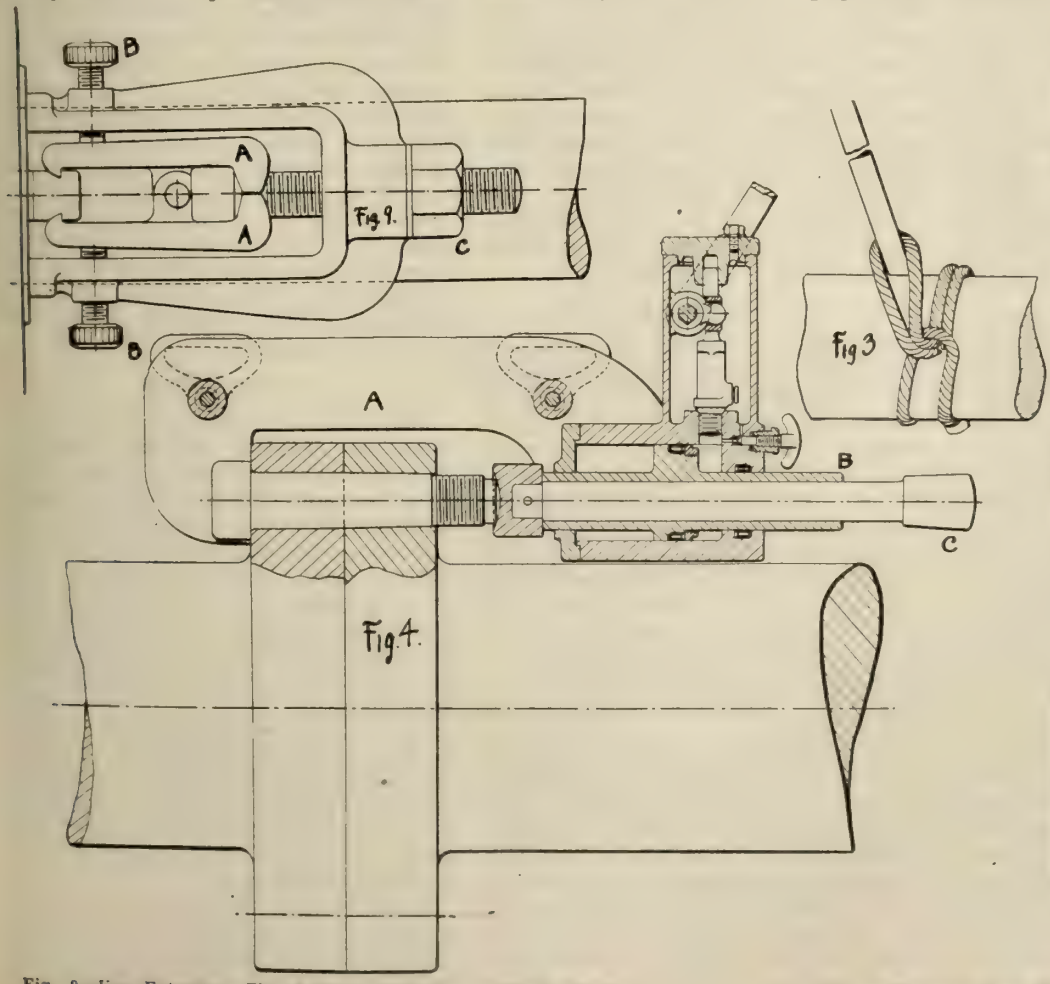
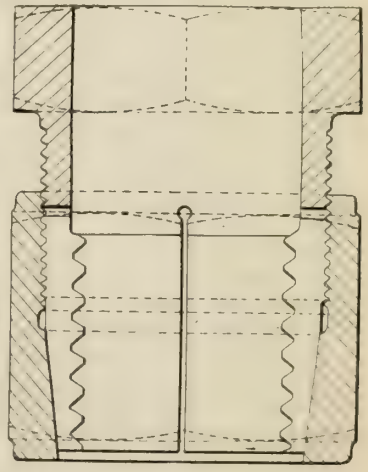


Fig. 9—Key Extractor. Fig. 3—Rope hitch for polished objects.



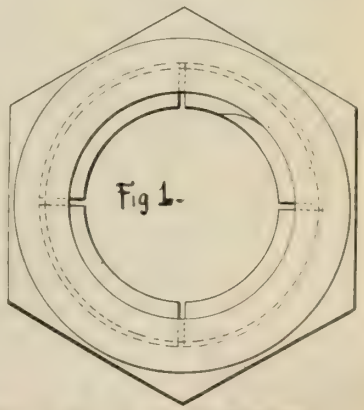


Fig. 4—Hydraulic Bolt Forcer. Fig. 1—A Stud Extractor.

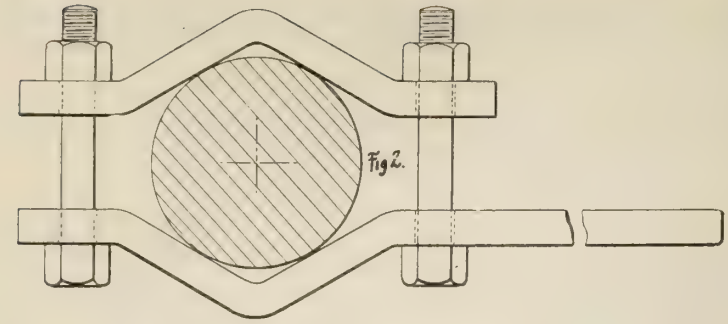


Fig. 2—Grip for Twisting Shafts.

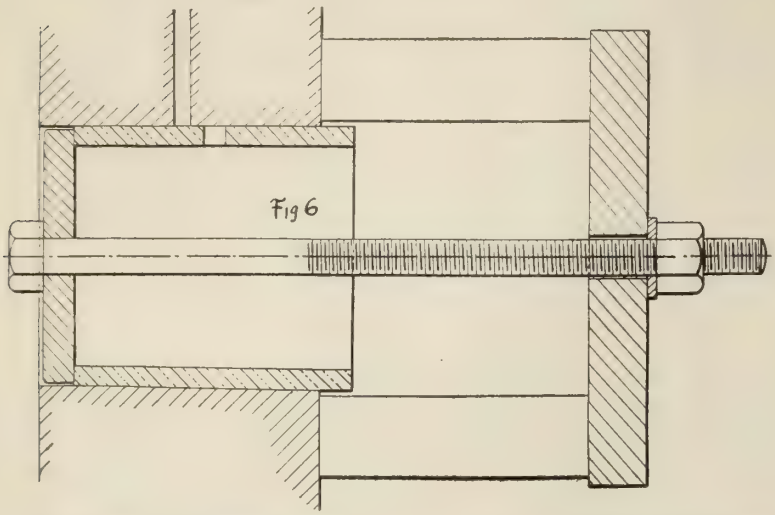


Fig. 6—Method of Extracting a Bush.

vance longitudinally with less trouble or opposition. This kind of useful action is still further assisted by side blows, if the shaft, etc., will stand them without injury, or by blows on the boss or other detail surrounding the shaft. The same remark applies to plane and tongued joints of various sorts which have stuck on the plane surfaces, or become wedged tightly at tongues or shoulders. Discretion has to be used in striking such lateral blows, or parts may be snapped off.

There is also a stage in the operation where direct forcing apart by screw pressure, or by wedges should be tried. It is generally feasible to get a wedge to start in a joint line, following it with another a little distance apart. Then hammering on the face of the piece (at right angles to the direction of driving wedges) serves to shock the rusted faces away from each other, followed by further sending in of the wedges. Both in the wedging and the top hammering, the limit of safety must be carefully considered, and the wedges increased around the edges if those at one side make no impression.

Rusted Bolts and Screws

Plenty of oil is essential in order to get these shifted, but heat is also a useful agent. It can be either applied on the top of a screw, to suddenly expand the head and give the opportunity for turning out (after judicious blows end on), or around a nut to increase the size of the hole. As a rusted screw is not of much value for subsequent use, provided it is of a kind easily replaceable, no time should be wasted in preserving the shape and appearance. A cold chisel struck against one of the corners constitutes a powerful wrench and will loosen the most obstinate nut; and a head may be jarred round very effectually in the same manner. The efficiency is still greater if two men get at the job, striking at opposite corners, which gives a true turning effort without thrust to one side.

Seized Parts

Sometimes the effort to get rusted ojects apart leads to the seizing-up of the metal and increases the trouble considerably. Very often the reason is absence of oil, whereby the abrasion of the metal develops roughness and heat, and tears up the surfaces until they become intermingled. The worst thing to do under these circumstances is to twist the work to and fro, as this aggravates the seizure. Short sharp blows are the most expeditious means of cutting apart the mingled metals, and it is consequently better to drive out a shaft, for instance, than to put a dog or clip on it and twist.

The seizing often occurs by reason of the omission to oil parts when they are forced or screwed together. This is so in the case of stud-bolts, screwed permanently into place, the endeavor to unscrew them eventually being perhaps futile, because it increases the tearing up. The stud may probably have to be twisted or sawn off and the stump drilled out. Where unscrewing is practicable, the well-known stud-block is available provided the fit is not over-tight. If it is, a pair of nuts locked together afford greater turning power. Or an extractor of the split clamp style (as shown in Fig. 1) is quick to tighten and release, and does not damage the stud threads.

It is important when intending to drive out a seized shaft or pin not to go at it in a half-hearted fashion. The blows should go straight in line, and be delivered with a crash. Weak ineffectual hammering only burrs up the end of the shaft, or sets up a peening and bending effect. The portion out of which the shaft is being driven needs to be properly and firmly supported by the boss surrounding the hole, and no risk should be taken of a slip which might allow the rim to receive the force of the blows. As regards the limitation of damage to the shaft end, wood of course is the best thing from this point of view. But a wood block, even though very hard, often proves too yielding to enable a tight shaft to be moved at first. Hence a copper or brass block, or babbitt for less difficult cases has to be selected. If preservation of the shaft centre is important, the lock should be drilled out to clear the hole and prevent the blows from taking any effect there.

Under circumstances that demand a powerful twisting hold on a spindle or shaft, the means of securing the grip may be settled by the presence of a lever or wheel or pulley, but if not, a clip requires to be bolted on. A handy type is the vee-plate, with one arm extended to form a handle, (Fig. 2.) a canvas or copper strip being lapped around the shaft to prevent bruising. When a hold of a milder nature is necessary on a polished shaft or tube, the rope and lever hitch (Fig. 3) answers satisfactorily. The objection is of course that the torque only occurs in the one direction.

Forcing Methods

The risks on excessive hammering, comprising burring, peening, bending, and fracture explain why pressure alone, or in conjunction with a certain amount of hammering is so favored a mode of extraction. The different ways of obtaining pressure include the bench vise, the arbor press, the hydraulic press, and bolt action variously devised. The vise is highly convenient for forcing, within its scope, and needs only a supporting ring or pair of blocks to rest the work against, and a pin to push on the end of the part requiring removal. The arbor press supplies a more generally useful range, because of its extended reach, the capacity for accommodation on the plate, and the quickness of manipulation of the ram.

Hydraulic pressure, either in a fixed or column type of press, or with a portable apparatus, furnishes great power under nice control. The fixed press is

only available under circumstances where parts are of suitable size or shape to bring to it, and its functions are principally concerned with the extraction of bushings, pins, studs, etc. The portable presses are principally applications of an ordinary ram in a special form of frame adapted to suit the contour of the article being treated, but occasionally special cylinders and rams must be devised to fit into awkward locations. An example of this character may be observed in Fig. 4. The press shown is specially intended for forcing tight or rusted bolts out of shaft couplings, such as for propeller and other big diameters. There are two arms, the further one of the pair, A, being seen, locked over projections on the body, and secured by a pair of bolts and distance-pieces, lifting handles being placed on the bolts. This built-up system is handy for getting the machine piecemeal into an awkward shaft tunnel or other confined situation. The ram B is made hollow, for the special purpose of receiving a steel drift C, fitted with a head, against the back of which the ram does the forcing. On working the hand pump as usual the ram moves forward and presses the head against the tail of the bolt. Should the latter be so tight or severely rusted that the pressure will not shift it, blows with a heavy hammer are given on the end of C, driving it through the ram, and starting the bolt while under the heavy pressure (ranging from 20 up to 75 tons, according to the size of the appliance.) A modification of the design serves for forcing drums or barrels from off their shafts, the body being cast into a sort of crosshead, through the centre of which the ram and drift go, while bolts in slots in ears of the crosshead reach out to the end of the drum, and hold a slotted clamp against the boss. Pressure is set up, and the drift struck if necessary.

A specimen of a jack design where the ordinary cylindrical ram cannot be applied occurs in Fig. 5. This is a propeller starter and is intended specifically for forcing ships' propellers from their shafts, an operation which is accomplished in most cases with ease, and not a tithe of the time and trouble involved in the old-fashioned wedge method. The construction embodies segmental jointing, to get the appliance around the shaft behind the propellers boss. Usually four segments are bolted together, but two or three of them can be set around smaller shaft diameters. Each segment constitutes an independent cylinder, of hammered steel, and fitted with a curvilinear ram (lettered A in the illustration) forced against the propeller boss by the water sent by a hand-worked pump through connection B. The backs of the cylinders rest against the stern tube and the three looped pipes provide communication between the cylinders, and allow elasticity to compensate for the altered settings of the segments on different shaft sizes. The stop-cap or plug C can be used on any of the nipples of the cylinders. The size of starter shown is 300-tons, but more powerful sizes are also made.

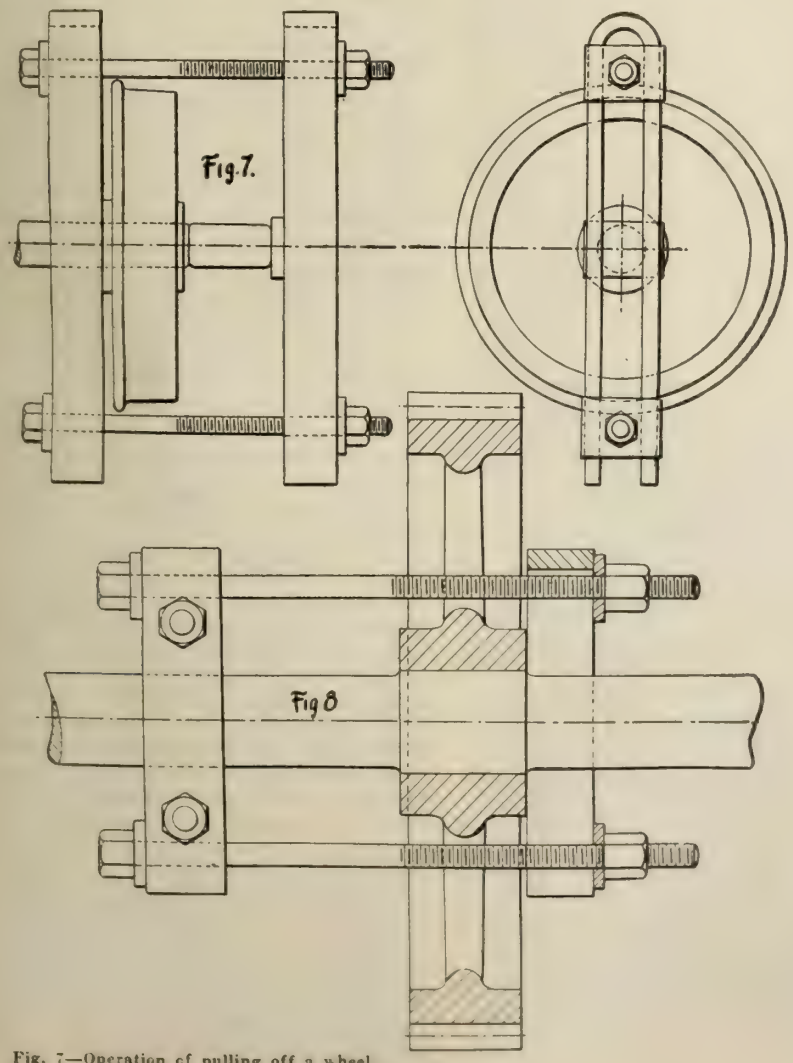


Fig. 7—Operation of pulling off a wheel.
Fig. 8—Pulling a wheel from a long shaft.

Bolt Action

This offers a cheap and accommodating mode of removing all kinds of fitting, the pressure being arranged in various ways with the aid of washers or clamps. One of the simplest cases consists of bushing extraction. This is not easy of accomplishment by hammering because of the narrow end surface and springy clinging nature of the bush, and a steady pressure is more effective and less damaging. An arrangement is represented in Fig. 6, which gives a central pull, and even pressure all over the end of the bush. When a wheel is to be drawn off a shaft, the resistance should be taken against the hub, which necessitates a hair-pin kind of clamp or bar, Fig. 7, to lap round the shaft, with a duplicate clamp at the outside which receives a plate pressing against the short pin used to force the shaft. On certain occasions a wheel or pulley might be located at a distance along a shaft, rendering the set-up shown out of the question. Then, instead of gaining a pressure on the shaft end, a divided clamp is attached at a suitable spot on the shaft, and another clamp passed around the shaft forces against the wheel boss, after the style of Fig. 8. For firms who do a good deal of wheel pulling, the familiar wheel-pullers with central screw and pivoted hook arms are useful.

By the time that a machine needs dismantling, it may happen that the keys are fairly loose and easily got out. But on the other hand, they may have been driven in very hard as a last effort to make them hold, and be consequently burred out of shape, with possible rusting as an added difficulty. On account of the small area of a key end, and the spreading that occurs when hard blows are struck there is generally a difficulty with the usual key drift sent in from the back of the wheel. The employment of a wedge or hooked lever between the head and the front of the wheel is likewise doubtful, the head being pulled out of shape and torn before a start can be effected. The quick-procedure, when such is practical, lies in driving or forcing back the wheel from the key. There is no bother with burring, and the effectiveness of the

blows or pressure much exceeds anything that can be applied to the small area of the key.

The utilization of an extractive device often simplifies removal by substituting a steady pull for battering. Fig. 9 shows a plan view of a tool of this character. It has a U-shaped frame, the feet of which rest against the wheel hub, and the arch receiving a pulling screw. Around the head of this screw fit the tails of the hinged jaws A, A, the prongs of which are formed with inturned hooks to engage in grooves chipped on the sides of the key ahead. These jaws are pressed in firmly by turning the screws B, B, and the key is steadily pulled out of its seat by turning nut C.

Some pieces which are very stubborn must be sacrificed, and separated in any fashion that is easiest and quickest. Here the value of drilling comes in, since it is easy to run a drill in carefully to remove the bulk of the metal, such as a pin, a key, or screw, etc., leaving a mere sheli that can be pryed out with a chisel or pointed bar. The drilling sometimes follows a cutting-off process, such as the shearing of a head, or sawing away of a shaft. It is also feasible in certain instances to drill out a core, and then pass a hack-saw through and make one or two cuts out to the bore of the hole, thereby weakening the shell so that it can be got out with facility. Accuracy of drilling is important if the hole has to be preserved, and a sort of jig-plate comes in useful for such cases. A piece of iron is drilled with a hole of the required size, and it is firmly clamped or bolted over the locality, with the hole in the exact spot to locate the drill and keep it true. By such means straying is prevented, and the hole comes precisely where it should.

Drilling as a preliminary operation to the twisting out of a broken screw offers an advantage for such a purpose, because it may start to turn the screw out unexpectedly. Failing this occurrence, a drift or extractor with square or spiral twisted corners has to be utilised.

When handling brittle or weak objects the drilling method has perhaps to be adopted because any blows are not permissable, as in trying to remove a pin from cast lugs. If it has rusted in, the requisite amount of hammering cannot be allowed, or the lugs will break off. Consequently the pin has to be scrapped, being got away by drilling it out. Even twisting, without blows at all, is not always safe, especially should there happen to be flaws in the casting.

A state of affairs, though somewhat rare arises when one cannot see for certainty the precise spot where a joint occurs, owing to the presence of rust, or of many scratches and lines on the area concerned. If blows fail to afford any indication of the joint line, flooding over with kerosene will sometimes provide the information, the joint showing as a darker line. And if jarring or rapping be done a little agitation of the oil will show at the joint.

SAVING OIL AND MONEY

THE H. H. Franklin Mfg. Co., were having altogether too heavy bills for oil, so proceeded to install an oil salvaging dept. According to Factory, who tells the story, the first problem was to get the oil soaked chips out of the way of the workers. The second problem was to recover from the chips the greatest possible portion of the cutting oil so as to salvage the valuable part of it for repetated use. The third problem was to store the chips and sell them as scrap.

In the equipment now installed, gravity chutes are used in moving the chips from the machine-shop floors, and power methods have been adopted for handling the chips while cleaning them.

The chips are pitchforked from under the machines to barrows which are wheeled to a hopper on each floor. These hoppers protrude into the room from a vertical chute set into the wall like a chimney, and are closed enough to the floor so that the barrows are easily discharged into them. When not in use the hopper swings shut to coincide with the wall, and so is entirely out of the way.

The chips from all floors pass down through the chute, which delivers them to the basement. From this point a trough extends along the wall of the basement to hold the chips. Above the trough a trolley track, equipped with a hoist, is attached to the ceiling. The hoist is supplied with a hook which lifts the inner basin of a centrifugal oil extractor. There is only one extractor, but there are three removable inner basins used in it. One basin is being filled from the chip trough by a helper while another basin is being whirled inside the extractor by the operator. The extractor is driven at high-speed—it is not the centrifugal laundry type, but one especially built for this heavy and high-speed work. The outside of the removabde basin is equipped with protruding radial blades, like a turbine, and steam fed into the circumference of the extractor by a turbine nozzle drives the basin as a rotor.

At the same time the excess velocity energy which still remains in the steam after it leaves the blades of the turbine creates a suction which helps the centrifugal force to abstract the oil through the perforations in the side of the inner basin. The steam also heats the chips and the oil, and forms a semi-solvent, causing the oil to be completely separated from the heated chips, so that it flies out easily through the perforations. The exhaust steam passes out near the top of the extractor, and the oil through a delivery pipe from the bottom.

After the chips are whirled for a sufficient length of time to be completely clean, the operator stops the extractor, brings the trolley hoist, over it and lifts out the inner basin with its dried chips. The trolley hoist, which can run beyond the extractor to a big bin for dried chips, takes the basin to the bin and dumps the chips into it. Thus, two men, with the occasional relief of another helper, are sufficient to clean all the chips.

The chips remain in the extractor long enough to allow the helper to fill the new basin at the chip trough, and also have time enough left over to help the machine operator and helper shove the basin full of dried chips aside a few feet along the trolley track until the extractor is closed and is in operation again.

Then the helper has still time enough left to push the dried chips over to the bin, dump them, and bring back the empty basin to be refilled at the chip trough. Usually two basins are enough to keep the system working. A third basin is used to take up slack by being filled and set aside for use whenever the cycle is interrupted.

The clean chips from the bin are sold periodically in carload lots. They are loaded by gravity directly from the bin into cars.

This company finds that the use of a steam-heated centrifugal chip separator in place of the old-type extractor, which was not heated, is the secret of the great saving which they have been able to show in the operation of their oil-reclaiming system. Where with the old type of extractors they were saving only from three to five barrels of oil each day, with the new installation they are reclaiming approximately twelve barrels each day on the same production.

Roughly speaking, the plant, even if extracting only a half-barrel of oil each day, would pay for itself; and installing a steam-heated turbine extractor would be warranted, as the additional oil obtained would very quickly pay for the expense of the installation.

FIREPROOF SHOES

A recently invented asbestos shoe is said to afford protection for those who work in steel mills or foundries, where molten or red hot metals are a constant source of danger. This shoe, it is claimed will protect the feet thoroughly, wear indefinitely and may be quickly kicked off in case of emergency. The uppers are made of the same material as the fireproof curtains used in theatres, and are soft and pliable. The lining is of cotton or canton flannel, both of which materials act as non-conductors of heat, while the soles and heels are of the same material as brake-band lining on automobiles. The shoe slips on like a slipper, having neither laces nor clasps to catch and retain molten metal, and has been found more practicable than any leather shoe.

Making and Boring Out a Huge Stator Ring

This Ring is One of the Largest in the World—Special Boring Mill Built for Extra Large Work—Dimensions of Machine—Method of Making Casting—How Work is Gauged.

J. A. MacGillivray

PRACTICALLY all the light and power energy consumed in the larger Canadian cities is supplied by hydro-electric power. The horse power now developed runs into the millions. In the large cities the demand for this power is very great. Where such a large demand exists it is always economical to install generating units of large capacity. These facts are generally known to even the poorly informed and are common property to the mechanic or man who is ot a practical turn of mind. But few of the men who follow engineering practices, realize the size of some of these Canadian units. The accompanying cut shows the stator ring of one of the largest generator in the world being bored out on the largest boring mill in America—and this is being done in Canada, by Canadians. The work is being accomplished on a boring mill, built especially for the Dominion Engineering Works, Lachine, P. Q. by the Wm. Sellers & Co, Inc. Philadelphia, Pa. There is another mill in the United States that will swing the same diameter, but it will not swing as high work under the cross rail. The table of this boring mill is 20 ft. in diameter and it swings 35 feet between the standards. The frame of the mill is rigidly bolted to its foundation and is not of the extension type, where increased capacity is obtained by moving the frame back on its ways. A general description of the huge machine will not be attempted at present but will appear in a later issue. Only a few interesting facts will be mentioned in passing. The mill is driven by its own electric motors, and will handle work 18 ft. high under the cross rail. The cross rail is clamped to the frame by hydraulic pressure which is controlled by the operator from a convenient position on the floor. This feature does away with the necessity of a man losing time by climbing on the machine to reach the cross rail studs. The huge stator ring shown is 30 ft. 4 in. in diameter, over all. It is of grey iron, cast in four pieces, each piece weighing about 23,000 pounds, making a total weight of 92,000 pounds. The inside diameter is bored out to 27 ft. The castings were swept up, no pattern being made. In sweeping, the sweep was adjusted so that the quarter circle section was flattened out as shown in Fig. 1. The mould was opened about ¼ in. on each end. The cores on the inside of the casting were broken up as soon as it was possible, as it was thought by the foundrymen that if these cores were allowed to remain untouched until the casting was cold the result would be distortion. A cross section of the ring is shown in Fig. 2. On each end ½ additional length was left to be faced off. This work was done on a large facing, boring, and drilling machine. A milling cutter was used, with inserted teeth. When all four pieces were faced, the holes at each end for the bolts that hold the huge ring together were laid off and drilled in two of the four pieces. Then the ring was assembled, with a drilled sector between each undrilled sector. The ring was clamped together and the holes in the undrilled sectors were marked off, later being drilled.

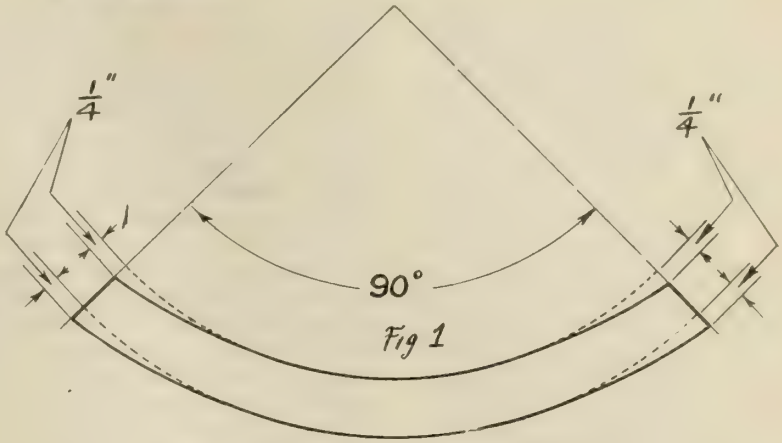
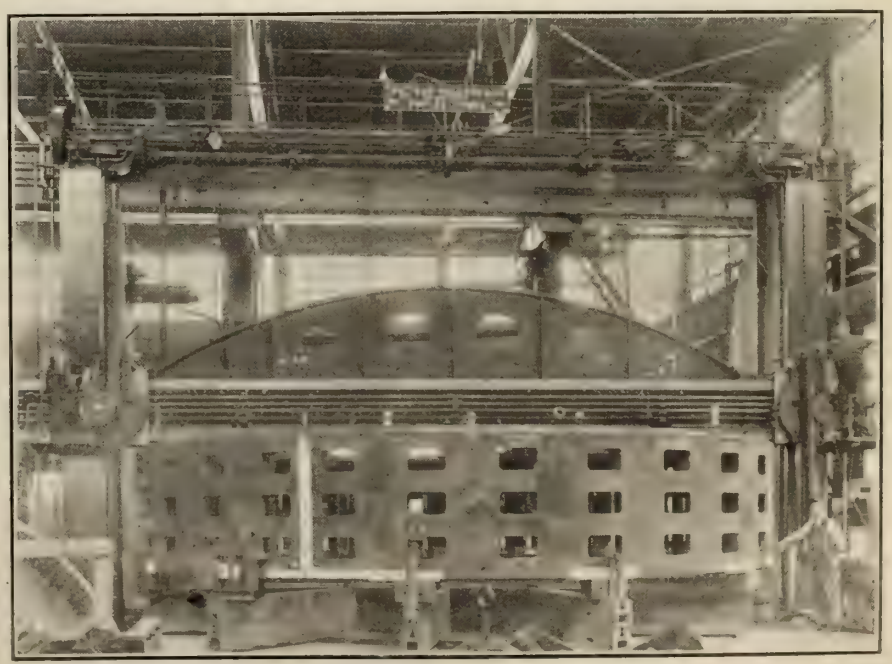


Fig. 2.—Showing Quarter Section Flattened Out.

When the stator ring was finally assembled two things attracted the attention of the writer. First, was that the faced joints were perfect, and second that the castings when trammed was within ⅛ in. of being a perfect circle. Great credit must be given the men who laid off the joints for facing, and to the foundrymen who produced such excellent castings. Of course, the men claim that the work in connection with this stator ring is very simple and only presents difficulties on account of its great size.

Extension pieces had to be placed on the table as will be noted by referring to the photograph. The ring was blocked up on the machine and the surface "A" was machined. Then the ring was turned over and set up again on a planed surface, when all other surfaces were finished. One good roughing cut in all instances served to clean up the scale. Various feeds were used and a cutting speed of from 35 feet to 45 feet per minute was employed.

(Continued on page 36)



Showing the Large Boring Mill in Action.

The Distribution of Manufacturing Expense

Five Methods Are in General Use for Distributing Overhead Expense—Man-Rate—Man-Hour—Material and Labor—Sold Labor—Machine Hour Rate—Methods Explained in Detail.

*By C. HAIGH

THERE are five methods in general use for distributing overhead expenses. These are as follows: man-rate; man-hour; material and labor; sold-hour; and machine-hour rate. The man-rate method is the one in most general use because of its simplicity. To use this method, it is only necessary to find the ratio of total expenses to total labor for a given business, and to apply this ratio to the labor cost of each job. For a factory making one product this method of distributing overhead is quite satisfactory, but where the product itself is varied and the tools used in getting out the product are different for each of the various units produced, this method of distributing overhead is incorrect and misleading as to final results. There is no more justification for considering that one dollar's worth of labor actually applied to the product should always take the same percentage of expense than there is for the assumption that a lathe and a boring mill cost the same, are operated for the same amount, and occupy the same floor space, or that the overhead cost of maintaining benches and assembly floors is the same as the overhead cost of maintaining and operating machinery.

This method of applying overhead also assumes that the highest-paid workman requires the most overhead expense, when actually the lowest-paid man often requires the most supervision, and frequently the machine tools used by the low-priced man are more expensive and require greater expenditures for operation and maintenance than those used by the skilled mechanic, because there is incorporated in the machine which enables lower-grade labor to be used the skill that the high-grade man has in himself. Thus, if a semi-automatic machine is used for making any part, a man who is not an expert mechanic can be employed to run this machine or even several of these machines, but if this special equipment were not used a skilled man would be required to be in constant attendance on a simpler machine. It is obvious in this case that the overhead expense that is incurred in running the automatic machines is much greater in proportion to the wages paid the operator of these automatic machines than is the overhead incurred in running the mechanical equipment required by the skilled mechanic.

It is also true that even if the same wages were paid all men in a manufacturing establishment, it would still be wrong to apply the overhead to each job on the basis of a percentage of labor cost, for we would still have the condition of one man running more machines than another, and of the difference in cost of the machines operated; also that some men would be occupied on jobs such as cleaning castings, checking finished product, painting, etc., which require little mechanical equipment, and therefore do not increase the overhead expense at the same rate as their wages increase the direct labor pay-roll. From the foregoing it would appear that the man-hour-rate method of distributing expenses is a dangerous one in some instances, and will result in a loss of money. There are cases, however, where this method may give results which will be satisfactory from the standpoint of profit, as cited in following:—

*This matter was presented before Convention of American Gear Manufacturers' Association.

Standardized Equipment

In a manufacturing establishment where the mechanical equipment is fairly well standardised. where the product, while varied as to different types, still has the same average types of output, and where these types all require substantially the same machining operations, it will be found that the ratio of profit to total output will come up to expectations when the man-rate method of distributing overhead is used. There is also a factor that must not be overlooked when considering any business, and that is the amount of information which the man or men at the head of it have of that business independent of records, as I have frequently found that when estimating the cost of new work, allowances are made by the owner of a business for a higher expected cost due to special facilities which will be necessary and to the expectation that the bigger machines in the plant will be used on the work. By making such allowances the final price submitted includes some of the factors of expense cost that are not actually subject to proof from any records of overhead expense which would be available if the man-rate method of distributing overhead were in use.

There is however, a question as to how many men who manufacture a wide variety of gears can give the necessary weight to all the expense factors which will increase or decrease the cost of a particular kind of gear, and it is undoubtedly true that many of the manufacturers who are making good profits on their total business are losing money on some particular type of gear because of their lack of knowledge of the operating costs of their machines. Also, that they turn down business on which there may be good profit because their selling price is figured on the basis of the average overhead, which brings the price up higher than the buyer will pay.

Man-Hour Method

The man-hour method of distributing overhead has for its base the number of hours spent on a job instead of the amount of wages paid. This method is subject to the same criticism as the man-rate method in that the assumption is made that the overhead expenses have a fixed ratio to the number of hours of time spent on a job. The advocates of this method point out that certain items of expense do not bear a direct relation to the number of hours worked and include under this head the expenses of the pay-roll and welfare departments, compensation, insurance, and supervision. To a certain extent these items do bear a closer relation to hours worked than to wages paid, but as they represent a small part of the total expense, and as it would be erroneous to distribute the major part of the overhead on this basis, I see no advantage in this method over the man-hour basis. Moreover, it can be pointed out that we do not reduce our pay-roll and supervisory force every time business falls off to such a point where we lay off some of the men, and therefore the cost per man-hour of operating these departments would fluctuate sufficiently to nullify any advantage gained over the man-rate method, particularly where this advantage consists chiefly in compensating for the difference in labor rates by substituting hours worked for wages paid.

The application of overhead on the basis of prime cost (material and labor) does not seem to be in very general use. This method requires that the total expenses of a business be divided by the sum of the direct labor and direct material, and that the ratio or percentage so obtained be applied to the direct material and labor cost of each job turned out. It is manifestly wrong to apply this method to the product of a business that uses various kinds of material, but where the product is all made from iron or steel, this method has some good points, as by taking the material into consideration as well as the labor, we apply more accurately the expense of handling the material in the shop, which, of course varies with the size of the piece handled. In a shop using both copper and iron castings, this method would be worse than the two previous ones, as by adding the value of a copper casting to the labor of machining it, we would get a total figure which would

carry a very high amount of expense; this, when compared with the expense cost applied to an iron casting of identical size requiring about the same amount of labor, would indicate that the expense cost of machining the copper casting was as much higher than that of the iron casting as the difference in the price per pound of copper and iron.

This method has many of the same kind of inherent defects as the man-rate and man-hour methods, as we would still be applying an average expense to jobs instead of an actual cost, the difference between this and the other two systems being only that the material is added to the labor before determining the expense to be applied. Even were this method correct for some kinds of business, the places where it could be applied would be limited in number, and this method could never be applied generally.

The sold-hour plan of distributing expenses provides that the total direct labor wages in a department be divided by the number of hours worked in the same period to get a flat average cost per hour for labor. The time in hours consumed on any job is valued at this flat rate per hour, and the result is called the direct labor cost. The expense is applied on the man-hour method previously mentioned.

This method is not a very general use, and little can be said in its favor. The man-hour method of distributing expenses has been criticised before, and not much need be said regarding the determination of labor costs under this plan, as unless the rates paid workmen were practically uniform, still another error would be included in the final cost by using an average rate per hour for labor. There are other methods of distributing overhead for special kinds of business, but because of their limited application they will not be included here.

Machine Hour Rate

The machine-hour rate method consists of distributing all the manufacturing expenses of an establishment by a charge to each job of the overhead cost of operating the machines and other facilities used on that job. This overhead charge is not an average for the whole plant or department, but is, as nearly as possible, the actual overhead cost of maintaining and operating each of the machines, group of machines, benches, etc., which are found in the plant. By the proper use of this method it is possible to show the difference between the expense cost of a boring mill and a lathe, a gear-cutter and a splining machine, etc.

To install a machine-rate method, the number of feet of productive floor space available for manufacture is first found, eliminating the space used for foremen's offices, stairways, washrooms, stockrooms, etc. The number of square feet so obtained is used as a divisor for determining the cost per squsare foot per year for maintenance, depreciation, taxes, insurance, and other kindred charges applying against the land and building. No expenses are included in this group that are incident to the actual operation of the machines, but only those charges that apply against the empty building ready for manufacture. However, the expense of lighting and heating the building and charges of a similar nature are included. In this way a charge per square foot is obtained which is practically the same charge as the owner of a building would make if he rented it and furnished the light, heat, and water used in the building, except that he would include a profit on his investment.

The factory is next divided into production centres, including in each centre machines of a similar type located together, or individual machines where there are no convenient groups. Different kinds of machines should not be included in one production centre, as this would defeat the object of the system. After the division into production centres has been made, the number of square feet occupied by each centre is determined, including in this area the space required for the material waiting to go on the machines, the space required for the workman, etc., and each centre is charged with a part of the rental of the whole building based upon the area occupied. This division gives the rent per year for each production centre, and in this way the total charges of the building which we have called rental charges would be allocated to various production centres. Thus it will be seen that one part of the expenses is now divided in such a way that these items can be included as one factor in the machine-hour rate.

The Actual Cost

The next step is to determine the actual cost of the expense items incident to the operation and maintenance of each of the production centres. These expenses consist of depreciation of the machinery and equipment, taxes, repairs, small tools, cutting oils, and of other charges which can be definitely allocated to the machines that have been included in one production centre. If a small group of machines, all included in one centre, requires the entire time of one foreman, the wages paid this foreman would be included with the other expenses in arriving at the total cost of operating the centres. The distribution of the power charge can best be made on the basis of the horse-power required by each production centre. In this power charge we would include the expense of running the power plant as well as the shafting, belting, etc.

The expenses under consideration should cover a period long enough to ensure correct results, as well as a period of normal operations, so that the results will represent the hourly cost of operating the production centres in normal times and under normal conditions. The best results are obtained if the expenses for a whole year are used as a basis for the machine hour-rate; and if these expenses are carefully analysed and allocated to the various production centres, the hourly rates first determined will not require much adjustment. In fact, the success or failure of the system depends on the amount of attention given to the division of the expenses at the beginning, as, unless the first rates are approximately correct, the first results obtained from the system will be so disappointing and misleading as to cause a manufacturer to condemn it an ti insist for all time that the plan is no good. In this article we will assume that the expenses analysed cover a period of one year.

Two groups of the annual expenses are now divided among the various production centres, and by adding the rental charges and the charges for operating and maintaining the machines, we have the basis for determining the hourly cost of expense applicable to work on the machine-hour basis. To determine the hourly charge, the total normal hours which each production centre will work per year are estimated; then the amount of the expenses allocated to each production centre is divided by the normal hours this centre should operate, and the result is expense cost per hour.

There still remain a few items of expense which have not been distributed, such as supervision, clerical, and general administrative expenses. These expenses should be totalled, and the total divided by the sum of the normal hours of all the production centres. The result of this is another hourly expense cost which must be added to each machine rate as a supplementary charge.

Attention is called to the fact that the machine-hour rate is based entirely on the assumption that the production centres will work a certain number of hours in a certain time, a year having been used as the basis. It is obvious that no man can predetermine accurately the number of hours any machine in his plant will be occupied, and many people reject the idea of installing this system for that reason alone. However, a close approximation of the normal working time of any machine can be found, either by keeping records or by examining records already available, and if the expenses of operating the machine are based on an approximately correct operating time, we have, by machine-hour rate method, means of showing immediately the financial effect of any variation of the operating time of the machines from the predetermined normal or standard operating time.

Making up Rates

In making up the hourly rates, we assumed that we had a certain amount of expense, say 1,200 dols., to absorb in a certain period, say one year, over one production centre. Let us say that we estimated the normal hours that this centre would be used in the year to be 2,400, or 200 per month. On this basis, the hourly expense cost of operating this

production centre is fifty cents. By adding fifty cents for each hour that a job required the facilities of this production centre, we would expect to absorb all the expenses connected with it. Now, if the jobs passing through this centre in a month required the use of the facilities for only 180 hours, we would see at the end of the month that on this particular centre we had failed to absorb 10 dols. of our expenses. We would have the same information for all other centres, and, therefore, for the whole shop, and would know at the end of the month how much of the manufacturing facilities had not been used or had been used more than we expected, this information being available in terms of both hours and money.

It is not, of course, expected that any manufacturer would absorb all of the difference between the amount of expense actually absorbed and the amount he expected to absorb, and to ensure that all expenses are included in cost, a supplementary charge is made to each job to liquidate the amount of expense that has not actually been absorbed through the machine rates in use. This supplementary rate is a part of this system of expense distribution, and is, in fact, a valuable factor, because we know from the amount we add to the cost to absorb these supplemental charges, how far from normal the plant is running. In fact, one of the great benefits of this system is that the supplementary rate soon shows if machines are idle, because the expenses that would be absorbed by machines having work to do become, when these machines are not in use, a part of the supplementary charges, and the fluctuations in the monthly amounts liquidated by means of this charge show to a great extent the efficiency with which the facilities of the plant are being used. It will be evident that the machine-hour rate method permits of a very close knowledge and control of overhead expenses, and that by this system actual costs of each job can be obtained.

When comparing the way in which expenses are distributed by machine-rate costs with the distribution by means of any other method, it will be seen that, as far as accuracy is concerned, everything is in favor of the machine-rate method. All other methods of absorbing manufacturing expense depend in one way or another on averages, and yet there is no more reason for averaging the expenses over costs of all the work produced than there is for averaging the material items.

LUBRICATING OIL TESTS

According to reports the chemical engineering and agricultural engineering department of the A. and M. College of Texas have started an experiment to determine the properties of asphaltic base and paraffin base lubricating oils in internal combustion engines.

Selection of Carbonizing Compound

H. B. Knowlton

THE selection of a carbonizing compound is no easy task. The best test is long use under commercial conditions. Short tests often lead to erroneous conclusions and yet for obvious reasons the selection must be made based on the results of short tests. The object of this article is to tell some of the things to look for in testing compounds and some of the errors to be avoided.

First: The chemical analysis of the compound tells very little. Bone and leather are rapid carbonizers and yet they contain comparatively little carbonizer. The formula which is given in most text books has been discarded by nearly all of the progressive makers of compounds. As much depends upon how well the compound is made as upon the formula. Second: The breakdown test (running several tests without the addition of any new material) often leads to erroneous conclusions. Compounds are not used this way in actual service. The test should as nearly as possible duplicate the service conditions. In running a test the following points should be considered:—

1. Does the compound produce cases having the proper per cent and distribution of carbon?

2. Are the results uniform? Only a well made compound will produce uniform results. No compound will produce uniform results unless the furnace conditions are uniform. It often happens that lack of uniformity of results is charged to the compound when the real trouble is in the way that the furnace is controlled. Test the uniformity of the furnace while it is heating up, with several couples in different parts of the furnace.

3. Does the compound add anything injurious to the steel? Bone adds phosphorous and leather adds sulphur, both of which make the steel brittle. It is claimed that nitrogenous material and cyanides add nitrogen to the steel, causing surface brittleness.

After deciding these questions, economy must be considered. In figuring the initial cost it must be remembered that compounds are purchased by weight but used by volume; hence the weight per cubic feet must be considered. Compounds vary in weight from 19 to 54 pounds per cubic foot. The speed of carbonizing determines the cost of operation of the furnace with a given compound. The cost of upkeep of the compound depends upon two factors. 1. The amount of new material which must be added after each heat to keep the compound up to the required strength. 2. The amount of new material which must be added to make up for shrinkage. The larger one of these two factors determines the cost of upkeep of the compound. There is a vast difference between the different compounds with respect to both of these factors.

It should also be noted whether the compound remains of uniform composition after use or whether it breaks down into dust of one composition and larger sized granules of a different nature. Have the chemist analyse the compound before and after screening out the dust. The compound which passes all of these tests the best should prove both satisfactory and economical in use, but great care must be taken to make all tests comparative and to make them commercial. Guard against using too few test pieces in the test. Even the best furnaces and the most careful operation will produce results showing a slight variation. The more test pieces that are used the more the experimental error will be eliminated.

MAKING AND BORING OUT A HUGE STATOR RING

(Continued from page 33)

One interesting point is the method of gauging or calipering the size of the bore. A steel pin gauge with hardened inserted ends is used. As shown in Fig. 3 the gauge is supported at two points, each 8 inches from the end and its length is accurately determined by precision measuring apparatus of the company. Thus the sag between supports is taken care of, as the gauge is used exactly under the same circumstances, by which its length is determined and checked.

Another interesting operation on this stator ring is the machining of fifty-six vertical slots in the bars on the inside of the stator ring. Some interesting jigs and tools are being designed by the firm to index and machine these slots. The work will be completed with stator ring in its same setting on the mill. Canadian Machinery will have a full description of these tools in a coming issue.

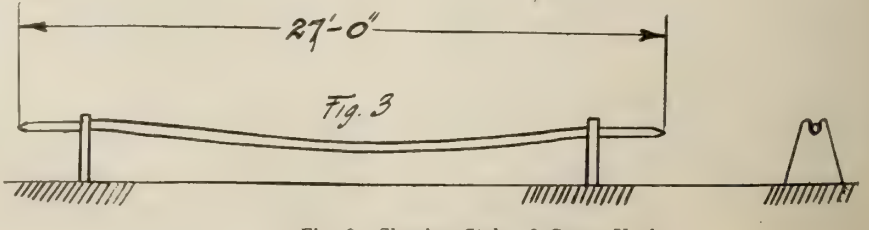


Fig. 3.—Showing Style of Gauge Used.

The Complete Drawing--What Should It Look Like?

What Are the Actual Requirements of a Properly Prepared Drawing?—Items Are Taken Up in Order—Degree of Finish Important—Drawings Should be Protected.

THE TIME-SAVING and error-preventing merits of drawings, made sufficiently complete to yield at a glance all the information required, are rarely fully appreciated by any but the few who have been for years in actual contact with the manufacture of large varieties of mechanical parts.

At a time when standardization is such a common dominant in the minds of manufacturers, continues V. O. S., in "Mechanical World," it is surprising to find, when comparing drawings produced in some of the most progressive drawing-offices of to-day, that rarely can any be found to contain what are, from the works requirements, basic essentials.

Through the lack of modern workshop experience many excellent functional designers and draughtsmen do not know, and often fail to realize when they do, all that is required of a drawing to make it a highly efficient instrument for all who have to use it.

The first essential of a drawing is clearness of outline and figuring. To obtain this, main outlines should be at least 1/32 in. wide; other lines about half this width. Figures should be block vertical with main dimensions 3/16 in. high, and fractions or tolerances 3/32 ins.

The layout, equidistant and balanced with ample spacing.

Arrow heads, terminating dimension lines, should be of ample size, and finish dead on the lines.

The greater the contrast of coloring between the lines and the surrounding ground of a drawing, the more quickly can it be read, and the clearer and more lasting will be the mental impression formed.

The lines should be dead white on a deep-blue ground. This necessitates the employment of a tracing ink sufficiently opaque to withstand a considerable exposure.

Dotted and dot-and-dash lines, often used to show the position of invisible outlines, are a frequent cause of drawings being misread. The possibility of this should be avoided by showing a sufficient number of clear projections.

Sectioning and cross-hatching are also often confusing, and should be replaced by shading the tracing with a light colour-wash to produce a semi-tone. Machine surfaces should be coloured red. By far the safest way to show tolerances is to give both limits; the absence of a tolerance may denote a known limit.

Tolerances should be complete and leave nothing to chance.

Limits for areas, sections, etc., which, if departed from, would affect the efficiency or strength of a machine, should be fixed by the functional designer. This applies to dimension between rough as well as machined surfaces.

Every factor or essential of a part should have fixed limits.

The planning department, who, from the designer's drawings, make the detail working drawings, should see that all limits required are clearly stated.

By doing so they will not only be avoiding the many troubles which follow undefined limits, but they will be effecting a very considerable saving as well by preventing time being wasted on obtaining a greater degree of accuracy than may be required.

Degree of Finish

The exact degree of finish desired on a surface is another important item that, by being stated, will frequently prevent disputes and effect a saving by preventing a needless finish being given to surfaces not requiring it. The simplest way of doing this is to adopt a set of symbols, each representing a different grade, such as: Rough machine, rough grind, finest machine, finest grind, polish, etc. It is only then necessary to place the symbols through the lines representing the surfaces and give the code on some other part of the drawing.

The dimensions, limits, and information given need only be sufficient for the requirements of the department to whom it is issued. They vary with the operation or process. Those required by a blacksmith or a man roughing-out a casting, unless the rule of thumb is preferred, are quite different from what a driller or a grinder requires.

A list of limits to be defined on drawings should be hung up in every drawing-office, and should include the following: All dimensions, angles, and radii; concentricity and the peculiar relation of any faces one with another; compositions, strength, and elasticity of materials; hydraulic and atmospheric test pressure; degree of hardness, Brinell's; depth of casing, etc.

The arrangement of figuring on machine-operation drawings should be in agreement with the procedure of the operations. There is generally a common working face from which operations commence, and it is often the best practice to project all dimensions from this face so that they appear in the sequence required.

On no account should addition or subtraction or any other figuring be required to obtain a dimension. Neatly enclosed in a border round the drawing should be given all information that may be required pertaining to the part represented: The sequence of machine operations, suitable machines or groups, together with fixtures, tools, jigs, and gauges. A list of times required for each operation can also often be included with advantage. Any special processes required, such as heat treatment and case-hardening, dressing, cleaning, etc. If the part is a casting, the pattern number, or, if a stamping, the number of the die.

The order number and symbol number: If these have to be marked on the part, the method of doing so and the desired position should be clearly stated. The location of the part before and after an operation, with its final destination or stock-bin number, is useful in many instances.

Besides its own number and location in the different departments where it will be stored, a drawing should also show direct connecting references to all other drawings and sources of information that may be required. The date of issue from the drawing-office, the draughtsman's and checker's signatures, and the first order for which it is required should always be given. Spaces should be left for modifications, alterations, and their dates, or for any other information it may be found necessary to add from time to time.

For those departments requiring a complete reference of all the particulars of a part, the grouping together of all the small detail drawings on to one large sheet is an ideal method of storing information that can be rapidly visualised.

When ordering parts to be made by other firms from drawings supplied, particular care should be taken to ensure that not only is the drawing correct, but that no information is lacking.

Should Be Protected

Drawings that may have to withstand frequent use should be protected with a coat of varnish. On no account should workmen be allowed to handle drawings; however careful they may be, it is almost impossible for them to avoid soiling them. A boy attached to the drawing exchange of each department should rest or attach them to some special stand or fixture convenient for the workmen to read without need of handling. When finished they should be collected and replaced.

The slightly higher cost of an ideal drawing is invariably exceeded by the saving it effects.

The amount of time wasted in many factories by employees seeking information which is not, but should be, on drawings is very considerable. If a record was kept for a year, the loss shown would be sufficient to cause

(Continued on page 53)



WHAT OUR READERS THINK AND DO



AUTOMOBILE REPAIR WORK

By A. L. MORGAN

The article on "Automobile Repair Work" by Donald A. Hampson, which was published in your Sept. 8 issue, made very interesting reading.

Referring to the section on his radius rod repair job, I would like to point out a few things which may be helpful to him and to others engaged in the same business.

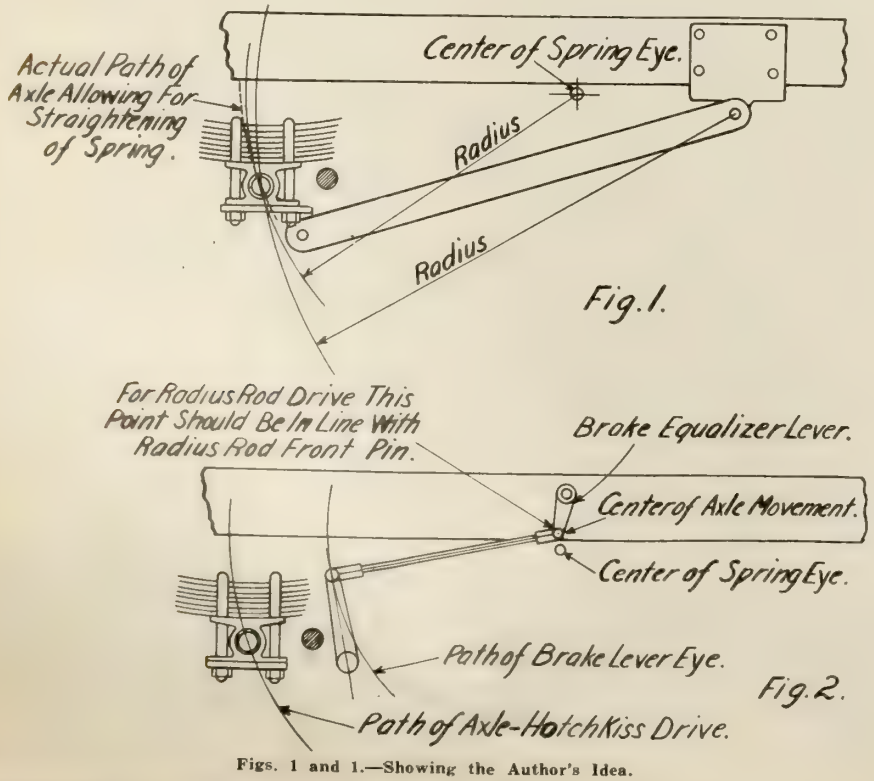
The "Hotchkiss" drive is a very good drive in the opinion of very many experienced automotive engineers, but in the design of some trucks, as appears to have been the case in the one referred to in the above article, something was evidently wrong, or no such trouble would have been experienced with the brakes, if the truck was properly looked after. However, for the present I will not go further into the merits or demerits of the "Hotchkiss" and radius rod drives.

In applying a radius rod to a "Hotchkiss" drive truck it is first of all necessary to put a shackle between the front end of the spring and the spring bracket the same as the one already at the rear end in order to allow the frame free movement in relation to the spring within the limits imposed by the action of the radius rod. If this is not done, the axle, as it moves up and do lation to the frame in going over bumpy roads, or under load, will be trying to move about two centres at the same time, namely, the centre of the spring front pin and the centre of the radius rod front pin.

If arcs of circles (see Fig. 1) are struck form these two points as centres and radii equal to their distances from the centre of the axle it will be noted that these two arcs cross one another. The straightening of the spring as the axle moves upwards further increases the angle at which the arcs cross . It will be plainly seen that a heavy strain is put on both the radius rod and the spring, to say nothing of the parts to which they are connected, by this movement, which will very likely result in a break in one of these parts sooner or later. Also, the bracket for the radius rod is attached to the frame very close to the point of maximum frame stress so that holes drilled there, which have not been provided for in the original design, are apt to cause trouble from this excessive strain.

In either the radius rod, or the "Hotchkiss" drive, in order to have the brakes work properly, the arc described by the axle in its movement in relation to the frame must be concentric with the arc described by the ends of the brake levers about the ends of the equalizer levers. See Fig. 2. If the latter are already located and are not to be changed, this will settle definitely the proper location of the front end of the radius rod and consequently its length.

Another cause of brake trouble in "Hotchkiss" drive trucks is poor connection between the spring and the axle. In fact I think this is the cause in ninety-nine cases out of one hundred. Clips alone are absolutely useless. There must be some positive anchorage that will prevent any movement whatever of the spring on the axle, forward or backward, under any strain within the pushing or pulling power of the spring. There are several well designed anchorages on some of the well known "Hotchkiss" drive trucks. It would be interesting for those repairing them to notice this point.



Figs. 1 and 1.—Showing the Author's Idea.

NEW CATALOGUE.

The Carter Welding Co., Toronto, have published a new book which describes in full the "Rego" line of welding and cutting apparatus. General cutting torches; general welding torches; light welding torches; heavy duty torches; sheet metal welding torches; decarbonizing torches; soldering torches; lead welding torches; various styles of manifolds; regulators of various natures; portable welding outfits; general welding outfits; soldering outfits, and in fact, all sorts of nipples, fittings and wrenches are included in this book which is very neatly arranged.

COLOR VERSUS HARDNESS

Quite often a workman spends considerable time in carefully drawing the temper of a piece of carbon steel, only to find to his dismay that it is soft, while yet the color is real light brown! It upsets his ideas of steel and hardening. Really, the trouble is that the piece was not hard when taken from the water. Either it was not hot enough to harden when dipped, or else it was removed from the bath too soon and drew itself before the black was polished off. Test the piece as soon as taken out of the hardening bath—it is quite apt to prove soft. Remember that the same colors can be produced on a piece of mild steel but they do not indicate a state of hardness.



The Question of Cancellations

"I UNDERSTAND from a reliable authority," says C. H. Marfield, vice-president of the Seaboard National Bank, New York, "that the attempted and actual cancellation of contracts last year, 1920, involved five billion dollars' worth of merchandise, of which three billion was in dispute here and two billion abroad.

"It is to be regretted," he continues in "Bankers' Monthly," "that merchants in our country who have always been held in high regard and looked upon as men of the highest business integrity should, because they faced large losses under contracts entered into, endeavor to squirm out of their position by taking exception to some slight irregularity, which in normal times they would have paid but very slight attention to.

"It is a dishonor to the business men of the nation that such action was taken by our merchants. The banks were thereby placed in most embarrassing positions due to the fact that they were morally and legally bound to live up to the letters of credit issued by them and that by so doing they faced the danger of losing the right to call upon their customers for reimbursement if the drafts were honored after instructions not to pay.

"I feel that even if it is necessary for a merchant to suffer receivership, the agreement signed in establishing a letter of credit should be inviolate. A merchant who as a buyer lives up to his contract even though by so doing he suffers tremendous loss brought about by a condition over which he has no control is one to whom any bank would be only too ready to lend every possible assistance in getting back on his feet."

Insuring Safe Shipments

IN SPITE of damage by shipment, some concerns still feel little interest for the safety of their goods after they have been packed in what they believe are suitable containers, and are placed in the freight cars. Other firms, however, on account of the nature of their products have an added duty, which is to see that the goods are carefully packed in the cars to assure their reaching the customers in satisfactory shape. This applies principally to carload shipments.

One New England concern which manufactures an electric industrial truck, which weighs a little over a ton, is not satisfied to leave the safety of their shipments up to the railroad workers. A few years ago they gave it a trial, but the damages experienced in some of the shipments convinced them that it was not a good plan, so they have been sending men to the freight stations with their shipments. T. F. Moriarty, who tells the story in "Factory," says that the railroads are quite satisfied to let the concern do this because it saves them considerable time, eliminates claims for damages and besides they are hardly equipped for the work. Heavy pieces of lumber cut to size accurately and a large quantity of spikes are needed for each job and this material can seldom be located at the freight stations in the city where the shipments are made.

While the expense has been considerable the concern is satisfied and will continue the policy. The plan has eliminated all claims for damage to the trucks and has resulted in getting the machines to the consignees in perfect shape. As many of the trucks are sent on approval, it is worth something for the concern to secure safe delivery.

The Increased Use of Fuel Oil

FUEL oil, for use in oil burning equipped plants, has increased remarkably during the past year. J. J. Tyrell, in "Textile World," gives some interesting figures relative to this subject. Speaking of the oil burning boilers used by textile mills in New England and New Jersey, he says that approximately 50 textile plants with over 400 boilers were converted from coal to fuel oil. The oil consumption exceeds 4,500,000 barrels, displacing about 1,125,000 tons of coal per year.

The outstanding fuel oil installation in point of size, according to Mr. Tyrell, is that of the American Printing Company, at Fall River. The main storage consists of a concrete tank with a capacity of 640,000 gallons. This tank is about 30 feet from the boilers and oil is fed to the boilers by means of pumps. The storage tanks are provided with heating coils to hold the temperature of the oil to approximately 100°F. These heaters utilize the exhaust steam from the oil pumps.

In selecting apparatus to handle the oil some attention must be given to its quality; that is to say, whether it is light or heavy. It is my opinion, says Mr. Tyrell, that although the first cost of the apparatus to handle the heavier oil is greater, it is economical from an all-around viewpoint to install the apparatus to handle the heavier oil. Such installations will allow the engineer to take advantage of the market without regard to the nature of the oil.

Developments during the past year were chiefly concerned with the design and development of furnaces for high overloads. It is, of course, generally known that it is not economical to operate boilers on overload for any length of time. Yet, it is necessary to have them operate over short intervals to take care of big loads. In concluding, he says that the men who burn the oil ought to be given apparatus to guide them to the best way to get efficient results, and to be certain that they know the purpose of such apparatus when installed.

Keeping Track of Production

COUNTING and keeping record of production was always a problem in our screw machine department, says W. D. Kyle, in a recent issue of "Factory," and while it was a simple matter to count the finished pieces by hand or on a counting scale, we were always ignorant of the quantity of waste produced by our operators. Furthermore, there was always a tendency to overrun or underrun an order.

One of our men suggested the use of counting machines on the screw machines. The question then came up as to how to prevent a false count by the counter recording when the machines were running idle. We purchased a few counters to experiment with and were able to overcome this trouble by attaching them in such a way that the product itself tripped the counter lever. This entirely eliminated a false count when the material was used up.

This application worked out very well, so satisfactorily, in fact, that we have since equipped all our automatics wth them. This simple installation gives an accurate account of total production and entirely eliminates overruns and underruns. It also gives certain knowledge relative to the most efficient operators and workmen, which we heretofore could not attempt to estimate.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Eight contestants submitted correct lists for the Sept. 22nd contest. Following is how they were picked out in the elimination test. W. J. Lawrence, Montreal; G. Land, Peterboro; J. H. Wood, Toronto; Wallace A. Power, Niagara Falls; J. S. McElroy, Toronto; J. Strain, London; Ernest V. Bell, Fredericton; and Lewis W. Munsie, New Glasgow, N. S. As W. J. Lawrence was picked out first, he gets the scale.

CONTEST FOR OCTOBER 13TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1 Something that has a solid steel bar.
2 A case of more than forty years of service.
3 Something dating back to 1864.
4 How to reduce friction.
5 Something which can be produced at a minimum expense.
6 A product said to be non-breaking.
7—Something you should do each day.
8 How to effect big savings.
9 Something that is made available for use as fast as they can be handled.
10 How to reduce production costs.
11 Something you get upon request.
12 How to handle work quickly and safely.

These are Correct Answers for List from September 22nd Issue:

1—The Toronto Iron Works.
2—The L. S. Starrett Co.
3—The Northern Electric Co.
4—The Geometric Tool Co.
5—Hamilton Gear & Machine Co.
6—H. H. Robertson Co.
7—Nicholson File Co.
8—The American Pulley Co.
9—Brown & Sharpe Mfg. Co.
10—Armstrong Brothers Tool Co.
11—The Dalton Manufacturing Corporation.
12—The Carlyle Johnson Machine Co.

Closing Date for This Contest is Nov. 3rd



DEVELOPMENTS IN SHOP EQUIPMENT



FRICTION CLUTCH WITH POSITIVE LOCKING FIXTURE

The Carlyle Johnson Machine Co., Manchester, Conn., have modified the design of their friction clutches. This modification consists of their regular friction clutch with a positive locking feature added so that the load can be started under friction only, and when the clutch is completely engaged it thereby becomes positively locked against slippage so that the driven machine will be operated constantly at the speed of the driver without any possibility of slippage due to any variation in the load or any other cause. Where conditions exist that require such a type of drive as this the method which has been worked out of handling it by this design of friction clutch appears to be very successful.

The principle of the standard type of clutch is as follows. An outside shifter sleeve carries a sliding wedge between two toggle levers which expand the friction ring until its grips the opposing surface of the cup member. In the modified design the positive locking feature has been added. In opposing positions on the edge of the friction clutch and on the shoulder of the outside shifter sleeve are two pins. There are six pairs of opposing pins all together, spaced equally distanced around these two members of the clutch. When the clutch is disengaged both the friction surfaces and the positive pins are out of engagement. As the shifting sleeve is thrown in, the friction surfaces first begin to take the load and practically pick it up to full speed before the opposing pins come into contact. Then, the full throw of the clutch having been accomplished, the pins are in engagement, the clutch drives as a positively locked unit, and slippage under load is said to be impossible.

TRIPLE-GEARED LATHE

The Houston, Stanwood & Gamble Co. Cincinnati, Ohio, have marketed a newly designed heavy duty triple-geared lathe of 60 inch. swing. The bed of this machine is a one-piece casting, 42 feet long, and the total weight of the lathe is approximately 40 tons. The machine is driven by a 35-horse-power variable-speed motor mounted on the headstock. An additional motor is furnished on the left end of the apron, affording rapid power traverse to the carriage. Two steady-rests are provided, the larger having a capacity for work from 23 to 37 inches in diameter, and the smaller, for work from 2 to 23 inches in diameter. The jaws of these steady-rests have bronze shoes.

The various spindle speeds are obtained by operating the levers and handwheel on the headstock, and the different positions of these are designated by letters to enable an operator to determine a speed readily by referring to this speed plate on the headstock casting. The majority of the headstock gears have a pressure angle of 20 degrees. Lubricant is delivered to the headstock by means of a pump mounted at the rear of the lathe, which is driven from the motor shaft. To insure that the oiling system is functioning properly, an indicator is located on an oil-feed line from the pump to the headstock. This indicator has an aluminum wheel which spins rapidly when oil is flowing. The wheel may be observed through a glass at the front of its container. A device is provided to prevent oil from flowing up on the motor pinion and leaking out through the housing.

Several other features are incorporated, and in a test, a cut 1⅞ inches deep was taken on a 16-inch diameter, 0.50 per cent carbon, hammered steel forging, at a feed of ¼ inch per revolution and a speed of 15 ft. per minute.

DRILL CHUCK

The Wayne Tool Manufacturing Co., Waynesboro, Pa., have marketed a drill chuck, which is specially adapted for holding twist drills with broken shanks. This chuck, which is very simple, consists of only seven parts, namely, the shank, casing, two pawls, two screws, a casing plate. The drill is ground to a 60-degree point at the broken end, which allows it to automatically center itself in a 60-degree recess in the shank; and upon turning the casing, the drill is locked in place by two pawls gripping it above the grooves. No wrench is required to tighten or release the chuck.

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Dismantling is harder proposition sometimes than assembling—Separating rusted parts—How to loosen rusted bolts and screws—Seized parts—Forcing methods—Specimen of jack design.

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This ring is one of largest in world—Special boring mill built for handling large work—Dimensions of machine—Method of making casting—How work is gauged.

Distributing of Manufacturing Expense 34

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Canadian Machinery Weekly Contest 40

Readers still take as much interest in this contest as ever—Have you landed a scale as yet? If not, why not this week?

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries.

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The Value of Apprentices

IN ANOTHER portion of the present issue we mention the names of seven Grand Trunk Railway apprentices who have been successful in capturing prizes for drawing at the 1921 Canadian National Exhibition at Toronto. Apart from the fact that these boys secured seven out of a possible ten prizes; we admire the calibre and talent of railroad apprentices in general. The seven successful contestants have real cause for pride, and in turn we as Canadians have reason to be proud of our railroad executives who have made possible the development of such boys. Apprenticeship on our railroads has been developed into an exact science. Hit and miss methods of training are no longer tolerated, and each boy is given careful tuition by capable instructors. Not so very long ago Canadian Machinery was privileged to sit through a session of one of the apprentice instruction classes at the G.T.R. shops in Toronto, and the clear and concise method of instruction appealed to us in every way. The earnestness with which the boys studied showed conclusively that they keenly realized the opportunity which was being afforded them, and the class of work which they accomplished proved they had grasped the lessons taught them.

The G.T.R. shops, in fact any railroad shops or manufacturing plants are doing a great work by this training of their apprentices, and in an indirect way they will be paid at some later date for any trouble they may be put to in the training of such boys. The Brown & Sharpe Company of Providence, R.I., have a very complete apprentice system, and one which costs considerable to maintain, yet they frankly admit that the class of boys they eventually turn out into full fledged mechanics well repays them for any effort expended. Likewise, the railroad shops produce the better class of railroad mechanics and engineers, men who have the interest of the G.T.R. at heart because they have grown up so to speak with the organization. Let us keep this thought before us regarding any apprentice. He actually represents raw material which can be either molded into a real mechanic or ruined through careless treatment. The moment a manufacturer takes a boy into his plant to train him for a mechanic, he is to our mind, responsible for the success or failure of such a lad. True, there may be those who never will become mechanics, yet who have chosen that as their life work. When a manufacturer is unlucky enough to find such a boy in his employ he should follow out the plan of the B. & S. Co., viz., tell the lad he is not suited to the trade. Such procedure may appear pretty cruel treatment, but we often have to be cruel to be kind. Let us boost the cause of apprenticeship and the need of proper apprentice instruction, for such boys will soon develop into ideal young men who will help to build up a still greater and better Canada.

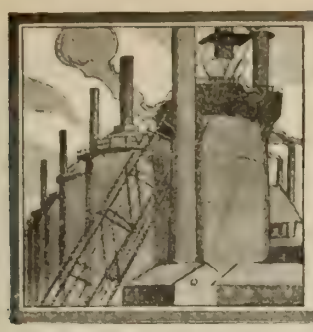
Ability and Experience

ONE of the erroneous impressions existent in the business world to-day is that ability and experience can be bought without much difficulty. While these two qualities can be secured in some small measure, the average experience proves that it is a very one sided viewpoint that you receive. Even James Couzens, who was formerly vice president and treasurer of the Ford Motor Co. admits that he was sadly disappointed in this respect.

Speaking of how the Ford Motor Co. made its start he says: "We started without experience. As we grew larger, we tried to buy ability and experience—and failed. We had a unique business and when we brought men in from the outside—men with reputations—they invariably started to recast our affairs into their own molds. I do not undervalue training and experience, but a man with a reputation usually becomes so fixed in the ways that have made his reputation that he is fearful of failure if once he steps outside of them. If he remains flexible—if he uses his training as a background, then the training is of the highest value. But that seldom happens. Old dogs do not learn new tricks. They are too sure of the right and of the wrong. Especially are they sure of the wrong method—they know too many ways in which an end cannot be accomplished and thus they surround themselves with conventions. They are afraid of making mistakes—afraid of hurting their reputations. We all make a large number of mistakes. It is well to recognize that fact and not to attempt to disguise it. As has often been said, it is not the mistakes that count, but the repetition of them."

When a man such as Mr. Couzens admits defeat, one has to look around for the real method of securing ability and experience. To our way of thinking the sanest procedure is to start off by hiring men who are bright, intellectual, and faithful. Bring them up with the firm; and if possible give them an interest in the business, thus linking their own future with that of the enterprise with which they are associated. A star performer may be a whirlwind in some particular section of a business, but transplant him into another department and he may prove a regular dud. Above everything else, keep the loyalty of your executives and employees alive. Without loyalty success can never be attained, for to do his best a man's heart must be in his work and he must have confidence in his employers. Many a good executive has been nipped in the bud through shabby treatment.

A company that follows out a fair and square policy of promotion will never need to look around for ability. They will find it right in their own plant, and besides, the open market is not the best place in the world to look for a *real* executive. If a man is a capable worker, and is receiving good treatment, he is very seldom in the open market. Never hire a man that is one sided in his opinions for he will but blossom into a star. Secure men of broad understanding, men who see all sides of the question; train them the way you want them to go, and the result will well repay you.



MARKET DEVELOPMENTS



Confident Feeling Exists on Present Market

Steady Improvement is Noted—Steel Market Shows No Change In Prices—Small Tools Selling At Fair Rate—Tin Plate is Active Scrap Metal Remains Dull

THE VARIOUS markets report a steady improvement, although in no case is the change for the better very decided. It would seem as if the slogan "Better Safe than Sorry," had been adopted.

In Montreal the steel market is picking up, while in Pittsburgh no change of importance has occurred during the past week. Toronto reports a fairly steady market and better things are looked for as time proceeds.

The machine tool business goes on in a small way. If enquiries counted for anything business would almost be rushing, but unfortunately all enquiries do not materialize into orders. Dealers say, however, that they expect this branch of the market to open up shortly.

Small tools are selling at a fairly good rate. Practically no change has taken place in the demand, and up to date of writing, buyers are still persisting in the hand to mouth policy of purchasing. Dealers in this line say that sheer necessity will force manufacturers to open up before long. In fact one concern, according to a story existent, contemplates buying $50,000 worth of such tools as reamers, drills, fixtures, etc., etc.

The railroads in the U.S. have announced a reduction in freight rates on iron ore. This reduction is 28 per cent, and on the face of it looks good. The furnacemen, however, are not much pleased with the move, as they claim they are moving very little iron ore at present.

They have large piles of this material at the furnace. What is looked upon as the unfortunate feature of the matter is that this reduction will perhaps encourage pig iron buyers to look for lower prices on that commodity. Such a condition is very unlikely, because as the manufacturers point out, it will cost just as much to make pig iron as formerly until the present stock of ore is used up.

Tin plate continues to show remarkable activity for this time of the year, sixty-five per cent. or more of the tin plate mills being at present in operation, against 25 per cent. last June.

There is some talk of strikes occurring around April 1st, 1922, but as that is quite a period ahead, it is to be hoped common sense will intervene in the meantime.

FREIGHT RATES ON IRON ORE REDUCED WILL NOT BENEFIT FURNACEMEN MUCH

PITTSBURGH, October 13.—Conditions in the iron and steel trade have changed very little in the past week. Prices have shown no important movements, and the volume of demand is not materially altered.

The railroads announce a reduction of 28 per cent in iron ore freight rates, balancing the 40 per cent increase August 26, 1920. so that rates will be down to where they were before that advance, being still well above the level of 1914. The announcement is that the reduction will be only to December 31, but the trade assumes that the reduction will be permanent. The rate from Lake Erie dock to valley furnaces will decrease from 91 cents, to 65 cents, but so far as known there is no reduction scheduled in the dock charges.

While the blast furnacemen have been anxious to see rate reductions they are not particularly pleased with this move because of all reductions it is the one that will do them the least good. They are moving very little ore now and the reduction will hardly encourage them to move more. They have large piles of ore at furnaces. What the furnacemen consider an unfortunate feature of the matter is that the reduction will encourage pig iron buyers to look for lower prices on pig iron, whereas for some time to come it will cost just as much to make pig iron as formerly, since the ore piles have to be used.

If the reduction had been made on coke the case would be different, for the furnaces are moving coke every day. Doubtless the railroads realized the circumstances in picking on ore for the first reduction, and accordingly some furnacemen call the ore rate reduction "a play to the galleries." When the ore reduction really counts it will mean about 47 cents on the amount of ore needed to make a ton of pig iron. The freight on a ton of Connersville coke to the valleys is $2.52, and a 28 per cent. reduction on this would be 70 cents. or about 77 cents on the amount needed to make a ton of pig iron. Doubtless this will come some time, but the railroads would like to have it at once.

Production of pig iron in September was at the rate of about 12,000,000 tons a year, this comparing with rates of about 11,200,000 tons in August and 10,000,000 tons in July, the low month. Production now is probably at fully 13,000,000 tons.

Production of Ingots

Production of steel ingots is at 33 to 35 per cent of capacity, against 30 per cent in August, and about 12 per cent in July the low month. There has been no material change in the rate of production in the past two or three weeks, though there is some reason to believe that there is a slight tendency towards increased production.

Semi-finished steel is very sluggish, there being scarcely any interest in the market. Mills generally are holding sheet bars at the recently advanced price of $32 but it does not appear that the price has been paid thus far. Sales a few weeks ago were at a trifle under $30. In billets there is no action at all, and some mills do not have even a nominal asking price. Rods are supposed to be $41, by the recent advance, but the market has not been tested.

Bars, shapes and plates continue sluggish. The Carnegie Steel Company recently announced its prices at 1.65c for bars and 1.75c for shapes and plates. So far as known the company is adhering to these prices and that is not easily understood since some independents are ready sellers at 1.60c for all three

products. The 1.60c price, however, seems to be the minimum, and if so the market is firmer than a few weeks ago.

Hoops and bands are in very poor request, but mills seem to be adhering to a price of 2.25c, to which they recently advanced, probably on the theory that they can secure one price as easily as another.

Wire products show nothing important marketwise, since the distribution is almost wholly on old orders, booked before the advances of September 12, $2 on wire and $3 on nails, present prices being 2.60c on plain wire, 3.10c on galvanized wire and $2.90 on nails.

A little business is now being booked by sheet mills at the $5 a ton advance of some three weeks ago, but of course the chief operation is against the old orders. Whether the new prices will hold indefinitely is a question, but already some of the mills are discussing the prospects of another advance. Present prices are: Blue annealed, 2.50c; black, 3.00c; galvanized, 4.00c.

Demand for pipe mill products has been increasing slowly right along, but there is little improvement now. For standard steel pipe, demand is quite fair, but there is little being done in line pipe or oil country goods. Crude oil prices have been advancing rather sharply in the past ten days, and this would encourage drilling were the season not so far advanced.

Tin Plate is Active

Tin plate continues to make an altogether remarkable showing for this time of the year, since week by week production increases, 65 per cent or more of the tin plate mills being in operation, against about 25 per cent last June. The increased production is due partly to increased demand and partly to liquidation of mill stocks. Prices are quite irregular.

Pig iron is firm in the local market but distinctly inactive, transactions being light, and inquiry as well. The market is quotable at $20 for Bessemer, $19.25 to $20 for basic and $21 for foundry, f. o. b. valley furnaces. Quite a divergence of opinion has developed as to the future of the iron and steel market over the next three months. In some quarters the opinion has arisen that all the improvement to be expected for this year has already occurred and that there may even be a recession of demand by December. In other quarters it is held that general business is going to increase steadily, bringing a larger consumption demnad for iron and steel week by week, and that by early spring everything will be quite active again.

Fresh dangers of strikes have loomed up. It is reported that officials of the United Mine Workers and the railroad brotherhoods have made an alliance for mutual support. While the reports may be incorrect, or the plans may go astray, the story runs that the railroad men will defer to April 1, 1922, the strike they have appeared to be wanting, and the United Mine Workers will demand an advance for the two-year scale to follow the existing scale, which runs through March 31. The common view is that the present mining scale is altogether to high and that there should be a stiff reduction. Then on April 1, according to the story, the mine workers and the railroad men will strike and the railroad men will refuse to haul non-union coal, or burn it in locomotives.

POINTS IN WEEK'S MARKETING NOTES

Consumers are maintaining their confidence in the various markets, and the volume of business in several lines has noticeably increased.

Some of the Tank Cars for Russian Government are now on their way. This fortunately, was a cash proposition so that everyone in Canada was fully protected.

The machine tool market in Montreal is not very brisk. Idle equipment, which is said to be in good repair, is chiefly responsible for the present inactivity.

Pittsburgh reports that the iron and steel trade shows very little change during the past week, even to the volume of business closed.

Railroads have announced a 28 per cent reduction in iron ore freight rates. The present announcement states that the reduction will only be good until December 31st, although the trade expects reduction will be permanent.

Production of steel ingots is at 33 to 35 capacity, against 30 per cent in August, and about 21 per cent in July, the low month.

Hoops and bands are in very poor request, although on the other hand, the mills seem to be adhering to the 2.25c price, probably on the theory that they can secure this price as easy as any other.

Tin plate continues to make a good showing. The increased production is partly due to increased demand, and partly to liquidation of mill stocks. Prices however are rather irregular.

Rumor has it that America will soon see some further strikes. Common sense may intervene in the meantime so that the rumored strike may never take place.

Small tools are selling at a fair rate of speed and dealers in this line say they cannot complain.

CONFIDENT FEELING EXISTS ON MARKET

TORONTO, October 13th—A feeling of confidence exists on the market this week which is worth while in itself. Business is not of very large proportions, yet in spite of this fact, dealers in the various lines say that they are not worrying. "We see business ahead," said one dealer to Canadian Machinery, and combining all the opinions given by the various men, the former remark fills the bill admirably. Another dealer put it this way: "For the past few months" he said, "we have been working up a considerable number of prospects. This has taken both time and effort, but neither has been wasted, for we now see strong possibilities of this business being closed, and of course, needless to say, coming to us."

Men engaged in other branches of the market tell a very similar tale. Take for example the steel market. Practically every dealer we spoke to, told us that business was steadily improving. Every week shows a slight increase over the former, and while the demand is far from normal, it is as good as can be expected at this time of the year. A few months ago buyers of structural material were inclined to purchase by floors, instead of closing the deal at once. In other words they ordered enough material to finish the steel work on one storey, and then hoped before they required the material for the next storey, prices would be lower. Luckily, this foolish hand to mouth policy has practically disappeared. Buyers have at last realized that steel prices are down to practically production costs, therefore they are showing more confidence in existing figures.

Another steel dealer spoken to said that from now on he looked for good business. By the spring he expects the upward movement will have brought them up to a good high mark. Business so far this month seems to be ahead of September so far as orders are concerned.

Small Tools

The dealers in small tools are not worrying any these days. True, they are not working overtime to write up orders, but all things considered, they feel they are getting a fair share of the business that's going. If a graph was made of sales per month from January to September, or even up to the present date, the average line would almost be straight, for each month has practically been the same throughout the year. Where one month would drop, the next would rise, and so on, therefore the average activity is about even.

Machine Tools

The report in this market varies slightly. Some dealers say this month so far has been poor, while others again say their sales have improved. The situation can be summed in this way. For some time past these different dealers have been working up prospects. Naturally, they break at different times,

so that while one dealer may be getting his prospects up to the buying point, the other has managed to close the deal with his purchases, and so it goes. Enquiries still continue to come in, and although one cannot truthfully report the market as very active, we can say it could be much worse. To show how long it sometimes takes to work up a prospect, we ran across an order which was just closed a few days ago and which had been hanging fire over six months.

Scrap Metal Market

It would seem as if this market has decided to take a long rest. Nothing has changed since last week, and it looks as if this condition will hold good until foundries generally get busy again. How long this will take is problematical. At present it would seem as if spring would be the turning point, but there may be something happen before that will change the present inactivity in this branch.

The best message we can give this week is the feeling of confidence existent. Nobody is discouraged. Everyone feels the worst has been passed, and although not looking for a sudden improvement, they expect the upward trend will continue in a steady manner.

SLIGHTLY BETTER CONDITIONS PREVAIL IN THE LOCAL MARKETS

MONTREAL, October 13th—Slightly better conditions have prevailed in the local markets during last week. Consumers have maintained their confidence in the various markets. The volume of business in several lines has noticeably increased. The slow but persistent improvement indicates a more healthy condition than would a sudden improvement from an indefinite source. The present better tone of affairs indicates almost a state of business "convalescence." There is the disturbing factor however of the approaching Dominion Elections which has to be taken into consideration, especially in the case of larger concerns. The manufacturer is quite as interested today in discussing the probabilities of the tariff as he is in getting after new business. Thus any large undertaking of the manufacturers, will very likely be held up until after the results of the election are known.

Steel Market

Steel business is improving slightly. Prices have been down to almost an unprofitable point, and with the better condition of the trade, the outlook points to a stiffening in price. The railways have practically placed the orders for all rails, plates and joints that they expect to purchase before next season. Sheets and plates are moving more freely and there is a firm conviction among the jobbers that an upward trend of prices is coming very soon. Structural shapes are rather quiet and bars are moving slowly. The Canadian Car and Foundry Company are commencing to ship some of the tank cars on order for the Russian Government. These cars have required large stocks of material, and the tanks are being shipped separate from the trucks. The Canadian Government Merchant Marine Ships are carrying the cars from Montreal to Novo Rossick a port on the Sea of Azov. The attractive part of the whole transaction is the fact that is is a prepaid one, including the freight charges.

Most of the large mills have almost completed their arrangements for winter rolling, and only in a few instances, will mills remain idle, although they will all be working at partial capacity.

The prices of pig have been maintained throughout the week athough business has shown a little better trend. Foundries are not evidencing any tendency toward getting back to normal, and in consequence the volume of business from week to week only shows nominal improvement. The indications are that the winter months will be quiet ones but with the spring of 1922 business that has been deferred from time to time will be placed from sheer necessity.

Machine Tools and Supplies

In most of the machine shops to-day there is more or less idle equipment. These tools are in most cases, up to date, and in good repair. Thus before machine tools commence to move in any quantities, business will have to reach that point which will put this idle equipment into production. However, manufacturers are industriously endeavoring to refine their designs, and add improvements and at the same time reduce the manufacturing cost so that they can place on the market a class of tool that will be a real investment to the purchaser. It is useless to look forward to exceedingly large sales, in the future, of standard tools, of the class that has been on the market the last few years, because the war time demand for these tools was such as to place them in the hands of users in such quantities as to take care of all the business in sight for several years. Thus the machine tool manufacturer that improves his design or builds new revenue producing features into his machines and offers them for sale at a reasonable figure is the manufacturer that will be among the first to get back to one hundred per cent production.

The supply business has been gradually improving and the last few weeks are very encouraging and indicate a somewhat greater volume of business in shops. Little by little the effects of liquidation are gradually disappearing. Prices are again approaching a point where they are more or less staple.

Non-Ferrous Metals

The trading in all the non-ferrous metals has been more or less keen the last ten days. Copper has made one or two small advances and the demand appears to be much stronger. Zinc and spelter also have been moving quite freely, and prices have a tendency to strengthen. Canadian quotations locally are usually something of a compromise between the New York and London markets, and quotations are usually made from the lower of these markets. Meanwhile the small volume of business moving is gradually increasing and prospects are slowly improving. A greater improvement will be noted as soon as the foundries start to come into the market again.

Scrap Metals

Another week of stagnant conditions in the scrap iron trade must be recorded. As business in this section of the trade is dependent entirely on the activities of the foundries no change can be recorded until first the operations in the foundries commence. One can get almost any quantity of iron scrap for six dollars a ton, which price, even if there was a greatly increased demand, would hardly pay for the handling.

Trade Gossip

Mr. Gordon James, manager Canadian S. K. F. Company stated to Canadian Machinery this week that their business for the year to date had been quite satisfactory. A slight improvement had been noted during the past few weeks. Mr. James attributes their success to persistent sales and advertising effort. No town however small has been overlooked and every possible source of business has been prospected.

A building which will represent Italy may soon be erected at the Canadian National Exhibition grounds at Toronto. Messrs. Cavalier Guilo Ricchardi, Italian Consul-General for Canada, Mr. Jos. Glionna, Acting Vice-Consul and Chevalier Victor E. Gianelli recently conferred with the Exhibition Board regarding the securing of a site and were assured by the board that space would be available and that such a building would be available and that such a building would be a welcome acquisition. If Italy decides to erect such a building, it would bring the total number of countries wishing to be represented up to five; these being France, Italy, Japan, Cuba and Great Britain.

Hamilton, Ont.—William Butler, machinists at present occupying premises at 18 Mary Street, will move into larger quarters at the end of the present month at 17 Hunter St. West, Hamilton. After settling down in the new quarters, Mr. Butler informed this paper, that he expects to add to his present equipment by purchasing a 24 in. drill and a power hack saw.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	31 80

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	5 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58½	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 25	$17 50
Electric copper	16 75	17 50
Castnigs, copper	16 50	18 00
Tin	34 00	39 00
Spelter	25	7 50
Lead	6 50	7 50
Antimony	7 50	8 25
Aluminum	30 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4 in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 20%.

Standard couplings, 4-in. and under, 20%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 9 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	8 00
Red brass turnings	7 00	7 50
Yellow brass turnings	5 00	6 00
Light brass	4 25	5 00
Medium brass	4 50	6 00
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	2 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 50	6 00
Can. plates, all bright	7.75	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	8.00	
Fleur-de-Lis, 28 B. W. G.	7.50	
Gorbal's Best, No 28		
Colbornes Crown, No. 28.		
Premier, No. 28, U. S.	6 75	6.00
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$
1¼ in.	27 25	
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.		34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21	Atlas	19
Peerless	22	X Empire	15
Grand	21½	Ideal	18
Superior	21½	X Press	13½
X L C R	16½		

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	17	Dark colored	13
Mixed colored	14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard	10%	Best grades	15%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

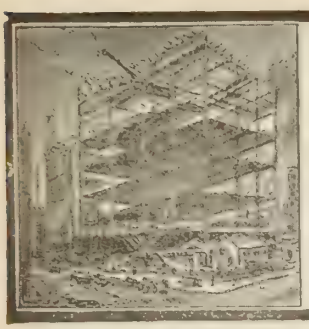
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 9 50	$14 50
Sheets, 3½ lbs. sq. ft.	9 25	14 00
Sheets, 4 to 6 lbs. sq. ft.	9 00	13 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

It is understood the Board of Education at Fort William are in the market for certain tools for their technical school.

F. F. Barber & Co., Foy Bldg., Toronto, have just completed arrangements for exclusive Canadian representation of the Warner & Swasey Company, Cleveland, Ohio.

Considerable activity is reported by machine tool dealers handling automobile cylinder regrinding machine . Machine shops and garages who have installed these machines appear to be doing a rushing business.

Dodge Brothers, Detroit, have purchased 35 acres at Sandwich, Ont., with 350 ft. water frontage, and according to reports the intention is to erect an assembling plant on this new location.

The Canadian Automatic Carburetor Co. intend establishing a plant at the corner of Royce Avenue and Dundas Street, Toronto.

T. & N. O. Railway extension work will be commenced this winter upon a 70-mile right-of-way northward out of Cochrane to Smoky Falls. The cost of the extension will be around $3,500,000.

Albert Francis, of Dunnville, will soon erect a foundry at Port Colborne. Three acres of land have been bought for the purpose.

Waterloo:—According to reports a large bricksyard will soon start up in this locality. Montreal capital is said to be interested in the new yard. The plant will be equipped with the latest and most modern brick making machinery and is expected to be in a position to cater to all kinds of trade.

James Bain & Sons, Hamilton, Ont., engineers and machinists report business as being very good and say that their present turnover compares favorably with the corresponding periods of 1919 and 1920.

The Hamilton Tool Co., Hamilton, Ont., are expecting a large order for a new line of patent motor truck radiators which they are manufacturing.

The McClean Machine and Tool Co., of Hamilton are manufacturing a new line of electric welding machines. It is claimed that these are the only welding machines of any type being manufactured in this country and a full description of these machines will appear in this paper at a later date.

John Carr, of the Carr Pattern and Tool Co., Hamilton, Ont., informs this paper that the above mentioned organization will move into larger premises about November 1st. The new factory is located at 108 Merrick St., and Mr. Carr says that they expect to purchase some new equipment in the way of machine tools at a later date.

Grimsby, Ont.—The Bay Mac Tire Co. are contemplating the erection of a factory which will cost around $15,000, and plans for same are now being prepared.

The Metabetchouan Pulp Co., Metabetouchan, Que., are erecting sulphite mill, sawmill, boarding houses and sheds which will cost around $750,000.

Toronto, Ont.—B. H. Prack, architect, 50 Bay St. intends calling for tenders shortly for the erection of a residence which will cost around $30,000.

Ottawa, Ont.—Tenders, no closing date set, will be accepted by David Arbuckle, 392 Daly Ave. for the erection of a residence costing $11,000.

Mr. R. J. Fleming, manager of the late Toronto Street Railway Co., has been appointed to the directorate of the Toronto Harbor Commission, thus filling the vacancy caused by the succession of R. Home Smith, as chairman, in place of the late Mr. Lionel Clark.

Considerable activity is reported by machine tool dealers handling automobile cylinder regrinding machines. Machine shops, and garages who have installed these machines appear to be doing a record business.

Brantford—The Dominion Steel Products Ltd., will shortly take on more men and if certain negotiations pending at present go through, it will mean a resumption of work to normal.

The Canadian Carpet and Comforter company, Toronto, are now running full time with complete staff. J. R. Syer, manager, expects business to continue good with them.

The capacity of the fifteen newsprint mills operating in Canada today is 3,412 tons a day or just over 1,000,000 tons a year. In this Canada is rapidly overtaking the United States whose production is running below 1,400,000 tons a year, after a total of 1,511,000 tons in 1920.

According to information received, the Waltham Motors Corporation of Canada, with head office at 9 Wellington street east, Toronto, intend manufacturing their motor trucks in Barrie. They have acquired the property of the Barrie Carriage Company and expect to move into this factory in a short time, and to be turning out trucks by the beginning of 1922.

It is reported that the Canadian National Railways intend buying equipment and supplies at an early date. If this is done it means considerable business for Canadian manufacturers in almost every branch of industry.

The Manager of a Toronto supply house says reports and business received from his salesman have shown a steady and encouraging improvement since June last. This company covers Ontario and Quebec with six men who keep in pretty close touch with all industries, large and small.

At a meeting of the Canadian Foundry and Metal Trades Association in Toronto, Friday, October 7th, the question of wages paid laborers by the city came in for some discussion and it was decided to support the Manufacturers Association and other bodies who will approach the City Council this week with hopes of getting the 60 cents per hour rate now being paid, reduced to 45 cents or lower. It is felt that the 60 cent rate now being paid in Toronto places an unfair burden on Toronto employers as they have to meet this rate while other manufacturers throughout the province are able to pay much less owing to municipal wages generally throughout the province being lower than Toronto wages.

"The Toronto office of the Independent Pneumatic Tool Company has been removed from 32 Front Street West to No. 163 Dufferin Street. The new location will give this company larger space and increased stock facilities. The Toronto Office will remain in charge of Mr. William McRae."

Tillsonburg, Ont.—The Shoe Co. in this town actually has to work 65 hours a week to keep up with orders. 160 hands are employed, and present orders are sufficient for at least another six months. In the other factories, these including all industries there, considerable activity is in evidence, and no unemployment is spoken of.

Toronto:—The Transportation Commision have 1,500 to 2,000 men engaged at present on re-habilitation work. Other activities that are to be pushed by the city are as follows:—

Grading and sewer operations will be done by the Works Department, this total reaching $107,100 and $692,300, respectively. The Street Commissioner is ready to go ahead with the new northern stables, which will cost $660.000. Other buildings to be constructed include the Reception Hospital, addition to College street fire hall, and the new fire station in Ashbridge's Bay, at an estimated expenditure of $40,000.

NEWS OF INTEREST FROM ALL SOURCES

THAT all indications point to a tremendous demand for machinery from the motor car industry, is the opinion of a Detroit dealer who is in constant contact with the situation. Referring, for example, to the manufacturers of one of the highest class cars in that city, he declared it, well known that their equipment was in comparatively bad shape, but that the directors would not give the authority to buyers to go into the market for a new outfit at the present tim. They preferred rather to conserve finances against a more propitious day. It is a fact that, during the war, and for some time afterwards, industries such as these had bought heavily, but eventually were confronted by the necessity to curtail. Even the Ford Co. in Detroit has become somewhat conservative, and dealers point out the buying for this concern is now done chiefly on a 30-day, rather than on the 6-month plan. This of course makes possible a conservation of finances at a time when such course is imperative.

When the demand was a more definite quantity and deliveries of material somewhat problematical, the 6-month plan was feasible. Even with the factories running as they are, the buyer on the 30-day basis has to hump some; but deliveries are reported to be good. It is not that the big industries are looking for better prices. Dealers report that a pretty reasonable level has already been reached without getting a rise of any proportions. When the time comes—and great hopes are pinned on next spring—the demand will be something exceptional.

The Fox Machine Co., Jackson, Mich., consider this a time for preparadness. To that end they are doing considerable experimental work in their shops looking to the improvement of their product and development of new ideas generally. This cannot always be done when the plant is running at normal and they expect to come out of the period of depression with something to demonstrate that the time has not been lost. The Fox multiple spindle tapping machine is an example. While the general construction is similar to that of their standard multiple drilling machines, there is some departure from previous constructions used. Former tapping machines made it necessary for the operator to follow the taps by raising and lowering the head with the hand pilot wheel. If he did not move the head fast enough taps very often pulled out of the spindles; if the head was crowded too hard, threads were liable to be stripped and generally, the services of o high grade mechanic were necessary. The new machine can be operated by an ordinary mechanic. The machine has full ball bearings in the countershaft and in the gear boxes at top of column. Spindle reversal is obtained by reversing clutches of the grab tooth type. They are located on the vertical drive shaft to the head. There is a single oxy plate clutch mounted in the gear box drive pulley, which clutch releases the load from the entire machine before spindle reversal takes place. The operation is simliar to shifting gears in an auto, the operation being, however, automatic. The reversal is obtained under heaviest loads in but a fraction of second, without shock to the mechanism within five thousands of an inch of the same depth on successive operations. While the capacity for tapping on these machines depends upon the number of spindles in the heads, experience has shown that the power required for tapping is about one third of that required for drilling a tapped hole.

Some equipment manufacturers report that it is a common occurence these days to have purchasing agents put through a requisition for this, that or the other machine or machinery—and a requisition is first cousin to a real order. Some of these days there will be a command for full steam ahead.

"Comes forward an American banker with the declaration that these great domestic influences are retarding the readjustment of prices and costs. Briefly, they are: First, delayed adjustment of prices and costs. Second, sustained high cost of transportation, preventing natural and normal movement of commodities to markets, and third, continuation of unsound taxation that diverts working capital from its proper channels. And he concludes, "In spite of these problems, the process of readjustment is going on and there have been undeniable signs of at least a modicum of improvement in the last few months. Every tep in the process of readjustment is doing its bit to restore the normal value of purchasing power to the entire people, and in the nature of things there is no room for anything but confidence in the gradual improvement of business."

R. H. Cunningham of R. H. Cunningham & Co., electrical engineers, Walkerville, was in Toronto this week in connection with installation of high speed and preheating furnaces at the Toronto plant of H. Disston & Sons, Limited.

Manufacturers report that in many quarters the fact that an election is in sight is regarded as an excuse for slowing up of effort. "During the war," he states, "the country was confronted by some pretty stiff problems, but "Business as Usual" saw it through. What I want to say now is that the country can't afford to let up while politicians fight it out. This is still going to be a pretty good country to live and work in and even after the election."

E. B. Kelly, Penberthy Injector Co., Windsor, has returned from a trip to Eastern Canada, and reports conditions much more favorable and a more optimistic outlook generally than was the case six months ago.

An association has been formed in England having as its object the control of rubber production in the East Indies, to prevent a repetition of the present glutted market. This new company is known as the Rubber Producers, Corporation, with a capital of about $25,000,000. The corporation is to obtain control of about 2,200,000 tons, against a normal of 400,000 tons. It is further estimated that the world's consumption of rubber this year will not be in excess of 250,000 tons.

ENGINEERING NEWS

Two of the new machines of the Abitibi Power & Paper Company at Iroquois Falls for the manufacture of newsprint are the largest in the world. They are 232 inches wide, and each machine is capable of turning out a sheet of newsprint paper over 18 feet wide and about 200 miles long every working day, or approximately 85 tons. To produce this output there will be required each day the pulpwood contents of 14 acres of forest.

Business, according to G. J. Morris, assistant to the general manager, of the International Business Machines Compay, is good. Their turnover for this year to date is 20% more than the same period last year. A large part of the sales are to retail establishments, but Canadian Machinery readers will be interested in learing that the sale of time clocks and recording devices used by manufacturing plants is steadily increasing. Mr. Morris said this would tend to show that manufacturing plants are reopening and buying equipment.

Building operations were on a larger scale during September than for the earlier month of the season. Fourteen industrial groups showed expansions in pay-rolls as compared with the preceding fortnight amounting altogether to nearly 6700 persons. The market for nickel is showing an improvement. Mr. C. C. Corless, General Manager of the Mond Nickel Co. states that the mining and smelting operations of the Mond will not be any further curtailed. The company has the greatest confidence in the turning of conditions generally for the better.

The towns centrally located in the mining district of Northern Ontario particularly in the gold mining district are enjoying a great wave of activity and are perhaps the busiest industrial towns for their size in the whole of Canada. Timmins is the town referred to. There is a payroll now of upweards of 2,500 men in connection with the production of gold, in addition to which is a big pulp wood, lumber and tie business, along the Matteagami River. Additional mines are on the verge of re-opening these including the Porcupine, V. N. T. North Crown, Schumacher. as well. as the Dome Lake and West Dome Consolidated. The mines are producing gold at the rate of not under 3 tons of gold bullion every thirty days valued at close to a million and a half dollars. The indications are that the next few months will witness a total of seven mines turning out gold bullion in this field alone.

PERSONAL

Mr. Blair of Alfred Herbert, Limited, was in Montreal all last week on business. He intended to engage a resident salesman while there.

E. F. S. Mattice, B.A.Sc. M.E.T.C., has been appointed as manager of the Phoenix Bridge and Iron Works Ltd., Montreal. Mr. Mattice is a graduate in the Faculty of Applied Science, McGill University, and for most of his professional career has been connected with the Dominion Bridge Co., latterly as its general contracting engineer. He was for several years president of the Structural Engineering Co., and has supervised the steel design of many of the largest buildings in Canada. He was also for some years special lecturer on structural steel design in the architectural course at McGill University.

Frank P. Jones, has been appointed president of the Canada Cement Co., Montreal. A. C. Tagge and Henry Jones Fuller were appointed to the two vice-presidential positions which were vacant. Vacancies on the board were filled by the appointment of Gordon C. Edwards, Ottawa, and T. A. Russell, Toronto, Mr. Edwards has been associated with the lumber business and is a director of numerous Ottawa companies. Mr. Russell is prominently associated with the automobile industry, although connected with several industrials. Mr. Jones has been with the Canada Cement Co. since the beginning of 1910, in the capacity of general manager, later being made a director and still later a vice-president. He was previously associated with the Dominion Iron and Steel Co., starting with them as sales manager and risingto be general sales agent, and from 1905 to 1910, general manager. Besides his connections with the Cement Company, Mr. Jones is president of the Consumers Gas Co., director Canadian Bank of Commerce, director Montreal Trust Company, director of Ontario Steel Products Company.

Some further additions have been made to the Board of Directors of the English Electric Company of Canada. Many of the men appointed hold high positions in industry in Great Britain. These are Lord Meston, K.C.S.I., Director and Chairman, Finance Committee of the English Electric Company, Ltd., of Great Britain; Lieut.-Col. Sir John H. Mansell, K.B.E., Director of the English Electric Co., Ltd., of Great Britain; and P. J. Pybus, C.B.E. Managing Director, the English Electric Co., Ltd., of Great Britain. The London Advisory Committee is also announced, with Mr. Pybus as Chairman. It will comprise also Evan Parry, B. Sc., Engineer-in-Chief of the English Electric Co., Ltd., of Great Britain. and two of the principal members of the engineering staff of the same company.

The Canadian directors of the English Electric Co., of Canada, are as follows: Gordon F. Perry, President and Managing Director, National Iron Corporation; Russell A. Stinson, Vice-President and General Manager, Canadian Crocker Wheeler Co., H. J. Dly, President, Home Bank of Canada; R. Home Smith, Director, Algoma Steel Corp.; D. H. McDougall President, Nova Scotia Steel and Coal Co.; and T. H. Watson, President, Canada Machinery Corporation.

Following are the directors chosen for the proposed international bridge which will connect Windsor and Detroit:—William B. Gregory, of Gregory, Mayer and Thom; A. A. Templeton, of the Detroit Steamless Tube Company; J. W. Austin, of the Detroit Graphite Company; A. H. Healy, banker, Windsor; W. J. Pulling, of W. J. Pulling & Co., Windsor; Hiram Walker, of Hiram Walker & Sons, Walkerville; J. O. Reaume, Windsor; C. S. King, of Walkerville; C. E. Fowler, chief engineer and J. H. Cullen, secretary. S. D. Callender, Detroit, and P. O. Pocock, Windsor, are the general counsel. According to preliminary estimates the bridge will be ready for traffic including street cars, early in 1924. The "Deck" for railway traffic, however, will not be completed for another year. The American Transit Company, of Detroit, and the Canadian Transit Company, of Windsor, will erect the span. The bridge when completed will be the longest and heaviest in the world.

MARINE NEWS

According to the Canadian Chamber of Commerce in London, Eng., a scheme for running a fleet of oil-burning steamers between Canada and England on a four day schedule is nearly completed. The vessels will make twenty-six knots and will carry 600 first class and 3,000 second class passengers. The plan provides for eight ships of 50,000 tons each. The service, as planned, will be confined to Canadian routes, but it is to be extended later to all parts of the Empire.

According to the monthly tonnage report, the freight tonnage through the canals at Sault Ste. Marie shows a decrease for the year up to October 1 of approximately 18,000,000 tons, and September tonnage this year decreased a little more than 5,000,00 tons compared with September 1920, according to the monthly tonnage report, made public today. The September total was only 6,482,073 tons, which was 1,015,276 under the August total. The decrease was shown by nearly all commodities. Iron ore fell off more than 5,000,000 tons from the September total last year. Flour registered an increase for the month of 896,145 barrels and 27,000,000 more bushels of grain were carried than in September, 1920. There were 2,008 fewer passengers for the season up to October 1 than were carried up to that date in 1920.

INDUSTRIAL NEWS

Garlock-Walker Machinery Ltd., Toronto have moved from 32-34 Front St. West, to 163 Dufferin St.

J. C. O'Brien, Manager, The Toronto Laundry Machinery Company, Toronto, reports the summer just past, as the most successful in their history as regard sales of the "Jack Frost" mechanical refrigerator. These machines are manufactured in two sizes only, the one ton for commercial use, and a smaller unit for domestic purposes.

The Westinghouse Electric International Co., New York, will supply the equipment for electrifying the Chilean State Railway between Valparaiso and Santiago and to Los Andes. The contract covers the most important railway electrification since the beginning of the war. The main line, which is 116 miles long, and is now under steam operation, is the most important in Chile. It connects the leading seaport, Valparaiso, with the Capital, while the line to Los Andes is 28 miles long, and forms the Chilean end of the transcontinental line to Buenos Aires. The contract, which has a total value of $7,000,000, was secured in spite of keen competition from German and other European concerns.

The Cyclone Fence Company of Canada, Ltd., which recently secured a Dominion Charter, has selected Hamilton as the location for its Canadian factory. The Canadian Co. is a branch or subsidiary of the Cyclone Fence Company of Waukegan, Ill., manufacturers of ornamental and industrial wire and iron fencing in the U. S., and the parent plant is capitalized at $1,500,000 having an annual turnover of approximately $5,000,000. It is not the intention of the Canadian Co., to build until building conditions become more normal. A short term lease has been taken of a portion of the Canadian Cartridge Co. building at Hamilton, and manufacturing operations will be carried on there for the present. The company has built a number of special automatic machines at its Waukegan plant for the equipment of the Canadian plant, and these are now being shipped to Hamilton. It is expected that they will be installed in time to commence manufacturng operations shortly after November 1. The Canadian plant will employ upwards of 100 hands and will be under the personal management of Mr. R. R. Reaume, one of the directors. Although a Canadian by birth having been born in Chatham, Mr. Reaume has been connected with the Cyclone Co. almost since its inception and as the head of the sales promotion department, has had much to do with the company's steady growth. According to Mr. J. P. Arthur, president of the American and Canadian companies, the protective tariff and high exchange rate are responsible for the Cyclone Co. deciding to operate a Canadian branch.

The New Geometric Solid Adjustable Tap



Answers the Question How to Reduce Production Costs

Where a machine has no means of closing a Collapsing Tap, or for some other reason does not permit the use of a Collapsing Tap, the Geometric Solid Adjustable Tap is the requisite between an Adjustable Collapsing Tap and a Solid Tap.

The Geometric Tap has the Advantage of use either as a Hand Tap or as a Machine Tap

The Tap is not equipped with the collapsing device, but has all the other advantages of a Collapsing Tap. Being adjustable, correct size is always maintained.

Chasers are readily removed for regrinding, and when finally necessary to renew the Chasers, this can be done at slight cost. A great saving over the renewing of an entire tap.

Each size Tap accommodates Chasers for a range of diameters.

Reducing Production Costs is no New Occupation for Geometric Screw Cutting Tools and Machines

MET GEO RIC

Right from the Lead

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto; St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

GRAND TRUNK APPRENTICES HONORED

Seven Out of Ten Prizes Captured By Railroad Boys—Record to Be Proud Of

The results of the mechanical drawing competition held at the Canadian National Exhibition have been announced. The apprentices of the Grand Trunk Railway System have been exceptionally successful, having carried off seven of the ten prizes offered, taking first and second in each of the following competitions: electrical, structural, hydraulic.

This is a great honor, and the following are the prize winners—W. Grandison, F. Taylor, K. Murray and H. Bailey of the Stratford shops; W. Minton of the Montreal shops; F. Gooch, Toronto shops, and R. Harvey, London car shops. Since the inception of the mechanical drawing competitions at the Exhibition, the apprentices of this railroad have set a remarkably high record, which has certainly been well maintained this year.

The Grand Trunk Railway has always been interested in the development of apprenticeship training. There are more than 200 apprentices in the motive power and car shops of the Grand Trunk, and Vice-president W. D. Robb, who inaugurated the apprenticeship system on the railway, takes the keenest interest in maintaining the highest possible standard of instruction. This is carried out under a supervisor of apprentices. At shops where 50 or more apprentices are employed, there is a permanent class inspector, and at smaller shops, and at roundhouses, the instruction is given weekly by a travelling instructor. In addition there is an apprentice examiner, who examines all the apprentices at periodical intervals. The boys are moved from one machine or class of work to another, as their skill develops, and the instruction received in the shops is supplemented by classroom instruction in mechanical drawing, sketching, mathematics, practical mechanics and blue print reading. Evidence of the results obtained is found in the fact that the Grand Trunk has seldom been obliged to go outside of its own shops to fill the highest positions in its mechanical departments, while a large number of responsible positions in other railways are filled by men who obtained their early training in the Grand Trunk shops and apprenticeship classes.

WORK ON CANAL PROCEEDS STEADILY

Forebay is Completed And Electric Shovels Are Getting Near End of Their Job

One of the generators in the Chippawa power plant, the largest in the world, is ready, and another is nearing completion. It is expected that the water will be let into the canal sometime in December. According to reports, the forebay is completed and the electric shovels are getting near the end of their job. The control works at Montrose are well under way. Some bridges remain to be built. And the intake will not be constructed until next year. The coffer dam has been pumped dry, but the fingers or pipes through which water will be taken will not be put in place this winter. Nearly all the men now working on construction will be let off by December.

The removal of a "core" will let in the waters of the Welland and Niagara rivers. No ceremony will occur at that time, but when a few preliminary tests have been made, a formal opening of the power house for the generation of electricity may take place.

The new generator which is now ready has a capacity of 50,000 h. p. Five of them will be installed by next summer.

TORONTO SECURES NOVA SCOTIA COAL

Expect to Ship Coal Direct From Mines Believes This Will Overcome Shortage Troubles—Low Cost Said To Be Obtainable

Soft coal from the Sydney mines in Nova Scotia arrived in Toronto recently. According to Mr. Malone, western sales manager for the Century Coal Co., it is the intention of his company to deliver this coal direct by steamer to Toronto. Other steamers are at present en route to Toronto with further supplies.

Mr. Malone states that his company has succeeded in landing the Nova Scotia coal in Toronto at an economical cost, thus enabling them to meet the competition prices of coal from the United States. In this connection, Mr. Malone points out that the Turret steamers which are used have capacity for 4,000 tons. Owing to the limited depth of the Cornwall Canal they are obliged to lighter 2,000 tons at the bunkers in Montreal, the remainder of the cargo being brought direct to Toronto. After lightering her cargo in Toronto the steamer proceeds to Port Colbourne and loads grain for Montreal and other eastern points, thus giving the steamer the benefit of cargoes in both directions, the loading in each case, likewise, being accomplished in much faster time than ordinarily required to load freight consignments. This in itself, Mr. Malone states, makes it impossible for the company to compete with coal from the mines across the border. Under present conditions Toronto will be the western point of destination for the eastern coal until such time as the business develops and conditions at other points on the Upper Lakes warrant the transportation of this coal in that direction.

Assurance has been given by several large manufacturers in Montreal and members of the Montreal Harbor Commission that the Nova Scotia coal is equal in quality to that which is brought from Pennsylvania.

Mr. Malone believes that this will prove a practical solution in overcoming shortage conditions at certain seasons of the year, so far as soft coal for manufacturing purposes is concerned.

AUGUST STEEL OUTPUT SHOWS INCREASE

According to reports from Ottawa, the production of steel ingots and castings in Canada for the month of August, totalling 72,023 tons, was the highest month's output since November of last year. The Dominion Bureau of Statistics says that there was an increase of 25 per cent., or 17,698 tons, of steel ingots over last month's output. Basic open hearth steel accounted for the increase, August's total being 70,088 tons, as compared with 52,111 tons in July. The production of direct steel castings during August amounted to 1,684 tons, which was an increase of 347 tons over July's total. The quantity of pig iron and ferro-alloys produced during August was nearly 4,000 tons lower than of the previous month. The output of basic iron was considerably higher, being 46,939 tons, as compared with 40,720 tons in July.

Foundry iron production decreased from 10,339 tons in July to 1,882 tons in August. Malleable iron also declined during August. There was but a slight falling off in the output of electric iron castings, July's total of 105 tons being lessened by four tons.

ENGINEERING NEWS

Fort Willima, Ont.—An addition to the Bole elevator will be built immediately, and a $30,000 permit has been issued to C. D. Howe & Co., elevator architects and engineers of Port Arthur. The new structure will be 32 ft. square and 140 ft. high. The storage capacity of the new unit will be approximately 30,000 bushels.

WINDSOR—According to figures shown in the annual report of the Ford Motor Company of Canada, $37,836,400 worth of business was done by the company for the fiscal year ending July 31, 1921. After providing for all expenses and for income tax, the net profits transferred to surplus were $2,121,501.11, in addition to this must be added the sum of $231,12,7.96. Representing a balance remaining in the 1920 business profits tax reserve, making a total addition to surplus account of the year of $2,352,629.07. The output for the year was 46,832 motor cars and 3,063 tractors, compared with 55,616 cars and 2335 tractors for the previous year.

OBITUARY

John M. Gill, for many years associated with the James Smart Mfg. Co., as its president and general manager, died in Brockville a few days ago.

THE COMPLETE DRAWING

(Continued from page 37)

immediate reform at the seat of trouble.

To eliminate time wasted on reading drawings as far as possible also well pays for itself. A glance should be sufficient to give any information required and for a permanent impression on the mind.

A drawing that leaves room for doubt on any point is incomplete, unfinished, a constant source of time-wasting and possible error.

As a means of simplifying or eliminating complex card and paper systems, the day of the complete drawing has yet to come.

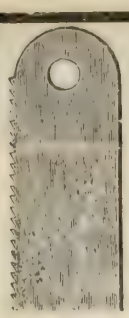
PERFECT PACKAGE MOVEMENT TO BE HELD

All trades and industries have been asked to co-operate in the "Perfect Package Movement" to be inaugurated by the railroads, steamship lines and express companies in the United States and Canada, in November, which has been designated as "Perfect Package Month." The purpose of the movement is to stimulate further public interest in good packing of shipments and to enable the carriers to improve the transportation service of the country. During November, an examination, of all shipments sent by freight or express, will be conducted, to obtain information as to the best shipping methods carried on by the various trades and industries.

In every city and town, the railroad and express people will form campaign committees, to co-operate with local shippers' associations, in carrying out the plans announced for "Perfect Package Month." "Exception Reports" will be made out for all faulty shipments discovered and these reports will be sent to the shippers' association for tabulation, to ascertain how high a percentage shippers in each city have attained.

Comparisons of the records made by the various cities will be announced at the conclusion of the drive, and the entire working forces of the railroad and express carriers comprising some two million men are with the movement. The railroads, through the American Railway Association, composed of practically all of the railroads in the country are pushing the campaign, as a means of raising the standard of the service, while the express agents are also getting ready to interest shippers in the undertaking. More on this subject will be announced at a later date.

3239. **Constructional Materials.**—A London firm buying for associates in India are open to receive regular quotation from Canadian exporters of iron and steel materials, machine tools, hand engineers' tools, and other engineering supplies required in India.



SIMONDS

Non-Breaking

Hard Edge Hack Saw Blades



When you put a Simonds Hard Edge Blade in your Hack Saw Frame you are assured of the maximum of cutting service, because these are the blades that cut fast, do not shell teeth, and when properly used they are non-breaking.

They are scientifically heat-treated and smoothly finished.

GET SIMONDS HACK SAW BLADES FOR BETTER WORK

SIMONDS

Canada Saw Co. Ltd.

"The Saw Makers"

Montreal, Que.

St. John, N.B. Vancouver, B.C.

PATENTS

Fetherstonhaugh & Co., The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

Rubber Mill MACHINERY

BERTRAMS LIMITED

SCIENNES EDINBURGH

BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators. Bakers' Ovens, trucks, casters, etc. Write for Booklet.

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Brantford, Canada

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Speedy Service—Phone Adelaide 2

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HAMILTON ENGINEERING SERVICE LIMITED

Consulting and Designing — Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.

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What can we do for YOU?

Through these columns thousands of dollars of equipment are disposed of each year. If you are not using Canadian Machinery now, let us tell you what others have done—are doing.

CANADIAN MACHINERY

Classified Advertising Section

143 University Ave., Toronto

Classified Opportunities

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

FLOOR SPACE — SEPARATE ENTRANCE— Suitable for machine shop or light manufacturing, with power, reasonable rental with long lease if desired; also small foundry building, suitable for 4 to 6 moulders; in good manufacturing town; railway centre. Apply Box 785T, Canadian Machinery.

POSITIONS WANTED

OPEN FOR ENGAGEMENT AS GENERAL Manager, Factory Manager or General Superintendent. Have had a good engineering education and 17 years' experience in executive positions in mechanical lines on interchangeable manufacture of typecasting machines, firearms, electrical work, experience on drop forging, heat-treating and testing of steel tool design and making. Box 793, Canadian Machinery. (c16m)

MECHANICAL ENGINEER, COLLEGE GRADuate with seven years' experience as Mechanical executive and in the design, operation and largest of Power Plants and Factories, accustomed to responsibility, desires position, best of references. Box 791, Canadian Machinery. (c16m)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
J. H. FOUNDRY, GALT, ONT.

SUNCLO BRAND
WIPING CLOTHS
COTTON WASTE
WOOL WASTE

Prepared By

THE LEVI'S
98 John Street
TORONTO, ONT.

Prices on application

FOR SALE

FOR SALE — COMPLETE PATTERN EQUIPment for the manufacture of a line of goods sold to Wholesale Hardware and Machinery Jobbing Houses. Good future before it and very little Canadian competition. Investment of about $2000.00 only, required. Must be sold quickly. Very suitable as additional line to Foundry and Machine Shop business. Apply Box No. 790, Canadian Machinery. (c16m.)

FOR SALE — 6 CUTTING TORCHES, 3 welding torches, 10 oxygen regulators, 4 acetylene regulators, and 1 50-lb. acetylene pressure generator, all of Davis-Bournonville manufacture, for sale at a bargain. This apparatus is as good as new. Will sell all or singly. Apply Box 788 Canadian Machinery.

LARGE QUANTITY OF VALVES—ALL SIZES, surplus stock of a Canadian shipbuilding company. Write for list, prices, etc. Box 789 N, Canadian Machinery.

SCREW MACHINE — "NEW BRITAIN" — SIX spindle automatic, 1⅝" bar capacity; condition new; never been used; located in Canada; low price for quick sale. Box No. 789M Canadian Machinery.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

REGO
WELDING
and
CUTTING
APPARATUS

Oxygen, Acetylene, and complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

J. & J. Taylor's Safes

One J. & J. Taylor Safe, inside dimensions 15 inches deep, 2 feet 6 inches wide, three feet, 11½ inches high and fitted with a built-in compartment. **Price $250.00.**
One J. & J. Taylor safe 18 inches deep, two feet 9 inches wide, four feet 5 inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. **Price $200.00.**

BOX 795H, CANADIAN MACHINERY,
143 University Ave., Toronto.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631: Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES shapers, milling machine and planer, etc Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

AGENCIES WANTED

IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Emanee Sales Co., Hamilton, Ont. (121315)

MACHINERY WANTED

WANTED—4 old lathes and a planer; will be used for special machines so condition does not matter. Price must be low. Box 792 Canadian Machinery. (c16m)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

What can we do for YOU?

Through these columns thousands of dollars of equipment are disposed of each year. If you are not using Canadian Machinery now, let us tell you what others have done—are doing.

CANADIAN MACHINERY
Classified Advertising Section
143 University Ave., Toronto

Surplus Machinery

Tool Room, Manufacturing Machines and Miscellaneous Equipment, for sale

Lathes.

2—12″ x 4′ Mulliner Tool Room, Taper.
1—11″ x 6′ Reed, Q. C. G., Taper and Relieving, oil pan, and collets.
1—14″ x 6′ Lodge & Shipley, Q.C.G., Taper, collets and oil pan.
1—16″ x 6′ Cisco, Q.C.G., Taper.
1—16″ x 6′ Hendey, Taper, collets and oil pan.
1—16″ x 6′ Hendey, Taper.
1—16″ x 6′ Pratt & Whitney, Taper, and collets.
1—16″ x 8′ Hendey, Taper.
1—16″ x 8′ American, Q.C.G.
1—16″ x 8′ Prentice, Taper, collets and oil pan.
1—16″ x 8′ Pratt & Whitney, Q.C.G., and taper.
1—18″ x 8′ American, Q.C.G., and Taper.
1—18″ x 8′ Hamilton, D.B.G., Q.C.G.
1—18″ x 8′ Walcott, D.B.G., Q.C.G.
1—21″ x 8′ Le Blonde, Heavy Duty, D.B.G. O. C. G.
2—24″ x 10′ Lodge & Shipley, D.B.G., 2 C.G.
1—24″ x 10′ Can. Mchy. Corp. D. B. G. QCG
1—24″ x 12′ Can. Mchy. Corp., D. B. G. Q.C.G.
1—26″ x 10′ Lodge & Shipley, D. B. G., Q.C.G.
2—26 x 12′ Can. Mchy. Corp., D. B. G., Q. C. G.
1—26″ x 14′ Nile Bemont Pond, D. B. G., Q. C. G.
1—30″ x 14′ Niles Bemont Pond, D. B. G., 2. C. G.

Hand Screw Machines

30—No. 1 1/2 Star G.F.H., 1 1-2″ Cap., Power Feed Turret, oil pan and pump.
6—No. 3 Superior, Plain Head, 1 1-4″ Cap., oil pan and pump.
1—No. 4 Warner & Swasey, G.F.H., 1 1-2″ cap., Power Feed Turret oil pan and pump.
6—No. 4 Smurr & Kamer, G.F.H., 1 5-8″ cap., Power Feed Turret, oil pan and pump.
2—No. 4 Millholland, G.F.H., 1 1-2″ cap., Power Feed Turret, oil pan and pump.
11—No. 2 Smurr & Kamer, Plain Head, 1 1-16″ cap., oil pan and pump.
8—No. 2—Warner & Swasey, Plain Head, 1″ cap., oil pan and pump.
4—1 3-4″ x 7″ Gridley Multiple Spindle Automatics.
7—2 1/4 x 7″ Gridley Multiple Spindle Automatics.
8—3 1-4″ Gridley Single Spindle Automatics.
7—No. 55 Acme Automatic, Multiple Spindle.
12—No. 56 Acme Automatics, Multiple Spindle.

Shapers.

2—20″ Smith & Mills, B. G., Crank Shapers.
1—20″ Gould & Eberhardt Crank Shapers.

Milling Machines.

1—No. 3 Ford Smith Universal.
1—No. 2 Kempsmith Universal.
2—No. 3 Cincinnati Plain.
1—No. 2 Ford Smith Plain.
9—No. 1 Burke Bench Millers.

Drilling Machines.

2—Alfred Herbert 7″ overhang, ball bearing.
3—No. 1-2 Avey, Pedestal.
2—No. 1-2 Avey, Bench.
1—Leland Gifford, 6″ overhang, ball bearing, pedestal type.
1—Sipp, ball bearing, pedestal type, swing 16″.
1—Leland Gifford, 6″ overhang, ball bearing, bench type.
6—1-4 Rickert & Shafer, vertical tappers on pedestal.
1—5 8″ Rickert & Shafer, horizontal tappers on pedestal.
1—No. 1 1-2 Cincinnati.

Tool & Cutter Grinders.

1—No. 1 Norton.
1—Greenfield.
6—Stevens.
1—No. 2 Brown & Sharpe Surface Grinder.

Miscellaneous.

1—14 x 9 x 12 Can. Ingersoll Rand Belt Driven Air Compressor with receiver.
2—75 H.P. Crocker-Wheeler Motors, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
1—75 H.P. Can. Westinghouse, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
3—Gas Furnaces.
2—High Speed Hack Saws.
1—No. 2 Standard Double Acting Press.
1—2,500 Ampere Plating Dynamo.
1—No. 9 Buffalo Conoidal Fan.
1—No. 5 Sheldon Exhauster, Motor Drive.
1—No. 2 Garvin Screw Slotter.
1—No. 1 Garvin Screw Slotter.
1—No. 2 American Oil Separator.
1—14 x 24 C.H.V.W. Mechanical Plater.
6—No. 2 Garvin Screw Shaving Machines.
8—B. & S. Polishing and Finishing Machines.
Pulley, Shafting, Couplings, Hangers and miscellaneous small tools.

The above equipment open for inspection at our plant, corner of DUFFERIN and KING STREETS, TORONTO

RUSSELL MOTOR CAR CO., LIMITED

Machinery Sales Dept. **Address communication** **Phone Parkdale 6744**

REAL FIRE BRICK SERVICE

When you buy Elk Fire Brick we sell you a brand with the qualifications equal to the duty for which it is intended. We do not recommend the best quality brick for a certain job if a lower-priced brand will stand up just as well. Each brand of

ELK FIRE BRICK

has some particular qualification which fits it to give better results in certain places than other brands we produce.

OUR BRANDS:

"Elkco"	"Keystone"
"Elkco" Special	"M.D. Elk"
"Elk Steel"	"Rotex"
"St. Marys"	"Elk Dust"
"Keystone Dust"	"Rotex Dust"

Try us on your next fire brick needs. You'll find both our quality and service right.

Large stocks on various shapes carried in warehouse in Hamilton.

Elk Fire Brick Co. of Canada Limited
Sun Life Building, Hamilton, Ont.

Buying a Pig in a Poke

The buying of advertising space used to be buying "a pig in a poke." The quantity and quality of circulation was shrouded in mystery and often the bag was tied against investigation.

That day has passed. The advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has untied the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

In buying advertising space in the Canadian Machinery you are not buying "a pig in a poke." Our A. B. C. statements will stand the analysis of the most exacting investigator.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L Air Liquide Society, Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont

Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Machine and Carriage Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

Bronze
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que

Malleable Iron
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom Steel Products Co., Brantford, Ont
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.

BUYERS' DIRECTORY

Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
Ideal Vt
Johansson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif
Starrett Co., L. S., Athol, Mass

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor Ont
Taylor Instrument Co., Toronto, Ont
Ackworthie, Ltd., John, Birmingham, Eng
Brown & Sharpe Mfg Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Ranold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Machine Moulded
Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can Steel Foundries, Montreal Q
Herbert Ltd., Alfred, Toronto, Ont
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Shafter Bros Mfg Co Inc., St Louis,
Williams Machinery & Supply Co., A B., Montreal Que
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N Y

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis
Cleveland Pneumatic Tool Co., Toronto Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont
Petrie, Ltd., H. W., Toronto, Ont

Hammers, Rivetting
Hobs
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Out.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can. Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Stewart & Co., Duncan, Glasgow Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars

Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves

Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic

Norton, A. O., Boston, Mass.

Jacks, Planer

Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens

[illegible] & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines

Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine

Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine

Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments

Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools

Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench

Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)

Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio

Lathes, Engine

Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret

Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)

Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving

Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand

Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting

Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand

Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading

Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning

Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy Co., Toronto Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe

Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery

Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants

L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes

Dennis Wire & Iron Works, London, Ont.

Lubricants

Oakley Chemical Co., New York, N.Y.

Lubricating Systems

Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists

Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel

Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid

Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy

British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers

Parker Co., Charles, Meriden, Conn.

Micrometer Calipers

Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments

Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic

Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench

Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand

Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain

Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Thread

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical

Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal

International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric

Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery

Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples

Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.

International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits

Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen

L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw

Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners

Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Oil Filtering and Storage Systems

Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers

Bowser, S. F., & Co., Ltd., Toronto, Can.

Oils

Canadian Oil Companies, Ltd., Toronto, Ont

Oil Hole Covers

Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble

Imperial Oil Ltd., Toronto, Ont
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen

Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus

L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam

Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L & P Mfg. Co., Niagara Falls, Ont.
Morton Mfg Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Pure Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ferri-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can
Can. Blower & Forge Co., Ltd. Kitchener
Can. Fairbanks-Morse Ltd., Montreal Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
National Machinery Co., Tiffin, Ohio

Riveting Machines
Bilton Machine Co., Bridgeport, Conn
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot.

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Cleveland Pneumatic Tool Co., Toronto
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal Q

Screens
Can. Wire & Iron Goods Co., Hamilton

BUYERS' DIRECTORY

Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que

Separators, Oil and Waste
Bowser S. F. & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont
Can Drawn Steel Co., Hamilton, Ont.
N S Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamiltor Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co. Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
& Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng
Toledo Machine & Tool Co., Toledo, Ohio

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont
Andrew Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, nt
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis
Charles Parker Co., Meriden, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Welding
L'Air Liquide Society, Toronto, Ont
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A R Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal Que.
The Canadian Fairbanks-Morse Co Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co Montreal, Que
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co Montreal, Que
The Garlock-Walker Machinery Co. Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto Ont
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co of Canada Limited, Windsor, Ont.
A. R Williams Machinery Co., Toronto, Ont
A. R Williams Machinery Co., Montreal, Que
Yeates Machinery Co., London, Ont

Over eight pages printed here each week for your convenience

Consult this Buyers' Directory when you want the names of reliable makers of machine tools, parts, steel, in fact any equipment you may need.

Would You Like to make some Extra Money?

Of course you would. Well then, why not do so? Canadian Machinery is always on the lookout for well-worth-while ideas, and are willing to pay a good price for them.

We are often asked, "What sort of ideas do you want?" Briefly, what we are desirous of obtaining is this, "Any idea that has proved of value in the machine shop, drafting room, or tool room." Think of how you got over some difficulty, a ticklish piece to hold in the lathe, or perhaps how you increased production on some particular piece. Any idea that saves time or money in the machine industry will appeal to us. Never mind the style. Write it as best you know how. We will put the finishing touches to both the wording and the sketch. Start in **NOW** and send us something of such a nature.

Address it to

The Editor, Canadian Machinery

143 University Ave., Toronto, Can.

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CANONSBURG GAS COAL CO.
COUNTRY CLUB COAL CO.
WEST PENN BY-PRODUCTS CO.

Mines and Coke Ovens
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MEADOWLANDS, PA.
CANONSBURG, PA.
CONNELLSVILLE, PA.

BRITISH-AMERICAN FUEL & METALS LIMITED

McKINNON BUILDING TEL: MAIN 7815 TORONTO

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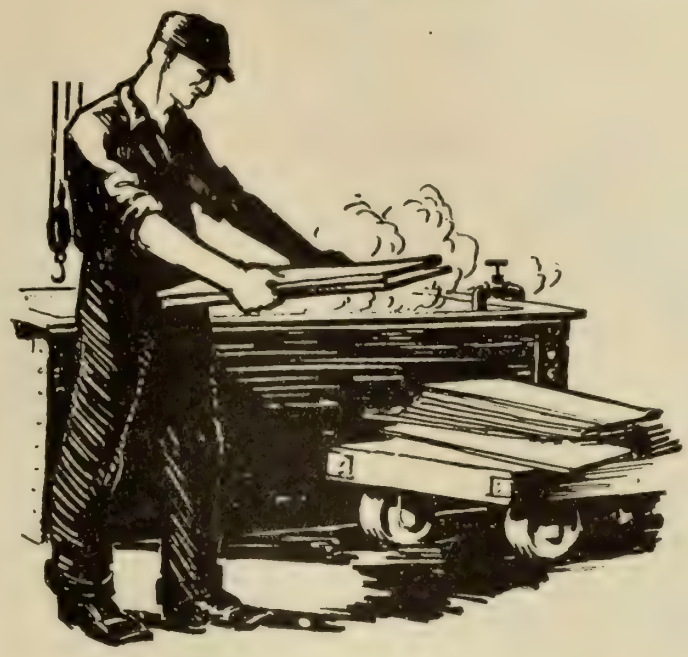
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"This Advertisement is one of a series based on actual occurrences"

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Oakite Cleaning Service is offered without charge or obligation to any manufacturer. This service comprises a study of existing conditions and definite recommendations for improving cleaning results.



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OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET NEW YORK





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Cast Iron - Brass
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We have a large line of patterns for flanged fittings for low pressure, standard, extra heavy, hydraulic, superheated steam and extreme hydraulic pressures, ranging in size from one-inch to sixty-inch, and for working pressures from fifty pounds to three thousand pounds.

The dimensions of the low pressure, standard and extra heavy fittings are in accordance with the 1915 American Standard.

Pattern equipment for standard sizes and shapes is such that absolutely uniform castings are obtained.

Castings for special fittings also may be made at a minimum expense owing to our large equipment of special patterns which may be altered at very low cost.



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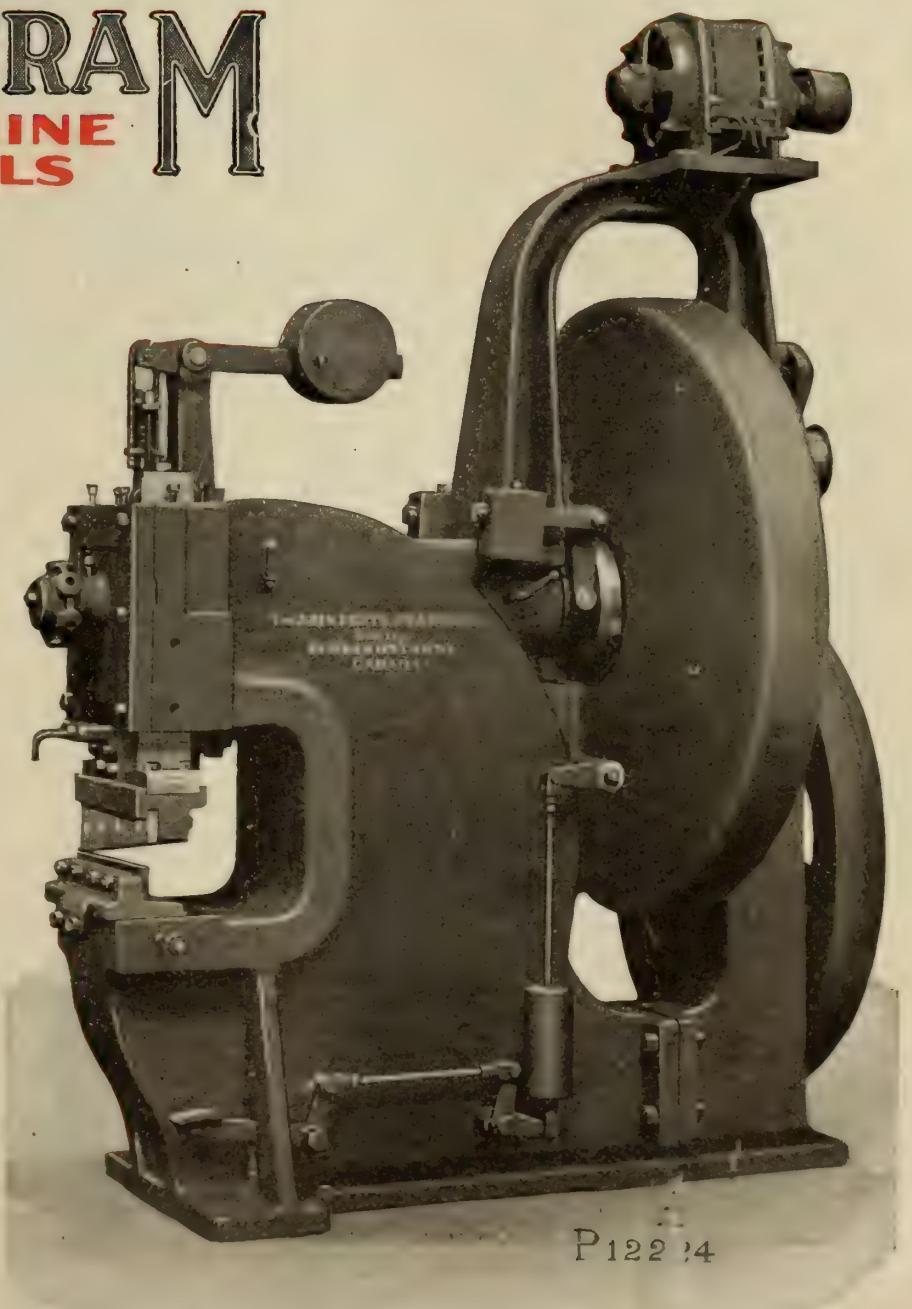
CANADIAN MACHINERY AND MANUFACTURING NEWS

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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM MACHINE TOOLS

Illustration shows our No. 4 Single Punch and Shear, 12″ Throat Motor Drive through belt, fitted with plate shearing attachments.



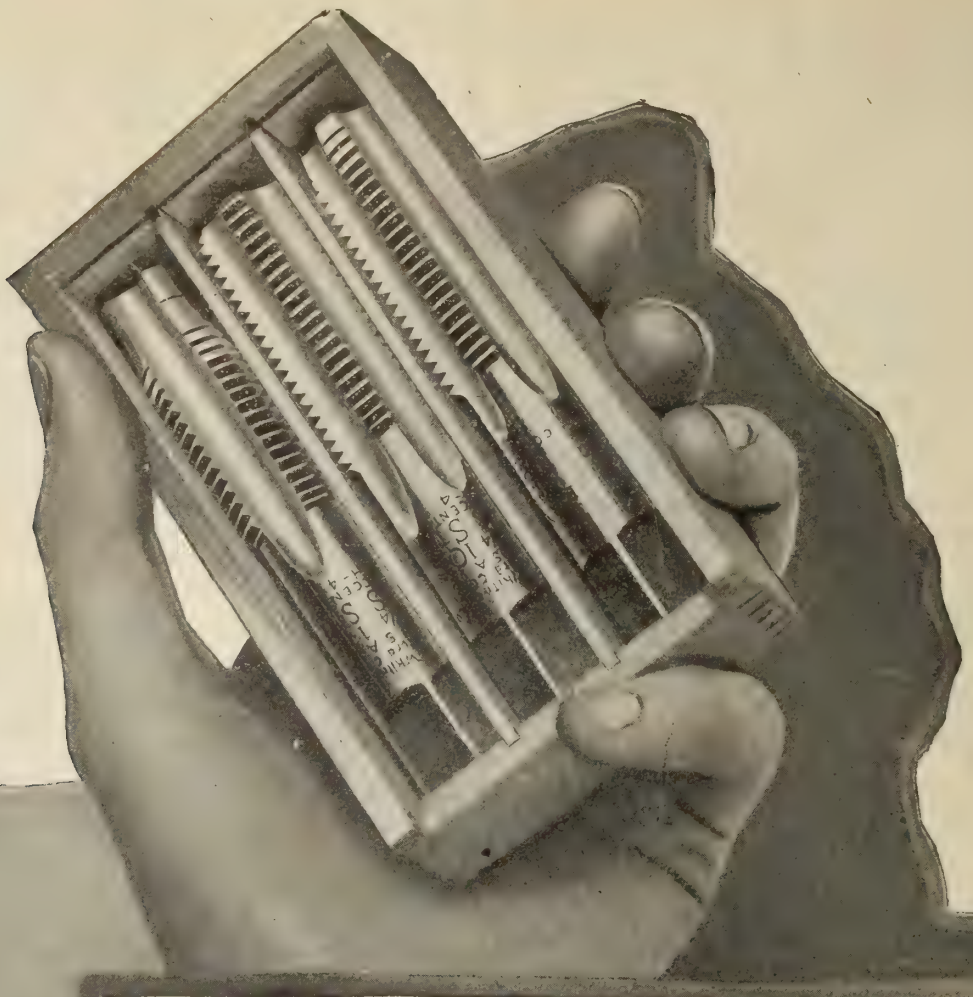
Capacity

To punch 1″ hole through 1″ Plate
To shear 1″ Plates
To shear 6″ x 1″ Flat Bars
To shear 1¾″ Round Bars
To shear 4x4x⅜″ Angles

Write for full particulars re any machine or machines in which you are interested.

The John Bertram & Sons Co., Limited
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VANCOUVER
609 Bank of Ottawa Bldg.
WINNIPEG
1205 McArthur Bldg.
HALIFAX
Roy Building
WALKERVILLE
103½ Sandwich St.



P & W

Pratt & Whitney Taps

"With the 'Con-eccentric' Land"

P & W Taps are **Good** taps—easily the best where accuracy and high speed are essential. They cost more to buy, but less to use than others.

If you're doing work that calls for big production and for unusual precision, give them a trial. You'll be back for more when you see them prove themselves.

The "con-eccentric" land — the special feature of Pratt & Whitney Taps, permits sharpening on face of the cutting edge without affecting size. It lengthens life and assures accuracy hitherto thought impossible in a commercial tool.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

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HALIFAX
Roy Building

VANCOUVER
B. C. Equipment Co.

WALKERVILLE, 103½ Sandwich Street

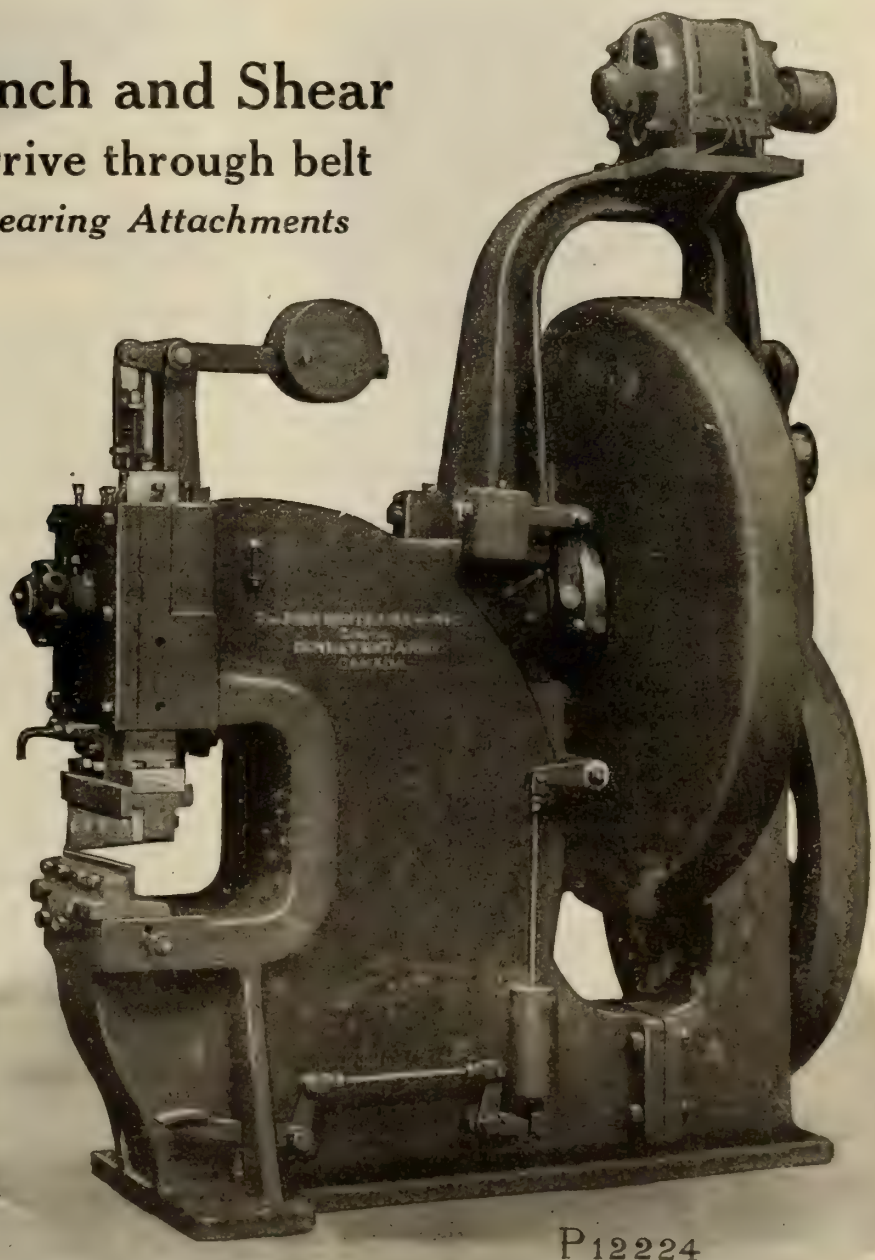
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MACHINE TOOLS

No. 4 Single Punch and Shear

12" Throat Motor Drive through belt

Fitted with Plate Shearing Attachments



P12224

CAPACITY

To punch 1" hole through 1" Plate
To shear 1" Plates
To " 6"x1" Flat Bars
To " 1¾" Round Bars
To " 4x4x⅜" Angles

The John Bertram & Sons Co., Ltd.
DUNDAS ONTARIO

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1002 C.P.R. Bldg.

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PWC-525

Pulleys that Cause Less Resistance Make Your Power Go Farther

DID you ever stop to think what percentage of your generated power was consumed in merely making the wheels go 'round?

If there are pulleys on the market that will deliver 25% more power to the work, or even 5% or 1%, they would soon pay for themselves at the present price of fuel, wouldn't they?

All right then—send for our booklet, "Getting Maximum Pulley Efficiency."

AMERICAN STEEL SPLIT PULLEYS

For sale by leading agents and branch houses throughout the country.

A few of the large plants where American Steel Split Pulleys are helping to conserve power.

International Harvester Co.
National Cash Register Co.
American Car & Foundry Co.
Procter & Gamble Co.
Ford Motor Co.
Cadillac Motor Car Co.
Packard Motor Car Co.
Studebaker Corp. of America
Dodge Brothers
American Woolen Co.
Scranton Lace Co.
Western Electric Co.

There are hundreds of others

The American Pulley Co.
Philadelphia, Pa.



The AMERICAN PULLEY

A wheel with a broad rim transmitting power from or imparting power to machinery, or changing the direction of motion by means of a flat belt.

A file cannot be resharpened. Yet it is just as imperative for a file to be absolutely sharp as for a saw or chisel.

It pays to discard a file at the first sign of wear, and get a new one.

Maximum sharpness means minimum time and effort on a filing job.

These brands stay sharp for a long time, giving fullest service for money spent:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

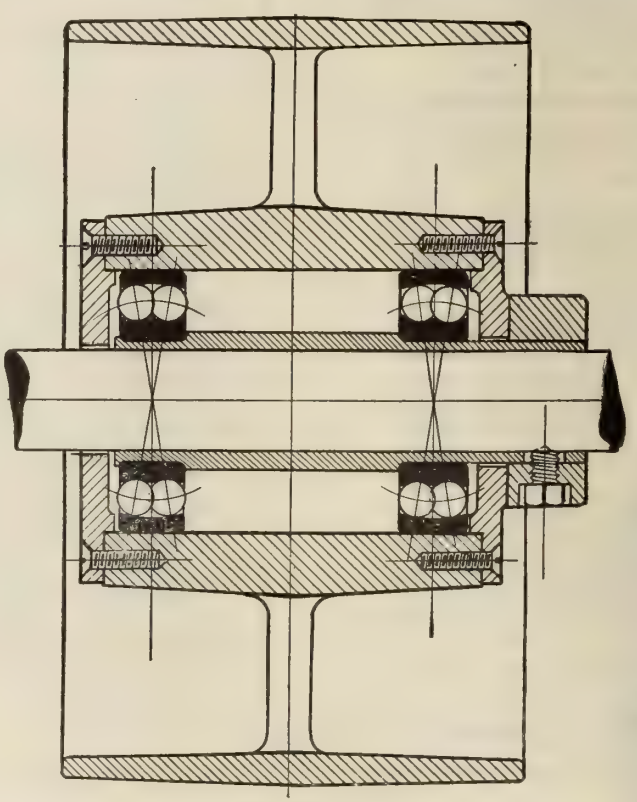
Port Hope - Ontario

SKF

ANTI-FRICTION TRANSMISSION

BALL BEARING LOOSE PULLEYS

SIMPLE CONSTRUCTION ★ ★ PATENTED



ACCURATE DESIGN AND BALANCE

AN ASSURED REMEDY FOR BEARING TROUBLES IN LOOSE PULLEYS

GUARANTEED TO WITHSTAND ANY LOAD AT ANY SPEED CAPABLE OF BEING TRANSMITTED TO THEM

THESE PULLEYS ARE NOW IN CONSTANT USE, DAY AND NIGHT IN BIG MANUFACTURING PLANTS WHERE HIGH SPEED AND HARD USAGE HAVE CAUSED THE FAILURE OF ALL OTHER TYPES OF PULLEYS.

EQUIP THAT TROUBLESOME DRIVE NOW

Canadian SKF Company, Limited

TORONTO - - - MONTREAL



5,000 Aluminum Kettle Covers

Per ten hour day is the steady output of this "BLISS" No. 1 1-2 Toggle Drawing Press at the Sheboygan Aluminum Company's Plant, Sheboygan, Wis. The operation is forming. The blanks are 10 1-2 inches diameter, 22 gauge Aluminum.

BLISS 1857

E. W. BLISS CO.

BLISS 1921

Main Offices: BROOKLYN, N. Y., U. S. A.

American Factories : BROOKLYN, N. Y. HASTINGS, MICH., CLEVELAND, O. SALEM, O.

SALES OFFICES

CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg. CINCINNATI, Union Trust Bldg. PITTSBURGH, Keenan Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg. NEW HAVEN, 2nd Natl. Bank Bldg.

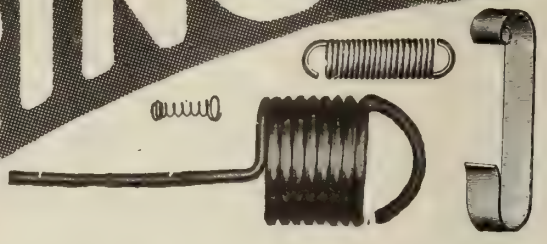
FOREIGN SALES OFFICES and FACTORIES

LONDON, ENGLAND, Pocock Street, Blackfriars Road, S. E. PARIS, FRANCE, 100 Boulevard Victor-Hugo, St. Ouen

No. 93

SPRINGS

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO



ALL STYLES and SIZES

Spiral Springs, Hook Springs, Common, Coil Springs, Flat Springs—in fact we can supply any design you may desire. Get our prices before placing your next order. Expert advice gladly submitted on request.



THE WALLACE BARNES CO., LIMITED, Main St. W., Hamilton

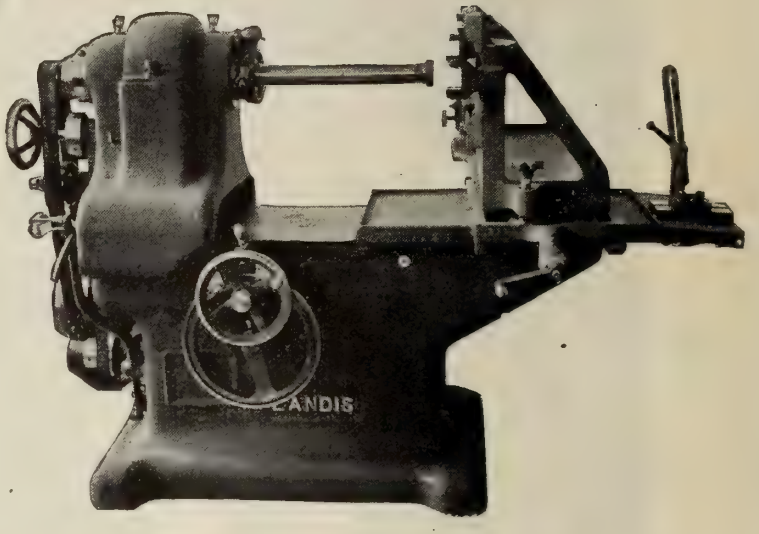
LANDIS

No. 5 CYLINDER GRINDING MACHINE

The Landis Cylinder Grinding machine is particularly adapted for rapidly and accurately re-grinding all types and sizes of cylinders for automotive engines.

Garages and Repair Shops equipped with a LANDIS will be able to put new life into worn motors as well as their own business.

Write for full particulars immediately.



LANDIS TOOL CO., Waynesboro, Pa.

NEW YORK OFFICE: 51 CHAMBERS ST.

Three Generations of Experience

In the Hanna organization you will find not only an intimacy with the best modern practice in the selection and use of pig iron, but also that practical, first-hand knowledge of past methods which makes the soundest basis for the thorough understanding of modern developments.

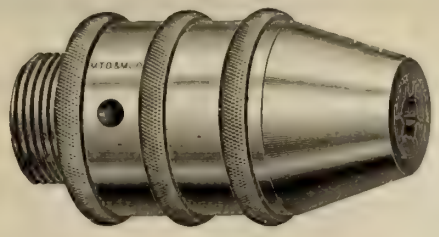
For three generations the Hanna organization has been an important factor in the progress of the iron and steel industry.

M A HANNA & Co.

HANNA

M.A. HANNA & Co.

Cleveland Toronto Cincinnati
Pittsburgh Buffalo Detroit



Have you seen the

"BEACH" Chuck

Made by the

Morse Twist Drill & Machine Co.

New Bedford, Mass., U.S.A.

These Chucks are Absolutely Accurate

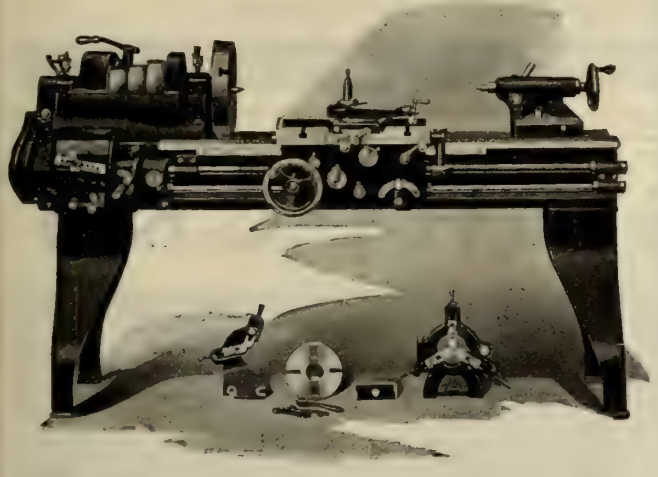
Always Run True and with ordinary care will last a life-time.

POWER--

strength, speed, accuracy—all the advantages of a big lathe are found in

THE ROCKFORD ECONOMY

Back Geared Quick Change Engine Lathe. Yet the "Economy," being small in size, operates for a fraction of the cost. It should be in every shop. Made in 12", 14", 18" and 22" swing. Ask for full details.



Rockford Lathe and Drill Co.

Rockford, Illinois, U.S.A.

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

THE MORSE CHAIN CO.

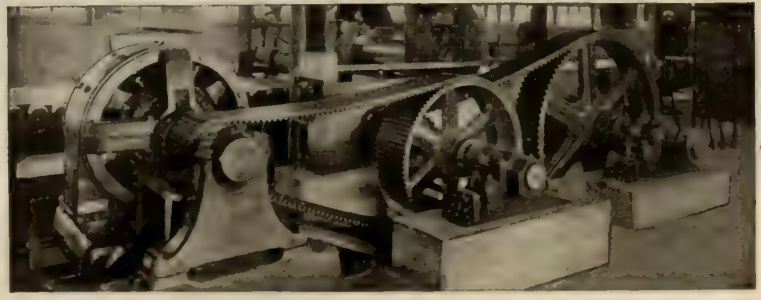
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

Why?

Morse Chain possesses the exclusive
Rocker Joint

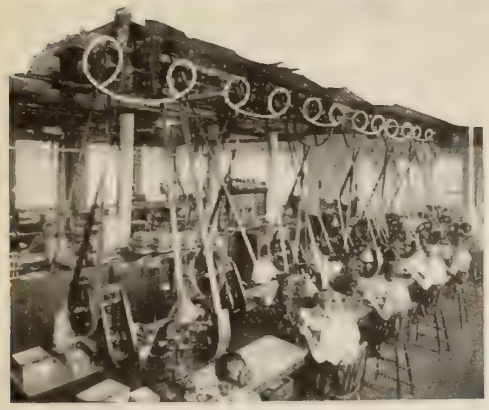
Frictionless—Requires no Oilbath.

Jones & Glassco (Reg'd.)
Canadian Agents'
Montreal - - Toronto



80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds

THE JOHNSON FRICTION CLUTCH



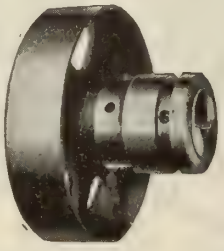
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

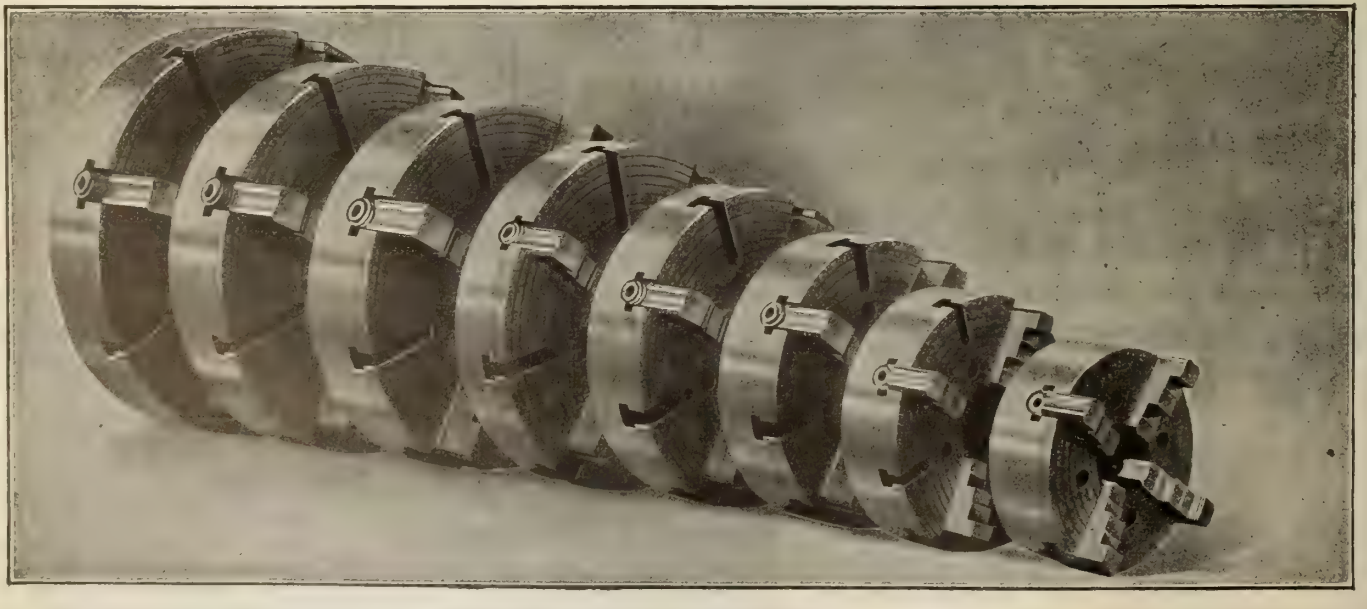
Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

DOMINION CHUCKS



DOMINION CHUCKS, STEEL AND CAST IRON

Built for Long Life and to Stand Severe Service

DOMINION STEEL PRODUCTS CO., LTD.

Engineers and Manufacturers BRANTFORD, Canada



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

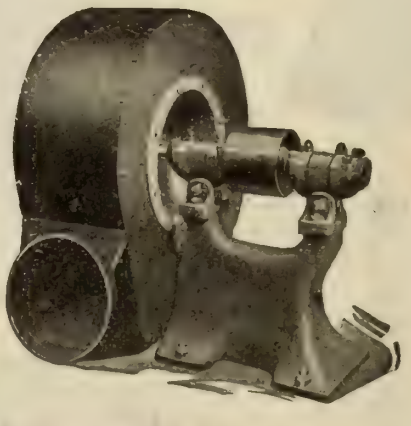
Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.

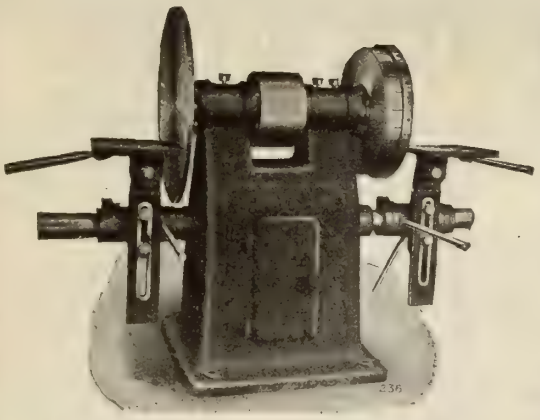


They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.

KITCHENER, ONT.

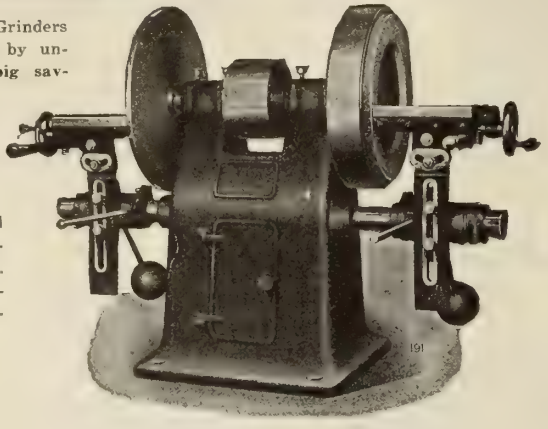


The Speed Line to Better Grinding!

FORD-SMITH

It's a pretty good time, right now, to get your manufacturing costs down to a **lower level!** How? Well, FORD-SMITH Grinding machines is one way. Consider the fact that from the many sizes there is one that will handle just the work that is now costing you more power and higher wages to have done on planers and shapers or other large machine tools. This is **logic** and it's being applied. It is worth investigating, so why delay?

FORD-SMITH Grinders can be operated by unskilled help—**a big saving in wages.**



In essential sizes and equipped with inexpensive work holders. Thoroughly tested before leaving the factory.

Let us tell you how to reduce your costs.

The Ford-Smith Machine Co.
LIMITED

HAMILTON, CANADA

Foreign Agent: W. E. Storey
London, Eng.





OXYGEN AND HYDROGEN
(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER

We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders OXYGEN PUROX HYDROGEN Who Want the Best!

WELDING AND CUTTING TORCHES

Our entire organization—technical and sales—is always at your service.

NATIONAL ELECTRO PRODUCTS
LIMITED

HEAD OFFICE: 80 ADELAIDE STREET EAST TORONTO

TORONTO SALES OFFICE	MONTREAL SALES OFFICE AND FACTORY	TORONTO FACTORY
80 Adelaide Street East	149 Moreau Street	295 Dufferin Street
Main 3167	Lasalle 508	Park 7656





BROWN-BOGGS

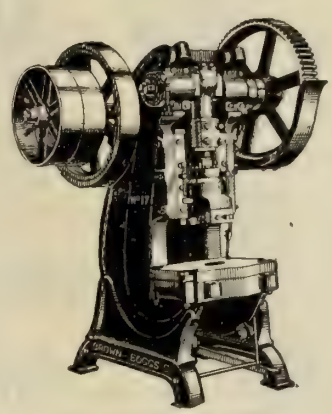
B B

Old Friends and New!

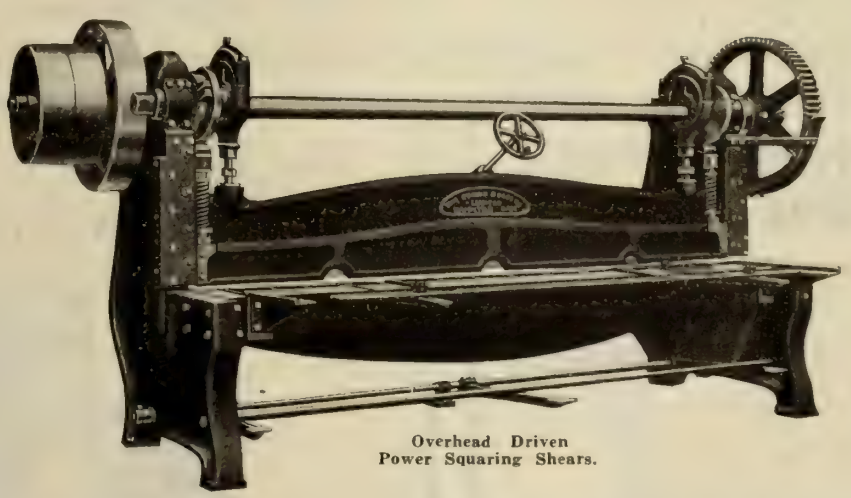
Some people will tell you that there is no friend like an old friend. Quite true! But we often make new friends who prove their loyalty on short probation.

Whether you have known and used "B-B" Tools for years or are just making an acquaintance you will be bound to say the same thing. The smooth-running frictionless designs place operating costs at a minimum; while the in-built strength, and carefully chosen materials keep them that way indefinitely.

Every "B-B" product is rigidly tested and fully guaranteed.



No. 17—Power Press.



Overhead Driven
Power Squaring Shears.

Let us know the machine you are interested in and complete information will be promptly supplied. We make presses, dies, drop hammers, machine dies, shears, canners' processing machinery, evaporating machines, special machines and power presses for punching, forming, embossing, blanking, etc.

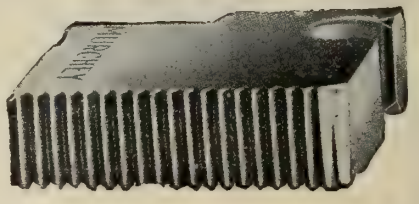
B B

THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.



Every Tap User Can Double Production



by replacing carbon tool set ups with

MURCHEY SOLID ADJUSTABLE TAPS

Besides enabling the machine to be operated at twice its former speed, MURCHEY SOLID ADJUSTABLE TAPS are economical! Economical because the high speed chasers, with which they are equipped cost no more than solid carbon tools yet actually cut **five times as many threads.** A fact worth looking into, isn't it?

The adjustable feature enables the chasers to cut full size until they are entirely used up. Then it's a simple matter to order new ones.

May we send you trial samples?

Murchey Machine & Tool Co.

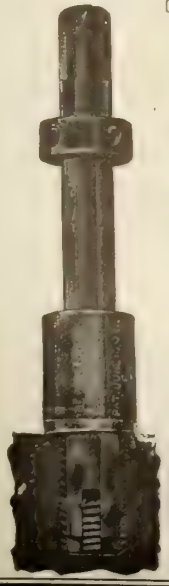
75 Porter Street, Detroit, Mich.

Fenwick Freres & Co., Paris, France

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.

Hartford, Conn.

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

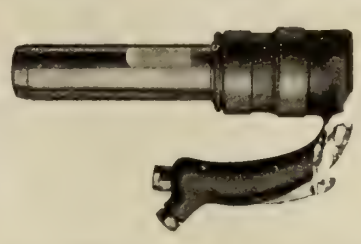
THE HIGH SPEED HAMMER COMPANY, INC.
ROCHESTER, N.Y.



Cleveland "Pocket-in-Head" Riveting Hammers

For Locomotive and Car Shops, Boiler and Tank Shops, Ship Yards, Etc.

THE "POCKET" IN-HEAD INCREASES PISTON SPEED



THE "POCKET" IN-HEAD INCREASES POWER of BLOW

The Inverted Handle Riveter is 4-in. shorter than regular styles. Cleveland Riveters are Shorter, Lighter, Hit Harder, Run Faster and use less Air in Operation than any Riveter on the market.

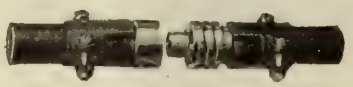
IN STOCK:—RIVETERS, CHIPPERS, CALKERS, AIR DRILLS, CORNER DRILLS, COMPOUND DRILLS, RAMMERS, PORTABLE GRINDERS, ETC.

BOWES AIR HOSE COUPLINGS AND CLECO PRESSURE-SEATED AIR VALVES



The Valve That Never Leaks

Are Standard Equipment Everywhere



The Coupling That Never Leaks



Cut Shows Never Slip Clamp Attached to Bowes

Write For Illustrated Bulletin No. 46, 50 and 51.

CLEVELAND PNEUMATIC TOOL COMPANY OF CANADA, LIMITED

84 Chestnut St., Toronto, Ont. **337 Craig St. W., Montreal, Que.**

LA SALLE

Has an Advantage Over Other Grinders

There is some outstanding feature of all La Salle Grinding Machines that lends it exceptional productive ability.

The American Drill Grinder is especially adaptable for grinding twist, flat and three-lipped drills, because it has automatic lip rest and caliper jaw device, which assures proper clearance on all sizes of drills automatically. Send for descriptive matter covering our entire line of grinding machinery.



American Drill Grinder For Wet or Dry Drill Grinding 1/8" to 2 3/4". Also 1/8" to 3 1/2" dia.

LA SALLE TOOL CO.

La Salle, Illinois, U.S.A.

Represented in Canada by

A. R. Williams Machinery Co., Ltd.

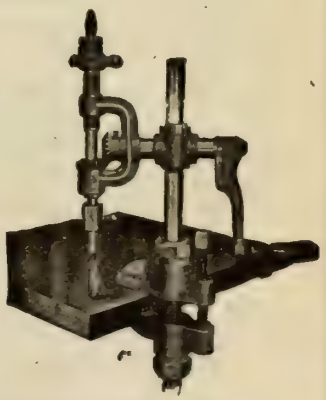
64-66 Front Street W., Toronto

Halifax St. John, N.B. Montreal Winnipeg Vancouver

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.





On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

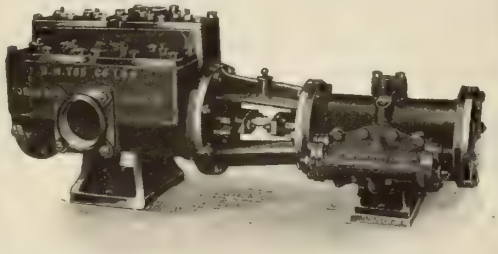
HEPBURN

The Pump that Raised Pumping Standards

THE next time you have the opportunity take particular notice of these Hepburn features.

1—Extra long stroke. This means steam economy.
2 The location of the steam chest on the side of cylinder and the self draining feature. More steam economy.
3—No tappets or levers to get out of order or require adjustment.
4—Easy access to all valves.

These and other features we will be glad to explain to you. Write to-day for particulars. Also Vertical Engines, Compressors, Presses, Cranes, Valves, Acetylene Welding, etc.



JOHN T. HEPBURN LTD.
Engineers and Iron Founders
18-60 VAN HORNE ST., TORONTO

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING AND DRILLING MACHINES
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories

Separate Catalogs on each Product

Send for the ones you want

GISHOLT MACHINE CO.
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

Would You Like to make some Extra Money?

Of course you would. Well then, why not do so? Canadian Machinery is always on the lookout for well-worth-while ideas, and are willing to pay a good price for them.

We are often asked, "What sort of ideas do you want?" Briefly, what we are desirous of obtaining is this, "Any idea that has proved of value in the machine shop, drafting room, or tool room." Think of how you got over some difficulty, a ticklish piece to hold in the lathe, or perhaps how you increased production on some particular piece. Any idea that saves time or money in the machine industry will appeal to us. Never mind the style. Write it as best you know how. We will put the finishing touches to both the wording and the sketch. Start in **NOW** and send us something of such a nature.

Address it to

The Editor, Canadian Machinery
143 University Ave., Toronto, Can.





The illustration above shows the three protective coatings which provide an impregnable shield for the specially annealed steel which forms the core. An actual sample will be sent to you upon request.

R. P. M. on the Montreal Piers

Two great Transit Pier Buildings have just been added to the harbor facilities of the City of Montreal—the second largest port on the American Continent.

On these new piers, Nos. 18 and 19, approximately 1,000 squares of Robertson Metal have been used. Previous experience of the Montreal Harbour Commission, resulted in the choice of this protected metal for this vast undertaking.

The hundreds of repeat orders that have been placed for R. P. M. for industrial and public buildings is evidence of its ability to fully measure up to the requirements laid down by the Montreal Harbour officials. But metals so thoroughly protected could not perform otherwise. When three layers of weather, fume and gas resisting materials so completely encase the steel, both surfaces and edges, there is but one result—long life and truly economical service.

(1) Asphalt (2) Asbestos (3) Waterproofing is the order in which these protective coatings are applied—one firmly pressed into the other until a solid protecting sheet is formed around the steel. R. P. M. is made in corrugated, flat or mansard sheets for roofs and siding. It is also made into skylights, ventilators, building trim, downspouts, gutters, etc.—all building parts that need just the sort of protection against the elements that R. P. M. can be expected to give.

There are many installations in Canada, some of which can no doubt be conveniently inspected. We will gladly give you a list and arrange for such inspection. A sample of R. P. M. together with interesting literature will be sent upon request.

Some parts of your plant may need replacement. Let our engineers make suggestions and prepare estimates.

This partial list of users is significant because of the prominence of the various corporations and because all of them have used *Robertson Process Metal* repeatedly. Surely experience covering many years' usage is evidence of true value in the Robertson Product.

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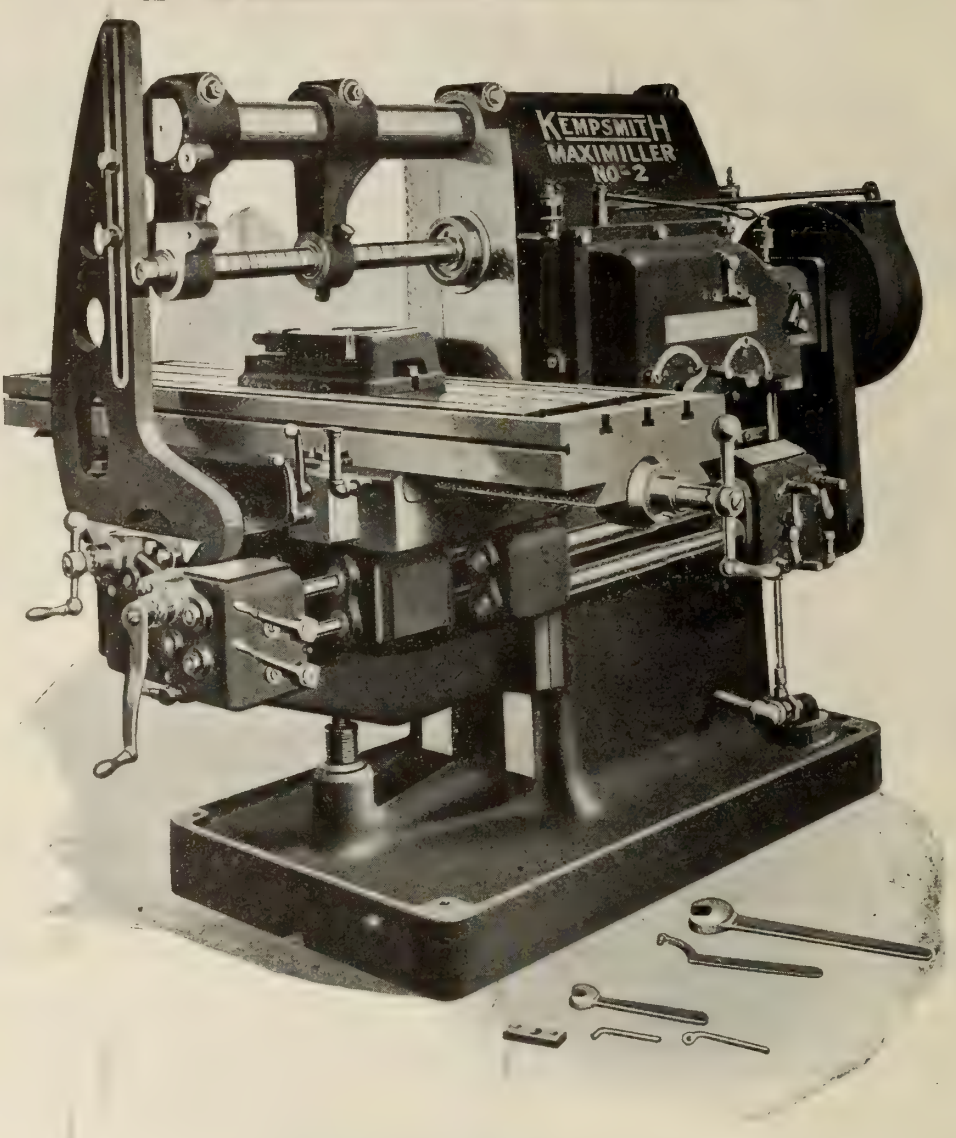
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ROBERTSON PROCESS METAL RP

FOR PERMANENT ROOFS, SIDING AND TRIM

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NO. 2 PLAIN MAXIMILLER

Kempsmith Millers are built in three sizes each in the Plain and Universal Cone Types, two sizes of Maximiller Geared Head Types, a Production Type, with a choice of three table ranges, and two sizes of Vertical Geared Head Type. Our Knee Type Millers can be fitted with a complete line of attachments, which greatly increase the range of the milling machine.

Literature will be gladly sent upon request.

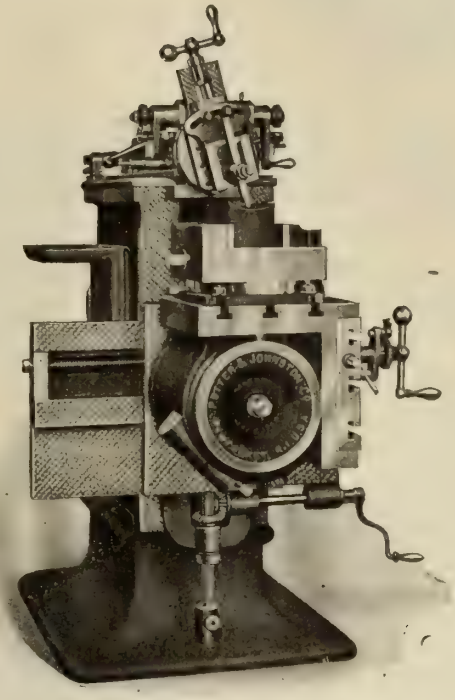
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MILWAUKEE, WIS., U. S. A.

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15″ Type

Swivel table with auxiliary tilting side.
Power down feed on any angle.
Automatic feed stop.
Graduated collars on tool head feed screw and table feed screw.
Swivel vise with graduated base.

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No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to:—

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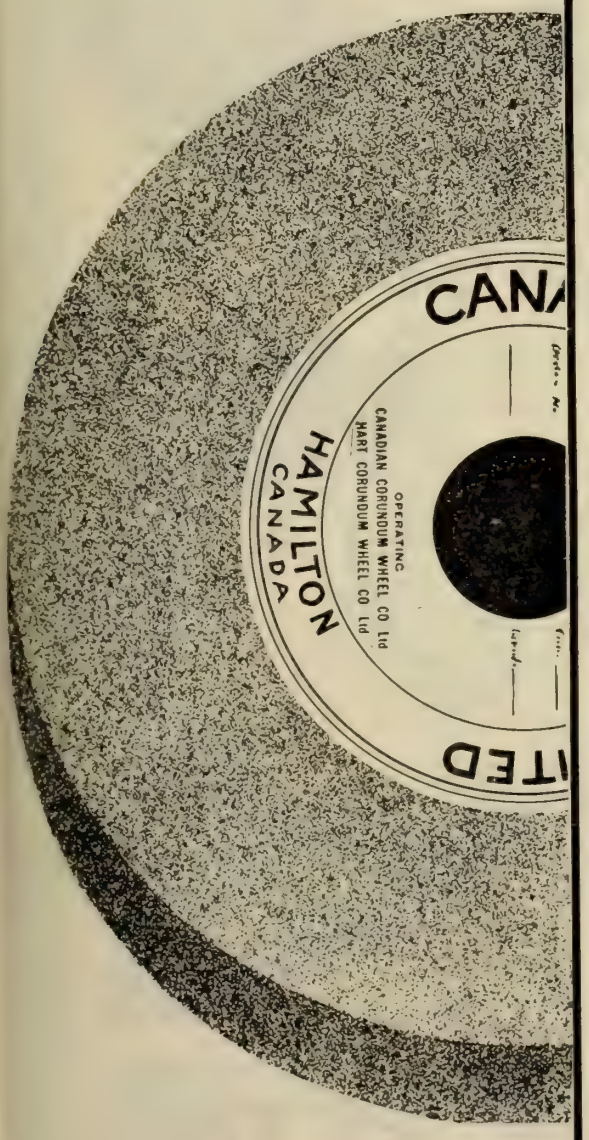
Let's Get Down to Business

SUMMER, with its dog-days, its vacations, its distractions, is over. We have had our holidays, our rest, our recreation. The Fall season, with its new opportunities for effort, enterprise and achievement, is upon us. Let us rip off our coats and get down to business. We may have allowed pessimism to grip us during the stagnant months of Summer. We may even have allowed laziness to enter our blood and our bones. It is now up to us to throw off both lassitude and pessimism. The time has come for action, for aggressiveness, for enterprise, for courage, for daring. Strong men make opportunities. Strong men do not supinely submit to conditions; they mold them. The business roadway has been cleared of almost all the weeds and rocks and swamp; begotten by the fatal war boom. The way is now open for a vigorous forward march. Let us cease looking backwards, let us cease bemoaning the hardships and the distress of the recent past. Let us look forward and let us go forward with confident unhesitating tread. Better times are within our reach if we will but reach out intelligently towards attaining them.—*Forbes.*



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Built in grades and grains for every class of work. Vitrified, Silicate, Shellac or Elastic Wheels



Made in Canada

For more than 34 years now Hart Products have stood for unvarying quality. If dependability means anything to you, ask for samples.



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the right policy is to keep always on hand a liberal reserve supply of abrasive wheels of the proper grades to cover every operation.

As soon as one wheel becomes worn it should be discarded at once because a new wheel costs less than the time used up by waste effort.

Another good policy, and one too often neglected, is to use for individual operations the kind of wheel designed for that work. If you are in doubt ask us.

Vitrified—Silicate — Shellac — these three grades will give you long service. Tell us the kind of work you do and we will choose the wheel you need.

Some interesting points about grinding can be gained from our catalogue. Ask for a copy.

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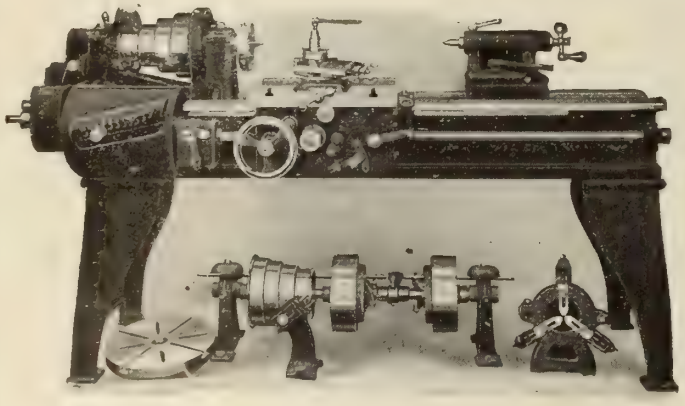
Hamilton - Ontario

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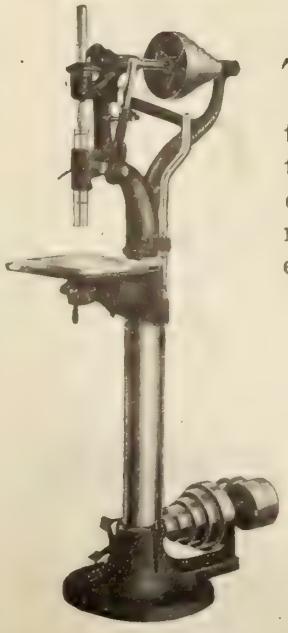


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V., U.S.S. & S.A.E, Cap Screws
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HEAVY FOUNDRY AND MACHINE SHOP SERVICE FOR MACHINE BUILDERS.

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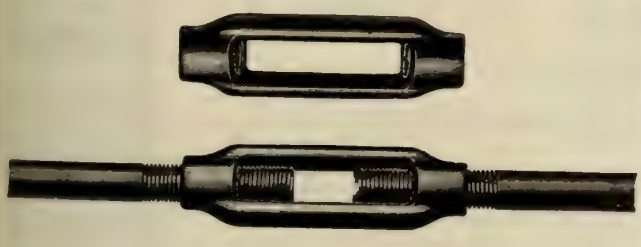
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CANADA
FOUNDRIES & FORGINGS
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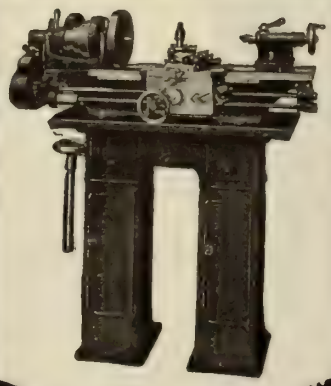
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Type B-6

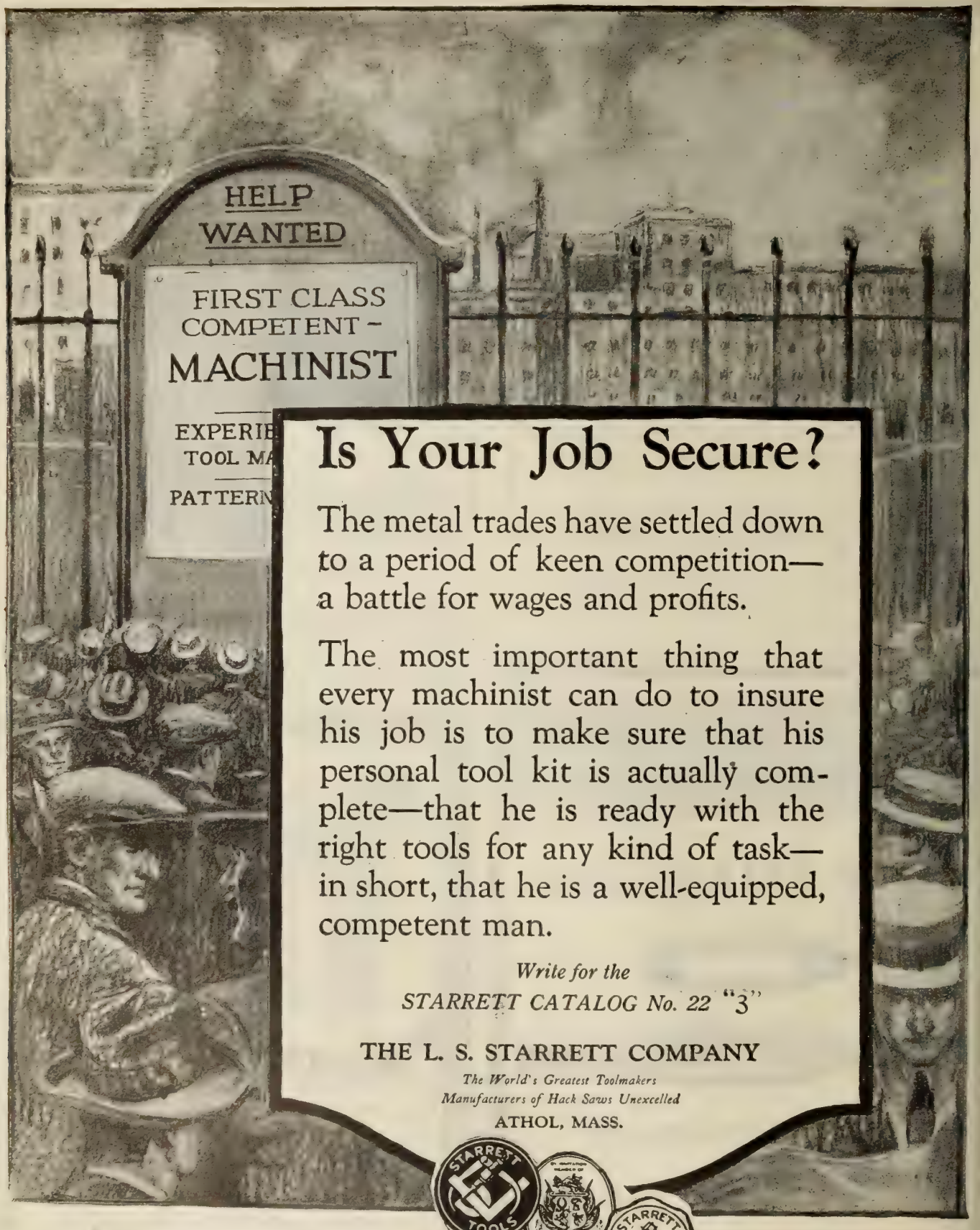
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For the tool room or experimental department the **"Dalton Six"** has no equal.

Actual Swing - -	8¼ inches
Between Centers -	18½ inches
Collet Capacity - -	¾ inch

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Cable Address - - "Aledal Stamford"
Also Manufacturers of Type B-4 Lathe

"DALTON SIX"



Is Your Job Secure?

The metal trades have settled down to a period of keen competition—a battle for wages and profits.

The most important thing that every machinist can do to insure his job is to make sure that his personal tool kit is actually complete—that he is ready with the right tools for any kind of task—in short, that he is a well-equipped, competent man.

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THE L. S. STARRETT COMPANY
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

4-2-222

Starrett Tools

HEALD



Just an Atom of the Regrinding Possibilities

When you pass the thousands of cars parked on the streets or outside of baseball parks and country fairs, haven't you been amazed at the possibilities open for accessories and attachments provided you could only get the owners to buy?

Did you ever stop to think that there is a field now opening up which is as necessary as having the carbon taken out or the spark plugs cleaned, and every machine will sooner or later be a prospect?

We refer to cylinder regrinding, which is fast being recognized as one of the operations absolutely necessary every time the car is overhauled or where there is an excess use of gas and oil in proportion to the power developed—when the engine knocks—smokes excessively— or has lost all power and pep.

Already this is being handled in certain sections of the country and excellent profits are being secured by those who are properly equipped, but there are hundreds of localities where there is not a single shop to take care of this high grade work, that is just laying around waiting for someone with a little nerve, mechanical training and business ability, to go out and get.

Think of it! There are 700,000 possibilities in Canada today, and only 12 shops Heald equipped to do this work. Furthermore, it only takes 3 four en bloc cylinders a day to bring in handsome profits to a two-man shop.

We are using all of our contracted space in the magazines to tell you of a business that, while it is only just started, is the most active mechanical line in the country today, knowing full well that once you have looked into it you will be sold, and that there is but one make of machine which will carry you through to success. That is a Heald built expressly for the regrinding trade.

Every manufacturer that grinds his cylinders uses Healds exclusively, and up-to-date regrinding shops find it will give more production in less time with greater accuracy and better results, than anything on the market today. These concerns will come out boldly and tell you so without making any bones about it.

If you are running a machine or jobbing shop and are waiting anxiously each day for hit-or-miss orders, you are losing money.

Opportunity stands at your door in the form of a Heald Cylinder Grinder. Heald and profits go hand in hand.

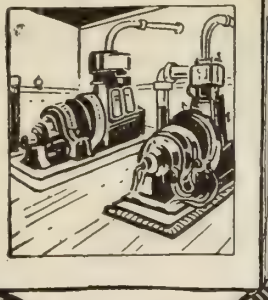
The field is increasing daily. It is up to you to change the course of the work that is passing your door, by writing, wiring or phoning.

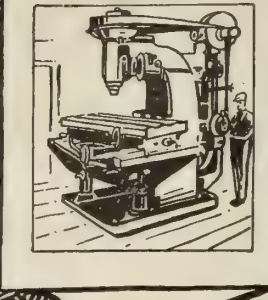


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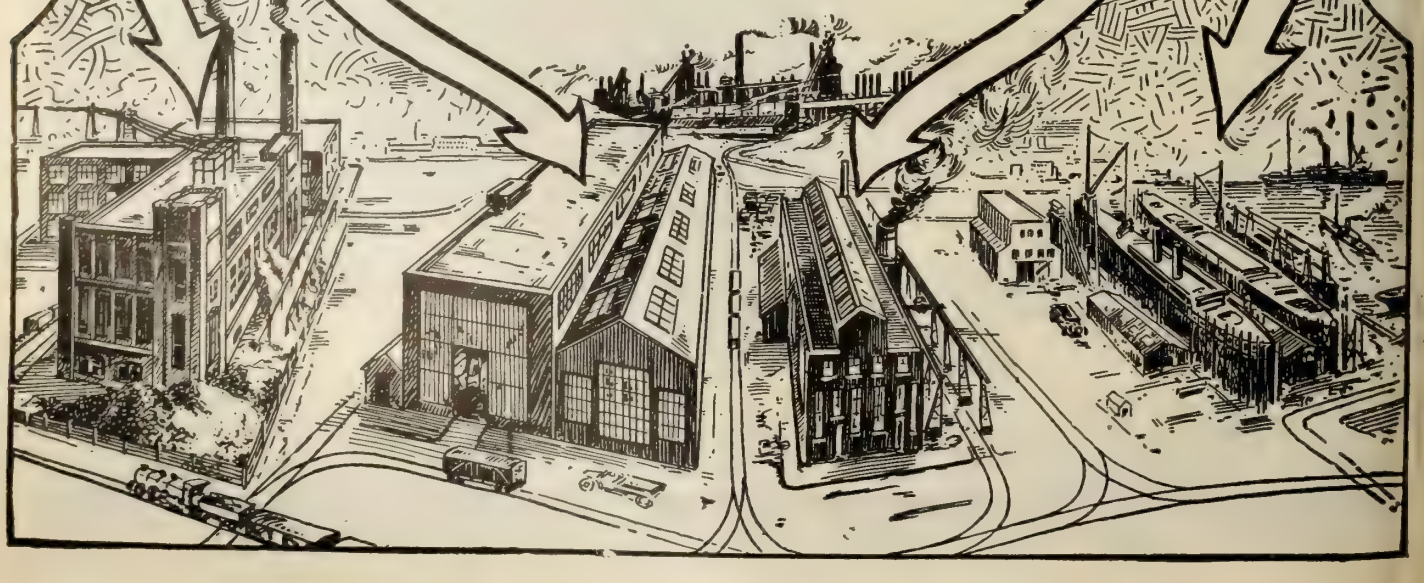
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Exacting requirements? Nichrome is the answer; the character of Nichrome users proves **that.**

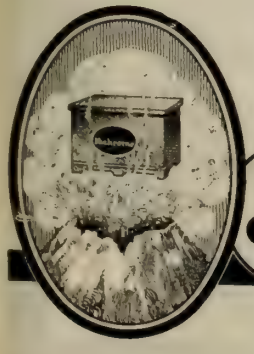
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Ask for Bulletin N-21

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CAST **Heat Treating Containers**

Endure in High Temperatures

Hisco Products

Quality & Service



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The fact that "Hisco" Machine Molded Gears require no pattern is a factor of considerable importance when the price of lumber and labor is so high. "Hisco" quality insures accurate, dependable gears. Remember — **the price of "Hisco" gears does not include the cost of patterns.**

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Let us know your requirements—we do the rest.

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Every Commercial Purpose

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BETTER TOOLS MAKE BETTER WORKMEN

And there are no better tools of their kind than WILLIAMS' Superior Drop-Forged Hammers. All kinds, all sizes.

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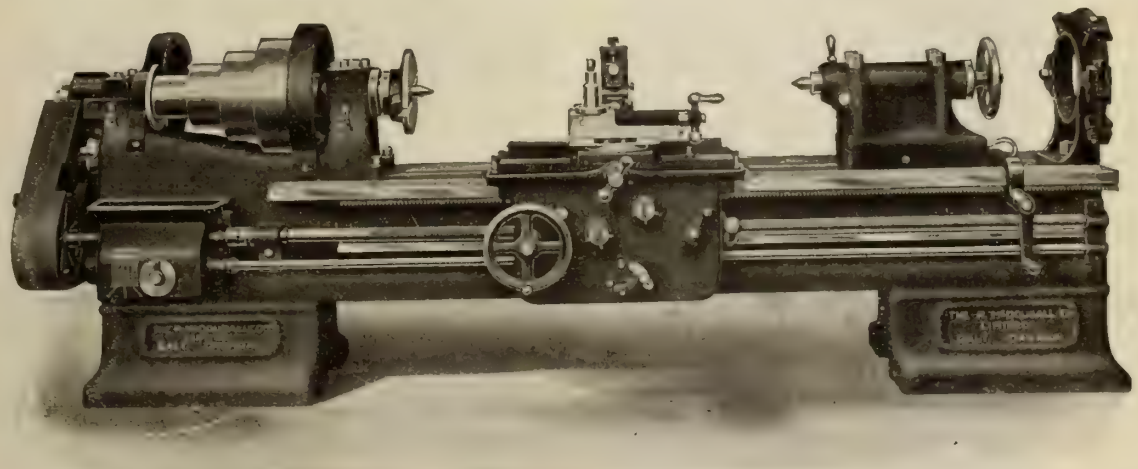
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A similar test in your grinding room will prove to you the advantages in using Norton wheels.

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For—

Soft Steel
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Soft Malleable Iron

NORTON CRYSTOLON WHEELS

For—

Cast Iron
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Brass

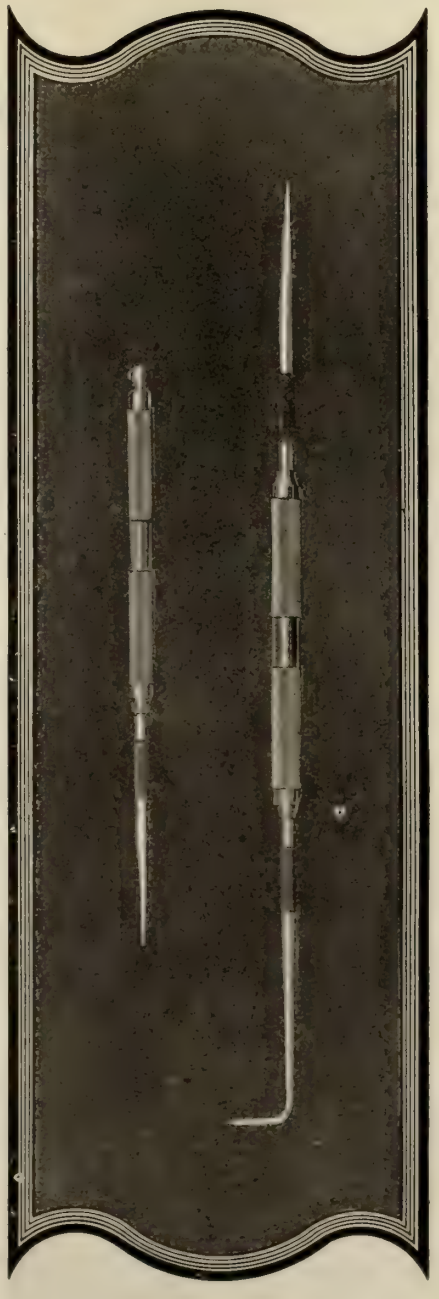
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Possession

To have the tools you want, of the quality you consider best is a source of pride and satisfaction that makes for better work.

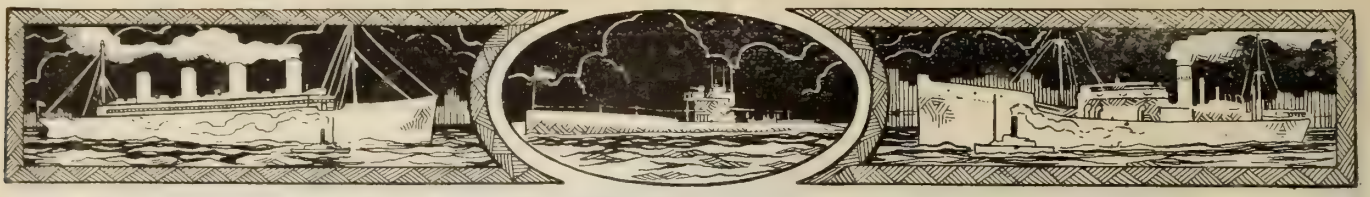
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are made by skilled artisans for the use of first class machinists. These Scribers No. 778, made in three styles, scratch fine, accurate, easily visible lines. Once you own one you'll appreciate it as a valuable addition to your kit.

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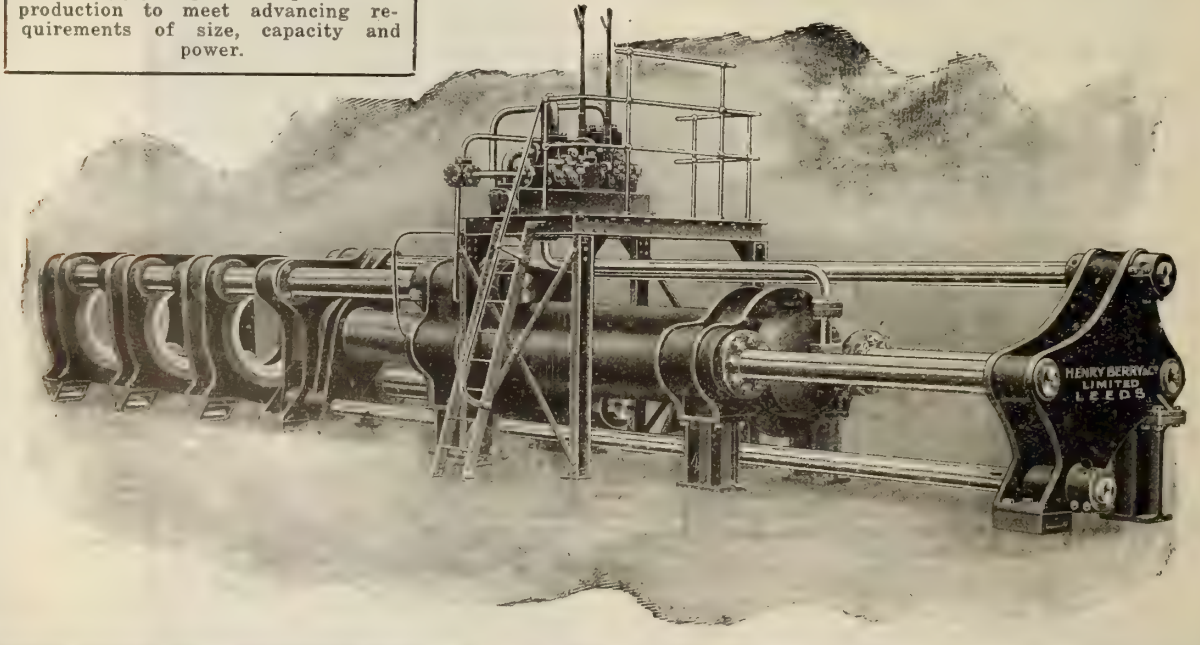
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI. No. 16 October 20, 1921

Producing Valves by Means of the Turret Lathe

Depending on Style and Size of Valve the Method of Holding Differs—Swiveling Fixtures are Very Useful—Machining a Small Valve and a Globe Valve—Tool Layout is Very Important

By J. H. MOORE

FROM time to time we have presented through the columns of Canadian Machinery, notable examples of miscellaneous work as performed on turret lathes. There is no need to emphasize the fact that the turret lathe is now a well recongnized production factor, so we will proceed to explain how these machines have been used to advantage in the finishing of valves.

Depending upon the class and size of valves the methods of holding differs. For example, Fig. 1 shows the general plan of holding small valves, and as will be noted the part is held by special chuck jaws which bear against the flange at one end, while clamps bind down upon the top of the flange, this holding valve securely in place. Apart from these precautions, no further support is necessary on the small type of valve.

At Fig. 2 is shown a swivel fixture, this being another method adopted when holding small valves. From this view it will be seen that special supporting arms and angle plates are used, these extending out from the face of the chuck. It will be noted that the valve is held between two of these arms, and in this case the part is finished

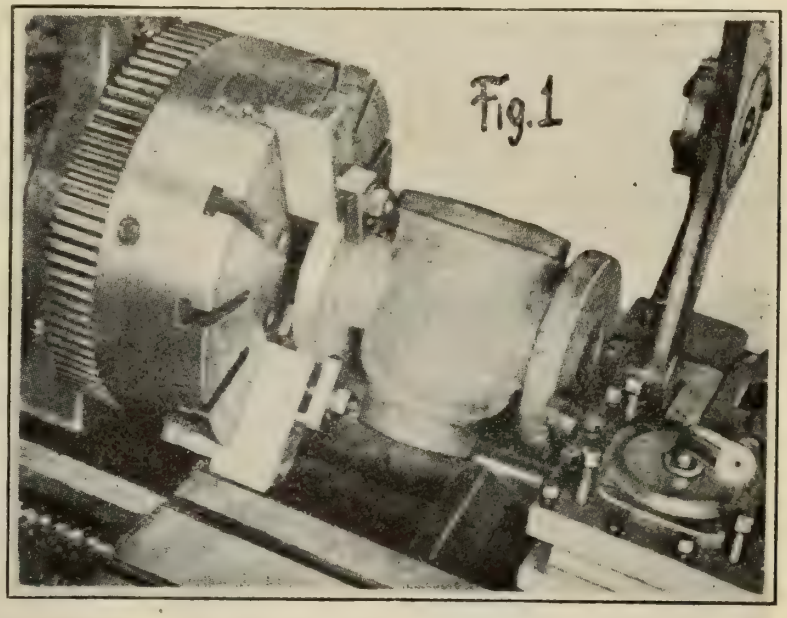


Fig. 1.—Method of holding small valves.

*Photogr phs and drawings through courtesy of the Gisholt Machine Co., Madison, Wis.

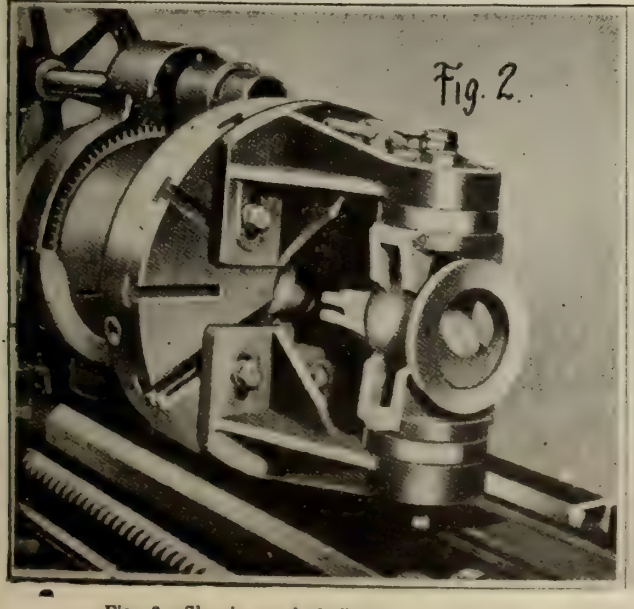


Fig. 2.—Showing swivel fixture.

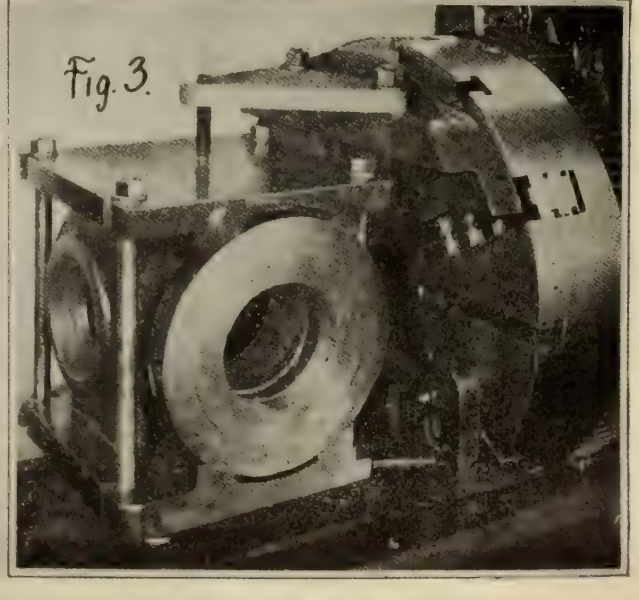


Fig. 3.—Fixture for large valves.

complete at one holding because the mounting can be so swiveled to present the different flanges to the tools. This really could be well considered under the class of a special fixture, as usually the simpler method of holding shown at Fig. 1 is adopted.

In machining larger valves of similar construction, a fixture similar to that shown at Fig. 3 is often used. This attachment is also of the swiveling type, although it differs somewhat in design.

It is so arranged that the valve can be indexed around to machine the two flanges, although as a rule the valve seat is not machined in this fixture, but is usually finished by holding it on a threaded arbor which enters at the end opposite the seat. This end is tapped to fit the arbor or stud, in order that the valve may be held as shown at Fig. 4.

This method of holding can only be used when there is a hole that extends entirely through the valve. One advantage of adopting this style of finishing is that where the valves have to be reseated in the field, they can be screwed on an arbor, and are then sure to run perfectly true.

Another method of holding valves is shown at Figs. 5 and 6. In the first photograph we see the fixture before the valve is placed in position, and in the latter picture we note how the fixture looks after the part is in place. Readers will no doubt notice that the arm of this fixture has a roller at the top, this bearing against the rotating part of the fixture in which the valve is clamped. Rollers are also provided at the sides (see Fig. 5) these being held in holders clamped to the vees of machine. By adopting this plan, the outer end of the fixture is thoroughly supported. Having explained these various methods of holding, we will proceed to the actual operations.

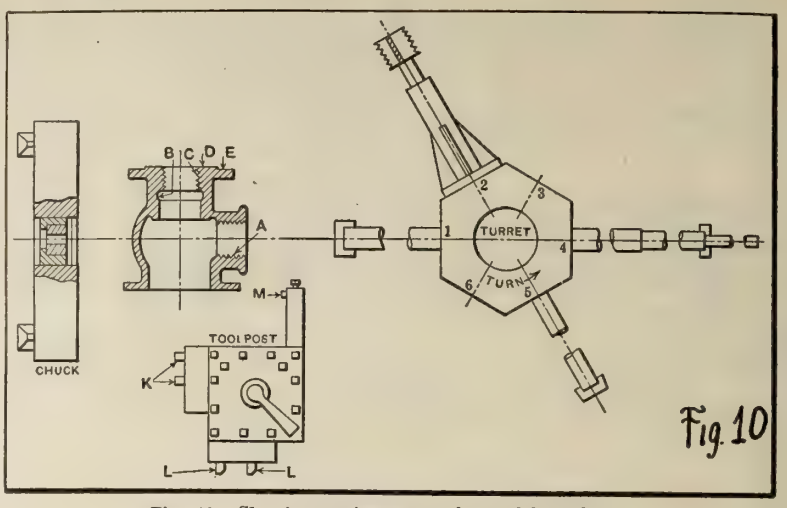
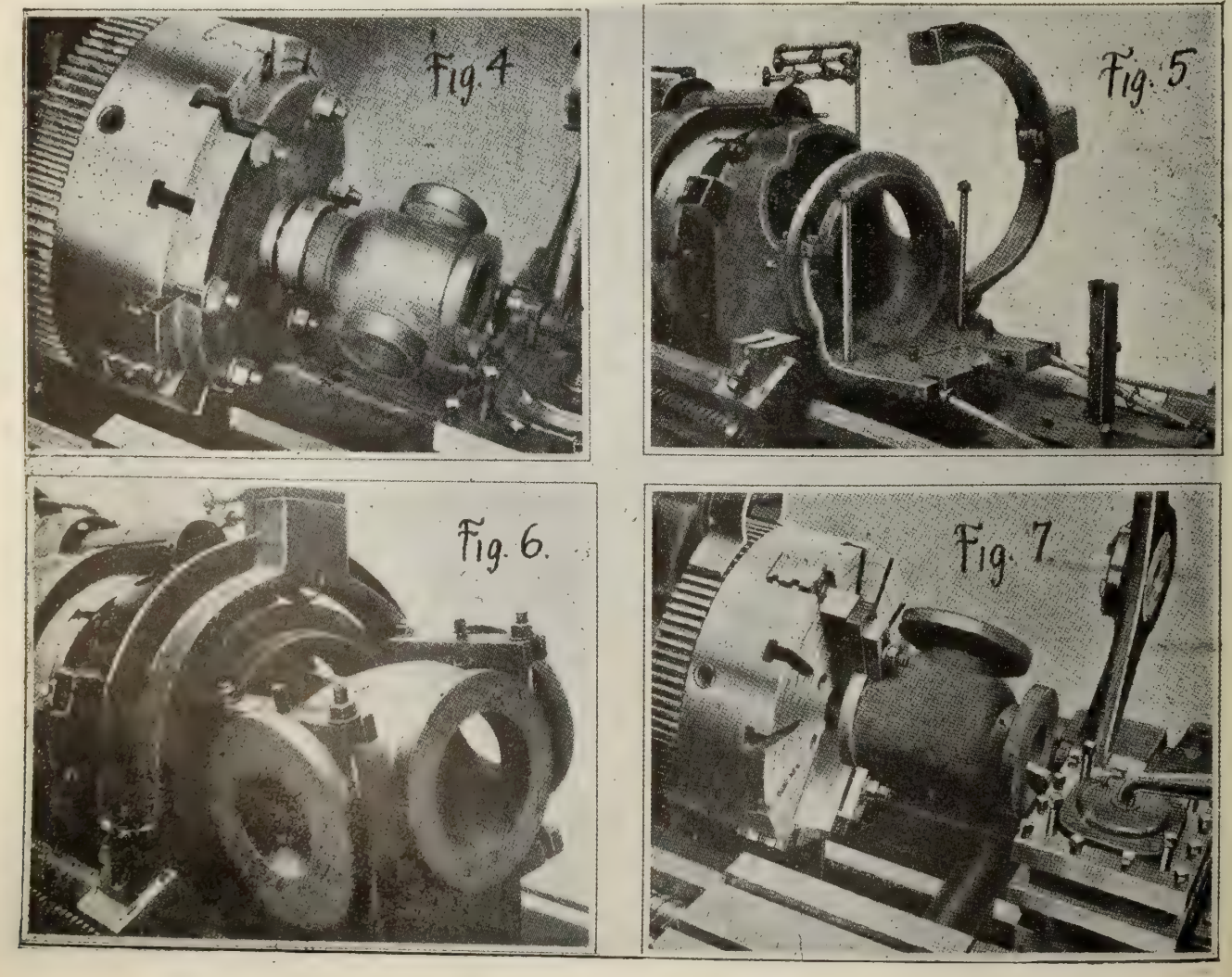


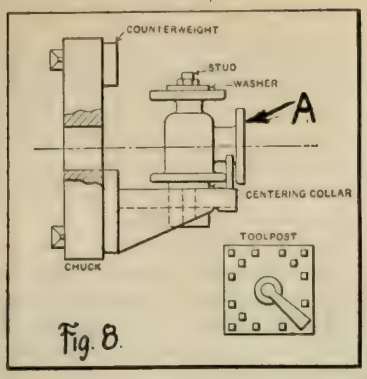
Fig. 10.—Showing equipment used on globe valve.

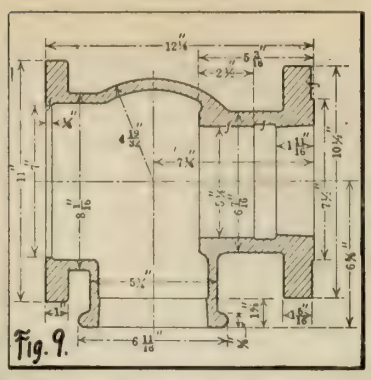
Machining a Small Valve

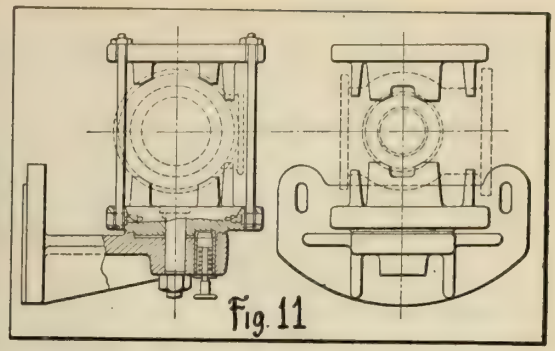
At Fig. 7 is shown a three way valve held by the method illustrated in Fig. 1. The three flanges have to be machined, the valve itself being cast iron. The first operation consists of chucking the



Figs. 4, 5, 6 and 7.—Refer to text matter for explanation.







Figs. 8, 9 and 11, showing fixtures and part described in text.

valve, then the flange at the opposite end is faced by a tool in the toolpost as shown. Five minutes for chucking and finishing this end is allowed.

In the second operation the valve is held by the finished flange while the opposite flange is machined. This takes another six minutes. The third operation, shown in Fig. 8, consists of finishing the face A with the tool in the toolpost. The valve is held on an angle plate which has a centering collar, and a counterweight is fastened on the faceplate to balance the weight of the angle plate. Uprights are arranged under the flange being finished, and screws passing through these support the flange sufficiently. The time on this third operation is 7 minutes. Instead of finishing the valve by holding it by chuck jaws as shown in Figs 1 and 7, the valve can be tapped at one end and held on a stud as shown at Fig 4, the object of this method having already been explained. Should the latter method be employed, the screwing of valve on stud, plus the facing of flanges, usually takes about five minutes.

Machining a Globe Valve

At Fig. 9 is shown a drawing of a cast iron globe valve and at Fig. 10 we see the tooling equipment used. At Fig. 11 is illustrated the fixture in which the valve is held while being machined. This attachment is of the swiveling type and is so arranged that the valve can be quickly turned around for machining the different flanges. Figs. 12

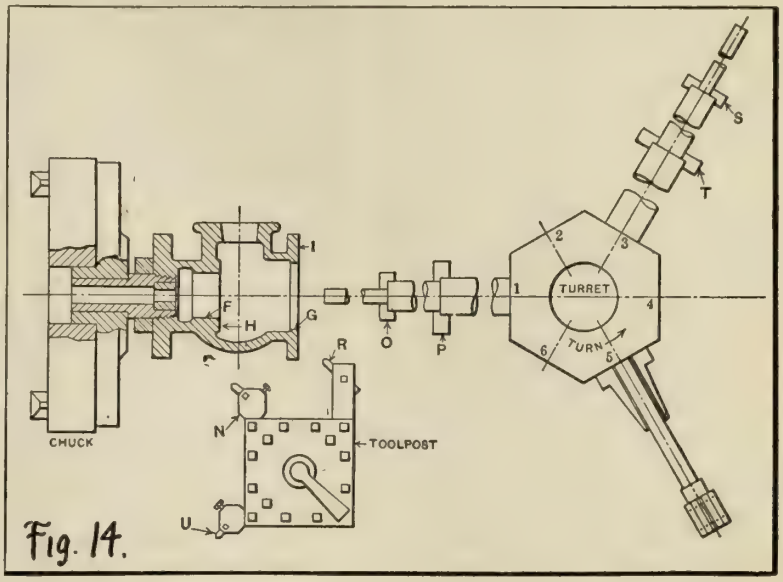
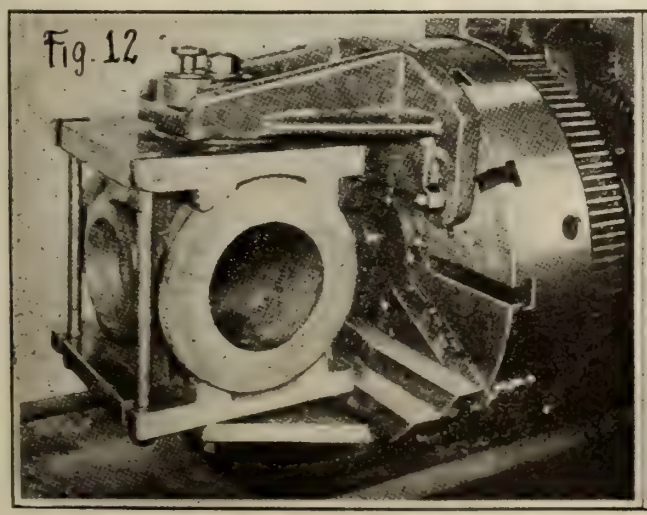
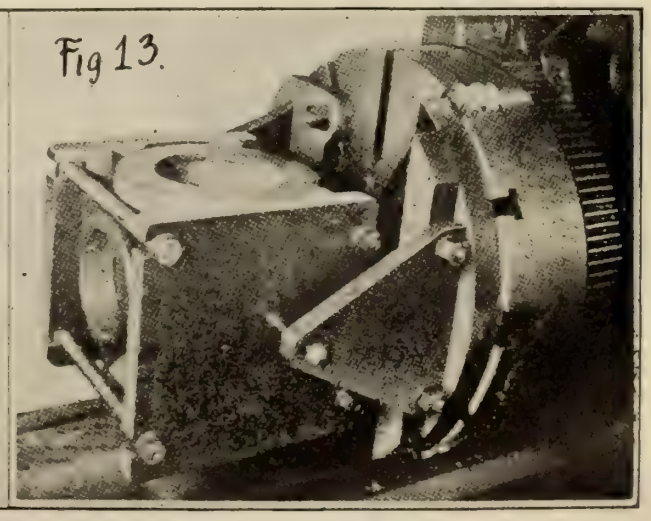


Fig. 14.—Showing tools used in marking valve.

and 13 depict the fixture in different positions. Readers will note that Fig. 13 shows the fixture turned around 90 degrees from the position in Fig 12. This shows up the construction of the fixture nicely. In machining this valve here are the steps taken:

The part is first placed between the angle plates, being held in a special cradle as shown. The hole A is rough bored with a cutter held in the bar that is mounted in position 1 of turret, then this hole is finished with cutter held in the bar at side 5 of turret. After this, the hole is tapped with the tap shown at position 2 of the turret. When tapping has been completed, the fixture, with the valve in place, is turned round 90 degrees. The flange faces D, and E, are now rough faced with the tools K, shown in the toolpost. The hole C, is next rough bored with a cutter held in bar at position 5 of the turret, after which the faces D, and E, are finished with tools L, in the toolpost. The hole C, is then tapped with the tap at side





Figs. 12 and 13.—Showing the fixture in different positions.

2 of the turret, and 15 minutes is the total time for all these steps.

The second operation consists of facing and boring the valve seat. In this case, the valve is held on a threaded centre plug. Following are the steps taken to complete. The valve is screwed on the plug, and the flange I, is rough faced with the tool N. (see Fig. 14). The holes F, and G, are next roughbored with cutters O, and P, respectively, then the shoulder H, is faced with tool R, held in the toolpost.

The two holes F and G, are next finished with the cutters S, and T, after which the hole F, is reamed with the reamer shown at position 5 of the turret. The flange I, is next finish faced with tool V, which is held in toolpost, and the total time occupied in this second operation is 8 minutes.

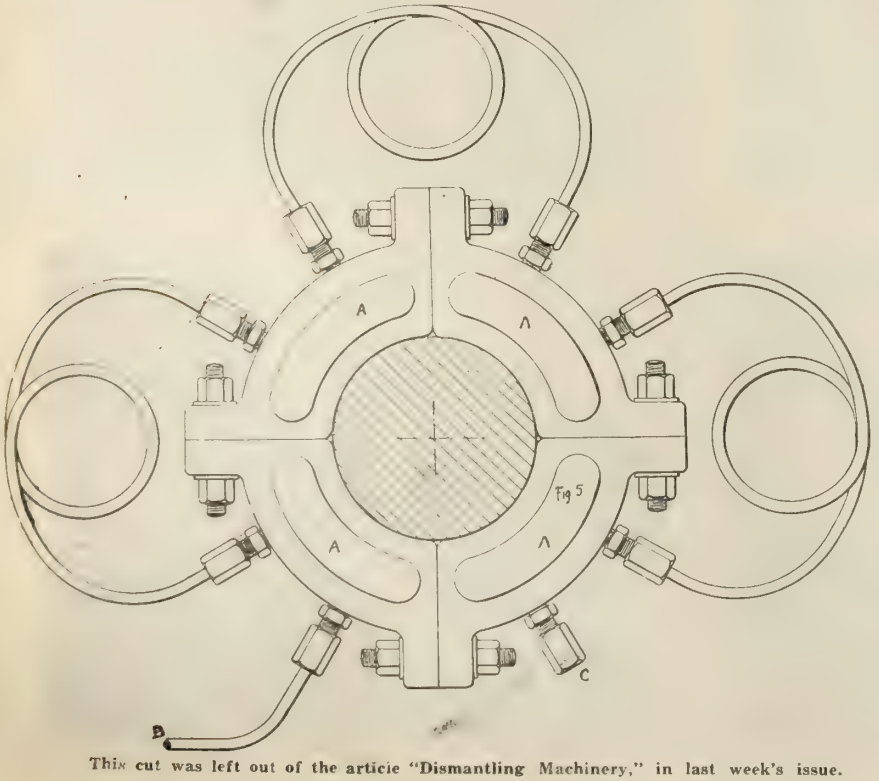
In machining valves, or in fact any style of work in the turret lathe, there are certain points to watch. For example there is the question of holding the work. The tool designer should first make up his mind how he intends gripping the piece and in the case of valves, the size is an important consideration. Naturally it would not be wise to hold a large and heavy valve with a great amount of overhang in the same way as a small and light one. Where irregular outline occurs it means as a general rule that a special fixture is necessary and here is where the designer gets a chance to shine. Simplicity of design should be one of the main considerations, and of course accuracy and production are equally as important. When all is said and done the productive capacity of any turret lathe depends largely upon the tooling used, and the means of holding employed. Where production falls below the expected mark, do not blame the machine before looking into the equipment supplied by the designers. Many a machine today is not producing as it should, simply because those responsible for the tooling have been afraid to expend a little money on suitable tools and holding fixtures. The first cost of such equipment is soon wiped out by the added production.

AN UNFORTUNATE OMISSION

The feature article in last week's issue of Canadian Machinery was on the subject of "The Proper Selection of Grinding Wheels" by P. N. Cooke, sales engineer with the Norton Co. of Hamilton. On page 28 of the Oct. 13th issue we stated that the conclusion of this article would be found on page 36. Unfortunately the remaining portion of the article was left out, so in order that readers can grasp the full significance of the conclusion of this material, we repeat below the article from the last paragraph appearing on page 28. It starts as follows:

It cannot be claimed that grinding is an exact science. The wheel maker cannot determine the correct abrasive, grit and grade to supply and guarantee that it is the most economical wheel by mathematical methods alone. If he has compiled the figures such as were shown in table in Oct. 13th issue, these having been taken from experimental data, then there can be no question but that the wheel with the greatest efficiency has been attained. A great many people do not realize the great strides that this particular industry has taken during the past ten years. There are a great many machine parts today that are ground that were formerly produced by other methods. Grinding has played a large part in reducing the cost of hundreds of articles. It would be hard to name a modern machine which could be sold for its present price were it not for the fact that the correct grinding wheels are used to produce many of its constituent parts.

The wheel manufacturer is always looking for improvement. There are extensive laboratories where scientific research is carried on to develop better abrasives, improved grinding wheels and improved methods of operation, working toward more efficient shop methods, cheaper prdouction and greater accuracy for industry. The grinding wheel user will do well to keep in close contact with the wheel manufacturer to insure most up-to-date grinding practice in his shop. The chart shown last week was included to summarize in outline form the forgoing discussion and general explanation. It emphasizes more particularly the important points upon which grinding wheel selection depends and emphasizes the details which should be given to the wheel manufacturer to enable him to make the best recommendations.



This cut was left out of the article "Dismantling Machinery," in last week's issue.

USEFUL DATA

Tables of any kind are usually interesting, and quite often they are worth saving. Contract Record has published such a list, and for readers benefit wereproduce it below.

A cubic foot of lump lime weights from 60 to 70 pounds. A 200-pound barrel of lime contains 180 pounds net of lump lime, or 3.1 cubic feet. A 300 pound barrel of lime contains 280 pounds net of lump lime, or 4.7 cubic feet. A bushel of lime contains 60 to 80 pounds, or 1 to 1.3 cubic feet, depending on the state laws, and a pound of magnesium lime requires about one pound of water to form a paste, or about 25 gallons a barrel.

A barrel of lump lime gives from 6 to 9 cubic feet of paste; average about 7½ cubic feet. A cubic foot of hydrated lime weighs from 30 to 45 pounds, average about 38 pounds. A small sack of hydrated lime contains 40 pounds, or 1 cubic foot. A standard sack of hydrated lime contains 50 pound or 1¼ cubic feet. A large sack of hydrated lime contains 100 pounds, or 2½ cubic feet, and hydrated lime requires about an equal weight of water to produce a paste. A 100-pound sack of hydrate gives about 2.3 cubic feet of paste.

A standard barrel of Portland cement weighs 376 pounds net and contains 38 cubic feet. A sack of Portland cement weighs 94 pounds and contains about one cubic foot. It is usually considered as 100 pounds. Cement paste weighs about 137 pounds per cubic foot. One cubic foot of Portland cement will yield 8 cubic feet of paste. The average wooden wheelbarrow load of broken stone is about 2.4 cubic feet, and the average wheelbarrow load of sand is about 2½ cubic feet.

Elements of Machine Design—Lesson No. 2

Theory of the Beam—Method of Moments—The Couple—Examples—Shearing and Bending Stress In Beams—Bending Moment —Action of Forces and Other Points of Value

*By L. T. RUTLEDGE, B. A., Sc.

MANY of the writers of the older textbooks on machine design and elements of machines were accustomed to begin with a definition of a machine and then follow up with a list of elements. It was generally stated that a machine, no matter of what nature, or how complicated it might be, was an instrument by which force applied at one point was transferred to another point, being at the same time intensified or changed in direction. Then it was shown that elements of the most complex machine are reducible to what are called the six mechanical powers: (1) the lever; (2) the wheel and axle; (3) the pulley; (4) the inclined plane; (5) the wedge; (6) the screw. In this course of lessons these important and fundamental elements shall not be ignored but the study will be directed along different lines. We should prefer to define a machine in these words: "A machine consists of resistant parts, which have a definitely known motion relative to each other and are so arranged that a given form of available energy may be made to do a desired form of work." The study of machine design is chiefly concerned with the determination of the proper shapes and dimensions to be given the component parts so that they may be sufficiently strong and stiff enough to carry the loads and transmit the forces. Whereas, if we were to confine our attention to the motions of the machine parts, the study would be called kinematics of machinery.

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should an yreader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

Machines and all mechanical structures in general, consist of combinations of the simple structures or fixtures, namely, beams, short and long columns, brackets, shafts, ties, fastenings, flywheels, pulleys and gears. This present lesson will be devoted entirely to the theory of the beam because it is of paramount importance. So many fundamental principles have to be learned, new quantities which in some cases are very abstract in nature are encountered, and so many new conceptions are acquired in the study of the beam that it must be given first place.

The principle of the lever enters into most mechanical problems and by its aid reactions may be determined as well as the stresses in the various members of a framed or machine structure.

If a force acts on a body tending to rotate it about a certain point, it is said to have a moment about that point equal in magnitude to the product of the force(in pounds or tons) and the perpendicular distance from the line of action of the force to the said point. In Fig. 4, the force F, acts about the point A, with a leverage equal to d. The point A, is called the point of moments and the distance d, the lever arm. The moment of the force F, equals Fd, in ft.-lbs., if d, is expressed in feet and F, in pounds.

There may be two or more forces tending to revolve the member about a point either in the same or opposite directions but when a body is in a state of equilibrium the algebraic sum of the moments must be equal to zero or in other words the sum of the clockwise moments must equal the sum of the anti-clockwise moments. When we use the expression algebraic sum we always mean an addition which takes into account the direction as well as the num-

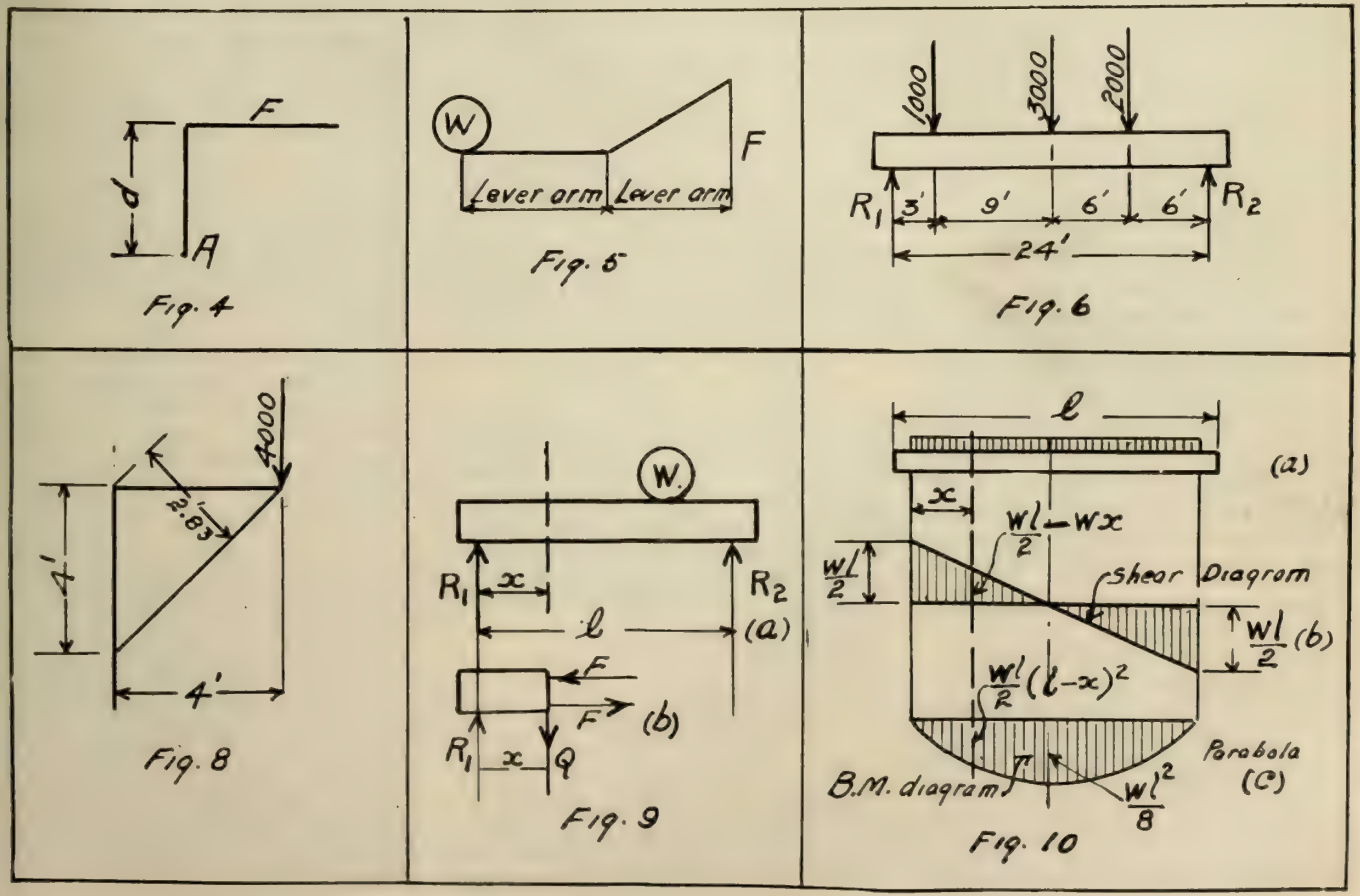


Fig. 4 Fig. 5 Fig. 6

Fig. 8 Fig. 9 Fig. 10

concentrated load W. The reactions due erical sum. For example, the arithmetic sum of two forces of 8 and 6 pounds is 14 pounds, but if the two forces are acting in directly opposite directions with the greater in the assumed positive direction then the algebric sum is +2 pounds.

In machine parts the levers are not always straight but very often bent; but no matter what the actual length of the lever member may be, the true lever arm for purposes of moments is the perpendicular distance from the point of moments to the line of action of the force. Fig 5 is an example of a bent lever.

The moment of a force about a given point vanishes only when either the force vanishes, or the line of action of the force passes through the point of moments. This fact is of great importance as will be seen later as it enables one to find two unknown forces in a system of forces by arbitrarily taking moments first about a point in the line of action of one of the unknown forces.

The following are two generalized statements of the Principle of Moments: 1:—If any number of forces in one plane acting on a rigid body, have a resultant, the algebric sum of their moments about any point in their plane is equal to the moment of their resultant about that point.

2.—If the forces are in equilibrium, their resultant is zero. Therefore the moment of the resultant about any point in their plane is zero. Hence, when a number of forces in one plane acting on a rigid body are in equilibrium, the algebraic su mof their moments about any point in their plane is zero.

The following are the sufficient conditions of equilibrium when a number of forces act on a rigid body in the same plane. 1:—The algebraic sum of the forces resolved in any two directions must vanish, and 2:—The algebraic sum of the moments of the forces about any point in their plane must vanish. It is to be noted that both of the above conditions are to be satisfied.

The Couple.

In this particular, it is well to note a special case of a turning moment known as a couple. A couple is a system of two equal forces acting in opposite directions If each of these forces be represented by F, and the perpendicular distance between them by y, then the moment of the couple equals Fy. A couple tends to rotate the body upon which it acts, and can only be balanced by an equal couple acting in the oposite direction.

Examples Illustrating Methods of Moments.

Example 1:—In Fig. 6 is shown an ordinary simple beam supported at each end and carrying three concentrated loads spaced as indicated. The end reactions R1 and R2 are unknown. But the beam is in equilibrium. It is required to find the end reactions. A practical example of the case would be a floor beam supported on two brick walls and carrying machines on the floor above spaced as given. Going back to first principles we may assume the beam to be a lever, pivoted at one end and supplied with an upward force at the other end. Then the sum of the moments of the loads about the pivoted end of the lever must be balanced by the moment, about the same point, of the reaction or upward force C at the opposite end. Fig. 7 shows the directions of the turning moments.

Assuming that the beam is pivoted on the line of reaction of R2, the sum of the moments about this point must be equal to the moment, about the same point, of the reaction of R1, the equation of moments is given as follows:

1000 x 21 + 3000 x 12 + 2000 x 6 = R2, x 24, the unit of measurement of each product being the foot-pound.

Then 24 Rl=69000, which gives Rl =2875 pounds.

To obtain the reaction R2, moments may be taken in the same way about the line of action of R1 and R2 and will be found to be 3125 lbs..

However, after R1 is found by moments, R2 can be obtained in a much simpler way. Since the forces are in equilibrium, the algebraic sum of the forces resolved in any two directions must vanish. Here we are only concerned with the vertical direction. Then to find the unknown force we have the equation R1 + R2—1000—3000—2000 =0.

But R1 was found to be 2875, then R2 must be 3125 to satisfy the equation. In more simple language, it may be stated that the upward forces must balance the downward forces, both being vertical.

Example 2:—Fig 8 represents a bracket on the side of a wall similar to a bracket used to support a crane rail in a machine shop. The load on the bracket is 4000 lbs, at the point B. For the stress in AB, moments are taken about the point C. The moment of the load about this point equals (4000x4) ft.-lbs., while the resisting moment about the same point is equal to the stress in AB multiplied by the lever arm AC. The condition for equilibrium is that one moment equals the other. Therefore 4000x4 equals stress in ABx4. Therefore stress in

$$AB = \frac{4000x4}{4} = 4000 \text{ lbs.}$$

For the stress in the member CB moments are taken about the point A. The moment of the load about this point is the same as before and the resisting moment is equal to the stress in CB, multiplied by the leverage arm of the perpendicular distance from A, to the member BC, which distance is indicated as 2.83 ft. Then

4000x4 = stress in CB x 2.83

Stress in

$$CB = \frac{4000x4}{2.83} = 5654 \text{ lbs.}$$

2.83

Shearing and Bending Stresses in Beams.

Fig. 9 (a) represents a simple beam supported at both ends and carrying a to the weight W are represented by R1 and R2. Thus the load and the two reactions are the only external forces present which induce internal stresses, it being understood that we are here neglecting the dead weight of the beam itself. If we imagine the beam to be cut between the load W, and the reaction R1, or in other words, if a section of the beam be taken as shown at (b), then the remaining portion of the beam may be held in equilibrium by a downward vertical force Q, which is equal to the upward reaction R1, and by two equal but opposite horizontal forces F, applied near the top and the bottom of the section of the beam along the line of section. The force Q, which is called the vertical shear, tends to cut the beam crosswise and is resisted by the strength of the material in this direction. Again R1, and Q, form a couple, the lever arm of which is the distance x, and this couple tends to rotate the section of the beam in a clockwise direction. The moment of this couple is called the BENDING MOMENT, at the section under consideration. Now the horizontal forces F, also form a couple with lever arm equal to d. This couple tends to rotate the portion of the beam in a counterclockwise direction, thus counterbalancing the bending moment. The moment of this couple is called the RESISTING MOMENT. For a condition of equilibrium these two moments must be equal, or R1x=Fd. from which

$$F = \frac{R_1 x}{d}$$

The forces F, which may be infinite in number, induce compression in the upper fibres of the beam and tension in the lower. There is a horizontal plane where the stress is zero. There the stress changes from compression to tension and in order to do this it must pass through zero. The plane is shown on the sketch by a line which is known as the NEUTRAL AXIS. It is now obvious that a loaded beam is usually subjected at any section to two kinds of stress, namely, vertical shear and bending.

Vertical Shear.

The vertical shearing stress causes the particles in the beam to tend to slide past one another in a vertical plane. An example of vertical shearing is found in the vertical shearing of boiler plate in a shearing machine. The vertical shear at any vertical plane is equal to the algebraic sum of all the vertical forces on either side of the plane. When the direction of the shearing stress is such as to cause the particles to the left of the plane to move upward with respect to the portions of the beam to the right, it is usually said to be positive, whereas if the shear causes the left hand section to move downward relatively to the right hand section, the shear is considered negative Many authors define the shear as the algebraic sum of the vertical forces to the left of the plane. This definition

is correct in itself, but too restricted for one can convince himself that it does not matter which side of the plane one selects to sum the forces by taking an actual example. For instance, take the forces shown acting on the beam in Fig. 6, and find with them the vertical shear at any plane. Suppose the plane is chosen between the forces 1000 and 3000. The vertical shear is +2875—1000= + 1875, when taking the forces to the left of the plane. Considering the forces to the right we have + 3000 + 2000—3125= +1875, the same as before and positive in each case according to the convention of signs.

Bending Moment

The bending moment (B.M.) at any point of a loaded beam, is equal to the algebraic sum of the moments about this point of the external forces on either side of it. This moment must be balanced by the resisting moment at the same point of the internal stresses in the material. When the bending moment induces compression in the top fibres of the beam, it is usually considered as positive, but if it induces tension in the top fibres it is considered as negative. This assumption is a pure convention. The necessity of some uniform system at the very start can be clearly seen.

Fig 10 (a) represents a beam loaded uniformly with a load of w.lbs. per linear foot. Each end reaction will be wl, being half of the total load on the

$$\frac{}{2}$$

beam. At each end there are equal but opposite forces acting on the beam, one-half of the total load acting downwards and the reaction of the support acting upwards, each equal to wl, divided by 2.

These two forces tend to shear the beam in an up and down direction. The vertical shear at each end of the beam the length x; or the shear at

$$x = \frac{wl - wx}{2}$$

on the left being positive and the one on the right negative, according to our rule of signs. These quantities can now be shown in a diagram to a selected scale. The positive shear is drawn upwards and the negative downwards. The shear at any arbitrarily chosen plane, say one at the distance x from the left support is equal to the reaction at that support minus the load on the beam in the length x; or the shear at x $\frac{wl - wx}{2}$

The variable quantity x is to the first power which shows none familiar with simple analytical geometry that the above equation can be represented by a straight line. In other words, the variation in shear as the distance x is being increased, is directly proportional to the distance. Then the shear diagram may be completed by joining up with a straight line, the extremes of the ordinates at the left and right hand supports. At the cenre of the span where the line crosses the axis, the shear is zero

The bending moment at any plane distant x from the left hand support is equal to the algebraic sum of the moments of the forces on either side of the plane. Let us now consider the moment for the left side, but precisely the same answer would be obtained had we selected the right side. The upward force is wl. The downward force is the uni-

$$\frac{}{2}$$

form load equal to wx. For purposes of calculation this uniformly distributed load of wx may be taken as acting at the centre of the short distance x so that the lever arm is x. Then the mom-

$$\frac{}{2}$$

ent at plane distance x is equal to.

$$\frac{wlx}{2} - \frac{wx2}{2} \qquad (6)$$

Equation (6) is the equation for a parabola with vertex at the centre of the span. Where the equation contains only one variable and it is raised to the second power, it is a good indication that the parabola will represent the variation. It is certain it cannot be a straight line. In Fig. 9 (d) the parabola is drawn and the bending moment diagram completed. The ordinates or vertical lines drawn from the horizontal line connecting the ends of the parabola represent to scale the value of the bending moment. The scale of the B.M. diagram will generally be so many inch-lbs or foot-lbs. equals one inch. It is observed that the B.M. is greatest at the centre where the shear was leat. This maximum value of the B.M. is Mmax= wl2.....(7). Now if W be let equal

$$\frac{}{8}$$

wl equal the total load, we have Mmax =wl ..... (8). This is the more

$$\frac{}{8}$$

usual form in which the expression for the value of the maximum bending moment of a beam uniformly loaded is given.

For a beam with a concentrated load at a distance x from the left hand support, the same method of solution applies. The positive shear under the load is W (l—x..... (9)

$$\frac{}{l}$$

and the negative shear is equal $\frac{Wx}{l}$

When x equals zero the positive shear is equal to W, and the negative shear equal to zero. The bending moment diagram is constructed with straight lines and it will be found that Mmax.=

$$W \frac{(l-x)}{(l)} x \qquad (10)$$

When the concentrated load is at the centre of the span we have

Mmax.=Wl ..... (11)

$$\frac{}{4}$$

The student is advised to work this case out in full and draw the shear and bending moment diagram.

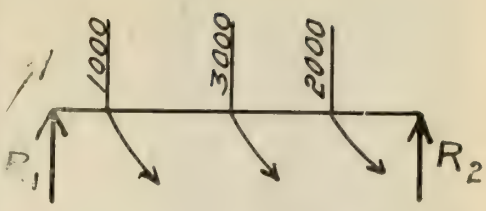


Fig 7

After studying the simple beam it will be found beneficial to determine the values for the shear and bending moments for a cantilever beam uniformly loaded and with concentrated loading. Many of the mechanical handbooks give the fundamental formulae and diagrams for these typical cases. In Mark's handbook under Beams, pages 397 to 401, diagrams and formulae for every general case of loading on beams is given. The student should own a good mechanical handbook for reference, and Mark's latest edition (McGraw Hill Co., New York) is one of the best. He should also have a Cambria or Carnegie steel handbook. Next leson we will take up further considerations regarding beams.

CANADIAN-BUILT PAPER MACHINES

In the Sept. 22nd issue we mentioned the installation of two 166 inch news machines by the Laurentide Co., Limited, Grand 'Mere, Que. These machines were built in Canada by the Dominion Engineering Works, Limited, at Lachine, Que., and represent a record in Canadian Machine building. They were ordered in October, 1919. One machine was installed January 5, 1921, and the other February 2?. 1921. While these machines were being built, the makers rebuilt parts of these other machines and turned out a new 90 inch, four cylinder board machine, and 1418 inch Harper Fourdrinier machine, all of which represent a remarkably good rate of production of special machinery in a new plant. Speeds of 1,000 lineal feet per minutes of paper produced have been reached on kraft paper, but these 166 inch machines are now producing newsprint daily at the rate of 1000 to 1030 feet per minute, and the combined product of the two machines averages 160 tons daily.

Machines for operation at such high speeds must necessarily be equipped with all the latest devices for handling the sheet through the machine and for insuring freedom from breakages and getting practically continuous production. When one considers that under the above conditions, the speed of a 30" diameter couch roll is 127 r.p.m., it is evident that the limit of human skill in handling paper through the machine by hand has been left far distant.



WELDING AND CUTTING



Learning to Weld--Points for Beginners

Preheating is Very Essential—When to Preheat—Table Showing Approximate Temperature Colors—Protecting the Weld—Penetration—Welding Speeds—Testing Welds—Brazing

*By FRED. E. ROGERS

IN the Oct. 6th issue of Canadian Machinery we commenced a lesson on welding. Space did not permit our completing it in that issue, but following is the continuation of the article.

Preheating

When welding brittle metals like cast iron and aluminum it is necessary to preheat an extended area surrounding the joint before undertaking to weld under conditions where the metal will be unduly stressed by local heating; or to confine the heated area to a narrow zone by cooling with asbestos soaked in water. Preheating may be accomplished in small parts with the welding flame, but it is very wasteful if not impossible to preheat large castings in this manner. Preheating is usually accomplished by means of charcoal or coke fires or by gas or oil burners. The heat should be applied to those parts that will be stressed most by local expansion, and means should be provided to conserve the heat and prevent waste of fuel. It is customary to build crude temporary furnaces of brick or sheet iron around parts to be preheated to confine the flame and direct them where the heat is required. Preheating of stoves and furnaces is desirable when the volume of work warrants the investment.

Temperature Colors, Approximate.

Color	Deg. F.
Faint red visible in dark	750
Faint red	900
Blood red	1050
Dark cherry	1175
Medium cherry	1250
Cherry or full red	1375
Bright red	1550
Salmon	1650
Orange	1725
Lemon	1825
Light yellow	1975
White heat	2200
Bright white heat	2500
Brilliant white heat	2700
Dazzling white heat	2900

*From a book published by the Davis-Bournonville Co., Jersey City, N.J.

The proper location of preheating flame may puzzle the beginner in the welding game, but if he will stop to consider where a wedge driven into the weld would be likely to break the surrounding parts it will not be difficult to decide where the wedging effect will most severely stress the metal. Preheating should be applied to these points. Attention should be given to slender parts that may be slightly bent by expansion stresses. These are likely to break and they should be preheated to increase their flexibility under bending stresses.

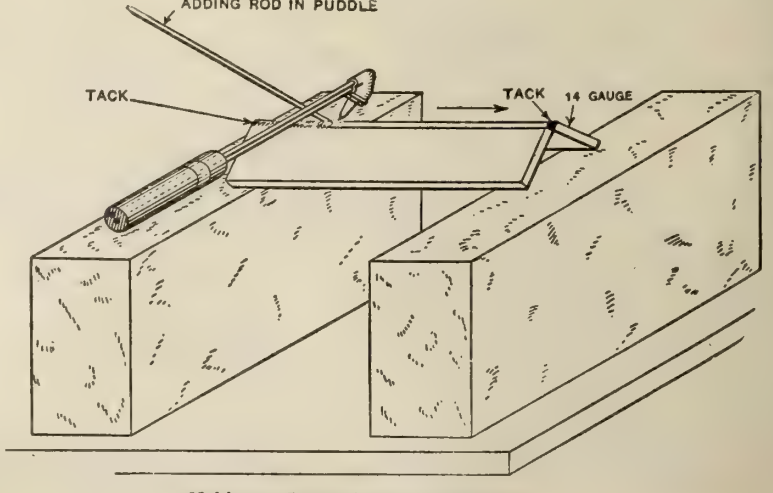
The welder should thoroughly appreciate the economy of preheating due to saving the costly welding gases. It is advisable to preheat heavy castings simply to save oxygen and acetylene even though there is no danger of expansion stresses causing fracture. A preheated casting is welded in less time and a sounder job results than if welding is begun with cold metal.

When to Preheat.

The welder of cast iron when in doubt, always preheats, if possible. He thereby insures the casting against breakage in the process of welding, saves gas and insures a sound weld. If trouble is met in getting the metal to flow, when welding a heavy cylinder, the reason almost always is that heat is being absorbed so rapidly that the metal cannot be raised to the fusion point beneath the torch flame. If the welder works long enough and uses sufficient gas he may finally produce a weld, but only at higher cost than if preheated.

If the job is one that must be done in a hurry and the cost is of secondary importance it may, under some circumstances, be done without preheating in the conventional way, but only by using a large tip and burning much gas. Preheating is done, nevertheless, but with acetylene instead of the cheaper coke, charcoal or kerosene. Ordinarily all cast iron work of any importance, especially of considerable thickness, should be preheated to a low red. It will then weld easily and quickly.

It is somewhat difficult to emphasize the importance of preheating cast iron parts without conveying the impression that it should be done invariably. The inexperienced welder should always preheat and only as he gains skill and experience may he undertake the risk of not preheating. In other words, the oxy-



Making a Corner Weld in Thin Steel.

acetylene welder should go through a period when he preheats everything, but the expert welder may, through knowledge and acquired skill, handle jobs successfully without preheating on which the less experienced welder would fail. No two jobs are alike, and set rules cannot be fixed as to what to preheat and what not to preheat. The only rule safely followed is: "When in doubt, preheat."

Castings having closed cored spaces such as piston heads should be handled with caution. Oil may have leaked into these spaces, and if the part is preheated the gas generated and confined may cause an explosion. The first thing to do is remove the core plugs so as to permit gas to escape freely.

Protecting the Weld.

When a weld is completed the torch flame may be swept over it and the parts adjacent several times to equalize internal stresses developed while the weld was being finished. When this is done the weld should be shielded to prevent rapid cooling. Asbestos paper is indispensable in the welding shop for preheating. Vulcanite asbestos is furnished to the trade in rolls, about 36 inches wide, and being easily shaped to any surface it may be used to good advantage when preheating, to take the place of sheet iron or brick. Several thicknesses may be required on large parts, depending on the size and situation.

Great care should be taken after welding heavy cast iron parts to protect the whole casting from drafts and rapid local cooling. Rapid cooling not only is dangerous but it tends to harden the metal if very hot and make it brittle which might be the cause of failure in service.

Penetration.

A common fault of a beginner's welds is "adhesion." When torn apart an adhered weld shows that the weld metal is plastered on and stuck in spots, whereas in a sound or cohered weld the weld metal and parent metal are thoroughly united. For want of a better term "penetration" is used to express thorough knitting or interlocking of a weld. The heat of the flame must "penetrate" and fuse without oxidization, under which condition union should be secured. Adhered welds are produced, for instance, when the operator fails to heat both sides of the joint evenly and fuse them with the welding rod. Often one side of the joint will be found soundly welded while the other side adheres in spots. Correct torch movement which directs the flame squarely upon the metal and heats the adjacent parts evenly to the melting temperature is one of the secrets of sound welding. Hence the importance of learning to handle the torch correctly in the beginning can hardly be overstated. Unless the welder secures penetration and cohesion his work is bound to be faulty. His training should concentrate on this point until he learns to recognize instinctively when the metal is blending under the flame.

Proper Size of Tip and Flame.

So much depends upon selection of tip and size of flame that the injunction is repeated that welders, especially beginners, should be governed by the table of tip numbers furnished with D-B equipment. Success or failure depends on the size of flame and this is governed by thickness of metal up to a certain limit.

If too small a tip for the joint is used the heat radiated will require that the flame must be held at one place so long that the metal will be oxidized before the weld can be accomplished. Furthermore, it will take much longer to make the weld, and require more gases to do the work than if the flame is of the proper size for the job.

Too large a flame is also objectionable because the operator will not be able to work the torch rapidly enough to place the molten metal before it is overheated. The correct size flame should reduce the metal to the molten condition of a width about equal to the thickness welded. Thus, if the metal is ½ inch thick a No. 6 style 99 tip should be used in D-B style C welding torch, which should fuse a section of metal about ½ inch wide. Of course, the relation is not carried out for very heavy sections but as these are—or should be—preheated, the work of the torch is made easier.

When welding heavy metal be careful not to blow molten metal on to "cold" metal as the result will be adhesions and not welds. Should the metal adhere accidentally the torch should be applied until thorough penetration and cohesion has been effected.

Welding Speeds.

Expert operators have welded steel plate ½ inch thick at the rate of 3 feet per hour, and in some cases higher speeds have been accomplished on even thicker metal. These are not average speeds, however, and in general the welding rate on ½ inch plate may be conservatively put at 1½ feet per hour. When the weld is considerably reinforced, as is the practice of concerns welding tanks and pressure containers, the welding speed may drop to 1¼ feet per hour, or even to an average of about one foot. Steel plates ¼-inch have been welded at the rate of 15 feet per hour. Much higher welding speeds are possible on thin sheets, 30 feet per hour being not unusual for the light weight gauges.

Testing Welds.

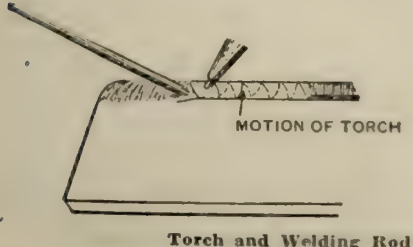
Beginners will learn much by breaking practice welds apart and closely examining the weld structure. They will be surprised to learn how faulty a weld may be that appeared smooth and sound before broken. A simple way of testing is holding in a vise just below the weld and breaking it with blows of a hammer. The presence of trapped oxide and adhesions will be almost invariably shown in first efforts. Repetition will give practice and result in rapid improvement, as the welder then realizes how important it is to follow the approved torch method.

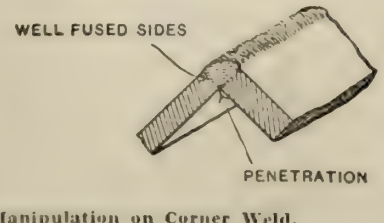
The importance of weld tests can hardly be exaggerated for nothing appears to stimulate the average welder as much as the discovery that his previous efforts produced poor results. The D.B Institute has installed a 100,000-pound Riehle testing machine for pulling test bars apart, and all students are required to weld steel test bars 2 inches wide and ½ inch thick until able to make welds of from 85 to 90 per cent. full strength, without reinforcement.

The vise-and-hammer test is also used to determine bending strength and to disclose defects, especially in the early stages of the course.

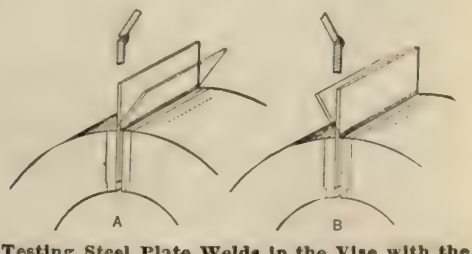
The structure of a weld may be made to stand out clearly by sawing across a welded joint, filing or grinding smooth, polishing and etching. Adhesions are thus shown by sharply defined lines between the adding material and the parent metal, whereas a cohered joint shows faintly defined lines and evidence of interlocking. A perfect cast iron weld should show no line between the weld and parent metal when broken but when polished and etched the slight differences in structure generally can be seen plainly.

(To be continued)





Torch and Welding Rod Manipulation on Corner Weld.



Testing Steel Plate Welds in the Vise with the Weld and Against the Weld.



WHAT OUR READERS THINK AND DO



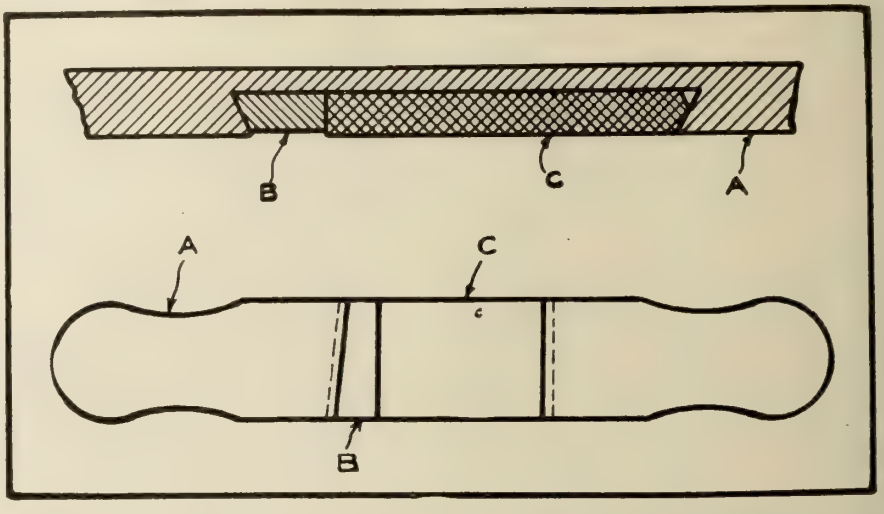
QUILT STITCHING MACHINE

By J. H. Moore

Gearing has many uses, but how about the maze of gear work shown in the accompanying illustration? At first sight it looks like some sort of a Chinese puzzle, and if the readers were given say three guesses each, it is doubtful if they would arrive at a successful conclusion.

This interesting arrangement of gear ing is used on a specially constructed "Quilt Stitching" machine. It is often a source of wonder to the uninitiated how the stitched pattern on bed quilts is so even, but here is the solution. A small pinion 1½in. diameter, which is fastened to the carriage of the stitching machine, starts its motion from the outside of the gearing arrangement depicted. The carriage to which the pinion is fastened is free to move in either direction, so that once the pinion starts on its journey, the carriage actually travels in a similar manner to that of the pattern of the gearing, in this way completing the stitched pattern on the quilt, as the stitching needle has been running up and down at a rate of 700 strokes per minute all this time.

The following figures will give the readers some conception of the proportions of this gear gauge, as it might be safely termed. The dimensions over all are 4ft. 3in. by 5ft. 3in., and the width at the narrowest portion of pattern is 2in. It is surprising how the pinion goes around such small curves for in many cases the radius on corners is only 2in. The gear teeth are ¾in. face and all teeth are cast. In fact to replace this casting would cost approximately $600. 00. Ten minutes is usually employed in the completing of the journey of the pinion, or in other words, the stitching of pattern on quilt takes about 10 minutes. Armstrong Bros., of Adelaide St. W., Toronto, produced this machine, and it is through their courtesy that we are able to reproduce what we consider a very interesting gear arrangement.



DRAW FILE HOLDER

The sketch shows a simple holder adapted to use up the ends of broken files. This part of a file is seldom used, and the holder as shown was made of ⅜ in. flat stock and was machined across the middle. One side of the slot is at right angles with the edges, while the other is cut at about 5 degrees taper. The taper key B completes the holding portion. The file used is ground on one edge to suit the slot, and of course the handles of the holder are shaped to afford a better grip. Draw filing is easily accomplished with the use of such a holder.



How is this for a mixed mess of gearing?

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Following are the names of those who submitted correct lists in the Sept. 29th contest: George Laud, Peterboro; Ernest V. Bell, Fredericton, N. S.; G. G. Saunders, Carzill, Ont.; and Paul A. Wink, Cobalt, Ont. Mr. Land was the lucky scale winner this week.

CONTEST FOR OCTOBER 20TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1 How to make your job secure.
2 Something that will soon pay for itself.
3 A product that raised a standard.
4 Something said to never leak.
5 An operation recognized as absolutely necessary.
6 Three things which protect.
7 Something that reduces labor costs.
8 A fact worth looking into.
9 Something that does not stop with delivery.
10 A point too often neglected.
11 Something done in two seconds.
12 A pretty strong statement.

These are Correct Answers for List from September 29th Issue

1—Nicholson File Co.
2—Algoma Steel Corporation
3—Wright Mfg. Co.
4—United States Electrical Tool Co.
5—Smooth-On Mfg. Co.
6—Landis Tool Co.
7—Steel Co. of Canada.
8—S. F. Bowser Co.
9—Roelofson Machine & Tool Co.
10—Canadian Link Belt Co.
11—J. C. McLaren Belting Co.
12—Elk Fire Brick Co. of Canada.

Closing Date for This Contest is Nov. 10th



DEVELOPMENTS IN SHOP EQUIPMENT



NEW CHERRYING ATTACHMENT

Several new points in design have been added to the Pratt & Whitney die sinkers to make them more convenient to operate and easier to maintain. The driving spindle has been provided with a positive pin lock in four positions so that the chuck or collet can be tightened without holding the driving belt.

The spindle pulley has a new system of oil grooving opposite to the direction of rotation so that oil is continually carried upward insuring complete lubrication without loss of oil. A floating babbitt washer takes the thrust of the cut on the spindle, a system of oil grooving distributing the lubricant evenly over the entire bearing surface without loss.

The main drive cone has been fitted with a hollow spindle communicating oil holes delivering the oil to a series of felt packed grooves, conserving the lubricant and guaranteeing an ample supply.

To protect the ways from chips and dirt, leather wipers held by cast iron caps are attached to the knee, fitting close to keep all foreign matter out of the knee mechanism. The vise capacity has been increased for larger work and the vise has been strengthened in proportion to this greater capacity. A telescopic elevating screw is now furnished in place of the old type of straight screw that required a hole in the floor to operate in.

The elevating wheel shaft is mounted with a thrust bearing for ease of operation, and the outboard bearings for the knee and vise slides have been straightened to eliminate any chance of breakage and the slides themselves are grooved and protected with covered oilers so that "sticking" in the slides is practically impossible.

NEW SANDER

The Oliver Machinery Co., Grand Rapids, Mich., have marketed a new belt sander known to the trade as No. 126. This machine is suited to sanding and polishing off all kinds of line and edge mouldings, flat and straight surfaces, and for sanding and finishing built up pieces. The polishing of metal can also be performed on the machine.

The table of machine rolls on ball bearings this feature being patented. It is said to be so easy in running that a slight push will run it the full travel of 36 in., consequently it is lighter for the operator in his work. By means of counter shaft to take up the slack of the belt a flexible tension to suit work is maintained. The machine has capacity to take work any length and sand to center of 72 in. It will take work on the table 54 in. high and over floor plate 72 in. high. The table travels 36 in. with a vertical adjustment of 14 in. Sanding belts up to 10 in. wide may be used.

The table top is constructed of plain wood strips with 1 in. gaps between each strip. These gaps allow any dust that may accumulate to drop through keeping the table clean. The table is 32 in. wide by 96 in long and is equipped with an adjustable bar to hold the work to be sanded. The idler is adjustable up or down to height of work and can also be adjusted in a tilting position to keep the sand belt from running to either side of centers. The edging atachment is made to attach o power stand arm and is used for sanding edge work. It is composed of a belt plate adjustable table that can be tilted to 45 degrees up or down and can be raised or lowered at the will of the operator. It also has attachments for sanding form edge mouldings or irregular shapes.

OIL GROOVING MACHINE

The Fischer Machine Co., 310 N. 11th St., Philadelphia, Pa. have marketed an oil-grooving machine which is designed for cutting either straight or helical oil-grooves on the internal surfaces of bearings up to 15 inches in diameter and 15 inches inlength. In appearance, the machine resembles an engine lathe, except that it is provided with a crank mechanism like that of a shaper, which imparts a reciprocating movement to the boring-bar in which the oil-grooving tool is held. The machine combines the standard features of an engine lathe and a crank shaper, and six spindle speeds ranging from 14 to 111 revolutions per minute are available. The swing over the bed is 19 inches, and the net weight of the machine is 3,000 pounds.

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Depending on style and size of valve the method of holding differs—Swiveling fixtures are very useful—Machining a small valve and a Globe valve. Tool layout is very important.

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A quilt stitching machine which has a very novel and interesting system of gearing—A draw file holder of simple yet effective design.

Canadian Machinery Weekly Contest 43

Many are still trying to land their first scale, while others again have been successful in procuring more than one. The contest is surprisingly easy—Decide to try it this week.

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Pittsburgh tells us of happenings in that field—Toronto says that local market is very erratic—Montreal reports that business is a little stronger in tone.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Something To Be Proud of

IT IS not generally known that Canada can boast of having two of the highest concrete telegraph poles in the world. These are located near St. Catharines, and are used to carry high-tension power lines over the canal; the great height being necessary to allow mast room for ships passing through. The poles we speak of are placed without guy ropes or braces, which is in itself a point worthy of notice, for even a steel mast of similar height is usually guyed and stayed. The secret of the concrete pole's strength is a very elaborate system of steel rod reinforcing.

In the rush of other matters, we are apt to forget the debt we owe to construction engineers, who by their patience and experimental work have made possible the extensive use of concrete. Think of the huge buildings on which enormous saving has resulted through the use of this material. Think of the construction work happening all over the world at the present moment, using concrete as one of the chief materials. To enumerate all the uses of this material would serve no special purpose, except to prove our previous claim, that the world at large owes a debt to those responsible for the advancement and success of concrete. The process of perfection has taken a considerable length of time, but like any other great achievement, each step has acted as a spur to still greater efforts. Without concrete we should have to go back to the slow and laborious methods of building which have been practically obsolete for many years.

The Reward of Merit

WHEN a man performs a notable deed he is usually presented with some token, to show that his effort, or bravery perhaps, has been appreciated. For example, when someone is rescued from drowning under trying circumstances, the rescuer is often presented with a medal from the Humane Society. The actual value of such a medal is perhaps $1.00 so far as material and work is concerned, but as a token of bravery performed, its value cannot well be spoken of in terms of dollars and cents. Likewise, the Victoria Cross, and other lesser medals presented on the field of battle are small items of value commercially, but are beyond price when considered in the spirit in which they were given, and received.

There are men and women, however, performing deeds of merit every day who do not appear in the public eye. The nurse daily goes about her duty, the doctor likewise handles intricate cases without a murmur, and so it goes. They perform their tasks quietly and efficiently with no other thought of reward than their regular salary. Another phase of industry that is often forgotten is the railroad. Millions of people travel daily on railroads throughout the world, yet seldom give a thought to the responsibility of those handling and operating the traffic. The man at the telegraph key; the engineer at the engine throttle; the operator in the switch cabin; all have their responsible duties to perform, and each must function at the proper time. We could go on indefinetly down the line to the man responsible for the condition of the tracks on which the trains run, but the enumerating of each position would serve no special purpose. The fact remains, that here is a section of industry which deserves great praise.

The true caliber of such men, however, comes out in an emergency. It is then we see whether a man has a quick acting brain, or if he is merely a functioner. The Canadian Pacific Railroad, in fact, many other roads, have the right idea, for to show their men they are watching and appreciating their efforts, they publish at various periods, bulletins covering deeds of both merit and demerit. When a man performs some deed of note he is given so many merit marks, depending on the nature of the act, while he receives demerit marks for careless work. This policy tends to keep the men on edge, as they are naturally very anxious to show their ability. Let us take at random, a merit, and demerit incident.

In a recent report, front trainman Hardy was given 30 merit marks for the following reason. While on a passenger train at night, and with no wire communication, he started to walk to the next telegraph office to report his train in trouble on account of a washout. Noticing a canoe on the shore of Lake Superior, the district in which he was operating, he secured permission of owner, and used the canoe across Jack Fish Bay, this action saving considerable time.

Let us next pass to the demerit story. A certain car checker received 10 demerit marks for throwing a melon skin on the switchboard in a telegraph office window, this resulting in wire trouble.

Having quoted the two stories let us see where these men stand. The first fellow Hardy was not only on his job, but was thinking of protecting his passengers. The car checker on the other hand was not thinking of his job otherwise the melon skin would not have been in his hand during working hours. The act of throwing the skin is so foolish in itself that we need not make further comment. To place an actual value on announcements of this nature is rather difficult. It may mean a slight increase in salary occasionally, but each item in itself has no commercial significance. The true value lies in the fact that the publishing of such stories is a sign these men are either making or marring the safety of railroads. The reward of merit cannot be reckoned in currency and the correct type of man desires well merited praise rather than money for the performance of such acts.

The practice of publishing such lists of merit is one to be highly commended, and we could well adopt the idea to our own line of industry, the machine tool trade. If a man prevents an accident, or reduces the time on some particular operation, he should be credited with so many merit marks, while on the other hand if he is careless and spoils unnecessary work; causes accidents, or gets hurt himself through neglect, he should have so many demerit marks chaulked up against him. Let us start a movement in this direction, and through time it may develop into another means of reducing the accident toll.



MARKET DEVELOPMENTS



Reports from Different Markets Vary this Week

Galvanized Sheets Go Up in Price—Sheets and Plates for Car Work, etc., Move Freely—Machine Tool Market Dull—Steel Ingot Production on Upgrade—Finished Steel Prices Stiffening

THE REPORTS from the various markets this week are rather conflicting. Take Pittsburgh for example. They te l us that the improvement in the iron and steel situation continues, and that although the steel trade has a very rough road to travel before it reaches normal, still it is far from being in a bad state. In fact they say there is no reason to complan.

In the Pittsburgh market letter is shown an increase in the production of steel ingots, also a stiffening of prices in finished steel products, bar, shapes, sheets, and plates, being foremost in this respect. The recent freight reduction on iron ore has thrown a damper on the pig iron market, but such a condition is not expected to last long.

Montreal says that general trade conditions have more than held their own during the past week. A stronger tone has made itself felt and jobbers, dealers, and manufacturers are more hopeful than formerly. There is a possibility that the government will place additional orders for rolling, so that the mills will be able to keep going through the winter. Sheets and plates for car work, tank work, etc., are moving very freely in ths field.

Both in the Toronto and Montreal markets, there is a lull in the demand for machine tools. This week seems to be worse than the one previous, and about the only thing that is selling is second hand tools. Many dealers have good prospects on hand, which they believe are brought up to the buying point, but so far no business of importance has been closed.

The small tool market is just about the same this week. One notable point is that orders are coming in from all over. This shows that a general activity is being felt, not merely a local spurt. The fact that many orders received are from very small towns proves this theory.

The scrap meta' market is at a standstill. Nobody wants to buy. Even the dealers themselves refuse to stock up further, and from present outlook no improvement is in sight.

IMPROVEMENT IN IRON AND STEEL STEEL INGOT PRODUCTION INCREASES

Special to CANADIAN MACHINERY.

PITTSBURGH, October 20.—The improvement in the iron and steel situation that has been practically continuous since the middle of July is not interrupted, but in some quarters there is disappointment that the gains in the past few weeks, since the midsummer period ended, have not been more rapid. The proportionate gains, however, have not been bad at all. The steel trade had a very long road to travel from the state of extreme depression, altogether unprecedented in extent, that prevailed last June and July, and the fact that the trade is still very far from a condition of reasonable activity is due to the distance to be covered being large, not to the rate of recovery being particularly low.

Production Rates

Demand for steel is measured by production rates, since with exceptions that are almost insignificant from the tonnage standpoint, buyers are ordering steel only against actual requirements and the steel is being produced and shipped practically as fast as ordered. One exception is that buyers of sheets were moved to stock up a little by last month's advance in price, buyers being permitted to cover at the old prices if they would furnish actual orders and specifications (not contracts) and accept deliveries as rapidly as the mills cared to make them.

The monthly report of the American Iron and Steel Institute indicates that steel ingots were produced in September at the rate of about 17,000,000 gross tons a year, or 32 per cent. of capacity, against rates of 30 per cent. in August and 21 per cent. in July, while the rate at the middle of July was about 19 per cent.

Production of ingots thus far this month has been at above the September rate. Last week the Steel Corporation produced at the rate of about 40 per cent. and the week before that, the week ended October 8th, at over 45 per cent., but that was a particular bulge, the departments scheduled for operation producing considerably more tonnage than had been expected in the scheduling. Probably the independents did not operate nearly as well, but it seems safe to forecast that the October ingot production will prove to have been at above 35 per cent. of capacity, when the regular report is made early next month. That would represent a fair gain over the September rate, and would be nearly double the rate at the low point, in the fore part of July. Such a recovery is really rather rapid, and the disappointment felt in some quarters just now may properly be ascribed to unreasonable impatience.

An important point is that all the appearances indicate that whatever gains the steel industry makes at this time will be permanent. There is no overproduction or overstocking, and actual ultimate consumption is bound to increase rather than decrease, while production for several months past has obviously been at less than the rate of consumption, since there has been liquidation of stocks of steel in the hands of buyers, and of stocks of manufactures of steel in the hands of manufacturing consumers and distributors.

Price Conditions

On the whole, the structure of finished steel prices is tending to stiffen. This stiffening is not attributable to the usual influence, of demand exceeding supplies, for in every branch of the finished steel trade there is surplus capacity, but is due to the mills trying to get prices to a level with production costs. It may be asked why mills do this when they allowed prices to decline as they did, when costs were higher than they are now. The answer given in some well informed quarters is that the mills were endeavoring to find a level at which buyers would take hold freely. They considered losses as of secondary importance if by taking losses for a time they could produce a large increase in steel consumption and get things go-

ing again. It may have looked, in June and July, as if there was simply competition, perhaps unreasonable competition, but there was method in the price tactics after all. The whole country was calling for "liquidation" in prices, and early in the year the steel industry had been criticized in not a few quarters for standing in the way of progress, for refusing to deflate. Then the steel industry "came back" at its critics. There can be no argument about this, for price comparisons make a plain showing. The Department of Labor's index numbers of commodity prices at wholesale are generally accepted as indicative. The department takes average prices in 1913 as 100 and then finds that July prices stood at 148 while in August the index number came out at 152, showing a slight upward reaction and indicating that price liquidation, in general, had come to a halt. Now as to finished steel, a weighted average of the representative products, bars, shapes, plates, wire, pipe, sheets and tin plate, at the recent low point (before the September advances in wire and sheets) shows an index number, based on the 1913 average, of 135, which is well below 152 or 148.

This stiffening tendency in steel prices is most marked at present in bars, shapes and plates. Since early in August there have been sellers of all three products at about 1.60c, if the order were fairly attractive, but the number of sellers at this level has been decreasing. A fortnight or more ago the Carnegie Steel Company firmed up to 1.65c on bars and 1.75c on shapes and plates. Several independents are on that basis. The sellers at lower figures are not unlikely to withdraw their lower prices almost any day. They are not trying to fill up completely but would like to get something like a fair order book.

In sheets there is also what may be called a stiffening tendency. In fact, the majority of independents have already announced a $5 a ton advance, making their asking prices 2.50c on blue annealed, 3.25c on black and 4.25c on galvanized. The object, of course, was to drive in orders at former prices, which represented an advance of $5 a ton over prices prevailing in the fore part of September. In wire products, on the other hand, there have been occasional sales in the past ten days at prices prevailing before the advance of September 12, that advance having been from 2.50c to 2.60c in plain wire and from $2.75 to $2.90 in wire nails.

Pig Iron and Coke

As was to be expected, the announcement of a 28 per cent. reduction in iron ore frieght rates, referred to in this report of a week ago, has cast somewhat of a damper on the pig iron market. The reduction, effective October 20, restores the iron ore rates in effect prior to August 26, 1920, but as the furnaces have large piles of ore in yard they do not save anything at present, and cannot "pass on the reduction" to pig iron buyers. If they were disposed to do so, pig iron buyers would naturally prefer to wait so that prospective reductions in coke and limestone rates could also be passed on, while they would also like to wait until rates on pig iron from furnaces reduced. The market has been quiet in the past week and is quotable at former prices, $20 for Bessemer, $19.25 to $20 for basic and $21 for foundry, f.o.b. valley furnaces. The freight to Pittsburgh is $1.96. In 1914 it was 90 cents and in 1901 it was 75 cents.

The Connellsville coke market has softened in tone in the past ten days. Minimum prices are hardly any lower, but expectations of an advance, based on the lower priced offerings being absorbed and taken out of the situation, have been dispelled. Prompt furnace coke is $3.35 to $3.50, fourth quarter contract coke $3.40 to $3.50 and prompt foundry coke $4.25 to $4.75, depending on brand. It is only decidedly indifferent quality coke that can be had at $4.25.

POINTS IN WEEK'S MARKETING NOTES

The railways have not yet come into the market for steel, machine tools or supplies to any great extent. There is a possibility however that orders for rails will be placed with concerns in Eastern Canada in order that the mills may be kept running during the winter.

Sheets and plates for car work, tank work, containers, etc., continue to move very freely.

The machine tool market in Montreal and Toronto is rather dull, and what demand does exist seems to be for second hand tools. There is a tendency to study prevailing designs, improving on the various types as much as possible.

Steel ingot production is on the upgrade, the rate varying from 32 to 45 per cent. However about 35 per cent. would be a better average to take. The production last July was only 19 per cent. so this is quite an increase since that time.

Finished steel prices are stiffening, bars, shapes, sheets and plates being foremost in this respect. The Toronto market shows an increase in price on galvanized sheets this week, the boost being equal to 25 cents per 100 lbs.

The coke market has softened somewhat during the past ten days.

Machine tools are not very active these days. It's the old story of lots of prospects, but no actual buyers. Various dealers have even tested the market for signs of faith, but have been so far unsuccessful in landing a good sized order.

Small tools are still selling at a fair rate, the orders coming in from quite a scattered territory. This would point out that while business is not rushing, the activity seems to be general rather than local.

The pig iron market is nothing to boast of. Nobody wants to buy, this applying to both dealer and consumer. A change from the better in this market is not yet in sight.

TORONTO MARKET IS SPOTTY THIS WEEK

TORONTO, OCT. 20th.—To describe the market this week is very difficult, for, in practically every line there is a difference of opinion, even among the dealers themselves. Conditions can safely be termed spotty, and while one dealer may be feeling quite optimistic, another may be filled with a pessimistic grouch. For example, a dealer in machine tools told us that September had been the best month he had experienced this year, while another man in the same line said this was the poorest wek he ever hoped to pass through. This condition holds good in practically every section.

The Steel Market.

The only item of importance in this market is the advance on galvanized sheets which went into effect on the 14th. This increase was not expected until the 5th, but as one dealer put it, a day more or less makes no difference these days. The increase in price amounts to 25 cents per 100 lbs., and the reason given for the step up is that makers are trying to get at least production costs out of their product. Dealers claim that the costs of sheets, dropped quite a bit below actual cost of production, and that this, the second increase within a short time, brings the price to a more reasonable level. Apart from this, the steel market holds nothing of importance. There are the usual orders dropping in from day to day, but structural material seems to have eased off somewhat this past week. There is no other change in prices.

Machine Tools.

The machine tool market this week is not very good. Enquiries are not quite so numerous, and some dealers claim that the coming election is indirectly responsible for the lull. There is a tendency to shade prices, which is not going to improve matters much, and dealers would be well advised to quote a price, then stick to it. While orders are few and far between, there are some very interesting prospects being worked up. One dealer says that if he closes up even half his present prospects, it will more than carry him over the past few months, which have been very poor. The average dealer is not at all pessimistic, that is, not all the time. He may have his black moments but when he settles down calmly, he cannot help but admit that business generally is on the upgrade.

Small Tools.

If every section of the market was as steady as the small tool department, all would be well. Orders continue to arrive steadily, and the best part of it is

that these orders are coming in from a well scattered territory. As one dealer said, "This proves that the activity going on is general, not merely local." Through time these orders will become heavier, so that small tool dealers are not worrying much.

Scrap Metal.

The scrap metal situation is still very unsatisfactory. One dealer describes the trouble in this fashion. "Consumers have made up their minds that prices are coming down still further. We, as dealers, know that such is not the case, and as we are pretty well stocked up we refuse to buy further. In other words, both dealer and consumer are out of the market. We will suppose a customer came in right now, and offered to buy a considerable amount of material at present prices. If the order was exceptionally large it is questionable if we would sell him at present rates, but instead, we would offer him a limited quantity at the existing market figures. This procedure would no doubt surprise him, "but in my opinion," finished this dealer, "the consumer can purchase old material for less at the present time than he will be able to do for the next five years. While we would like business, we are not going out of our way to get it at present prices."

We have quoted this conversation in order that readers can form their own conclusions, and while no definite announcement of future price or policy was given us, it looks as if there is more to the scrap market than appears on the surface.

Taken as a whole the various markets cannot well complain. It will take time for the various sections to become settled and as we see it, there is still a considerable journey ahead. The market will see its ups and downs but from now on the downward move will be very much in the minority.

STRONGER TONE SHOWN ON MARKET WINTER RAIL ORDERS MAY BE PLACED

Special to CANADIAN MACHINERY.

MONTREAL, OCT. 20th. — General trade conditions have more than held their own during the past week. The stronger tone, shown more particularly the last two weeks, is still present, and jobbers, dealers, and manufacturers are alike very hopeful, as there seems to be a feeling that good business is in sight. The elections, of course, are tending to put a damper on the natural development of many business schemes. Thus if the slight improvement, noted during the past six weeks continues, or even if present conditions are maintained until after elections, general conditions would be very satisfactory. In short, business throughout the country is discernible, but elections are only temporarily holding matters up. The steel industry is on a fairly good basis.

The railways have not yet come into the market for steel, machine tools, or supplies to any great extent. Other large industrial plants have deferred coming into the market for supplies or equipment. But these corporations are apparently making plans for next year and are arranging a manufacturing schedule. This is evidenced by the larger number of enquiries and the increasing amount of business actually closed in various lines. Everything considered, conditions have greatly improved since midsummer and in some cases are much better than was expected.

Steel Market.

The principal rolling activities in Canadian mills at present consist in rail production. Prices prevailing are fairly good, but represent only a slight profit. At present the Government is considering some additional purchases which were not scheduled to be placed till 1922, owing to representations made by Eastern municipalities in the neighborhood of the Dominion Iron and Steel plants. These purchases, no doubt, will be split between the Algoma Steel and the Dominion Iron and Steel plants. Sheets and plates for car work, tank work, containers, etc., continue to move very freely. These orders cannot be definitely assigned to one or two channels, but evidently the steel which is being delivered on a large number of small orders is eventually finding its way into a large number of widely diversified articles.

One large jobber in steel, stated that up to the present, October has been by far the best month this year. The confidence of the consumer is maintained and everything points to a future with an ever-increasing volume of business. He made the comparison of "business" to a "sick man," who has recently become convalescent and that although no marked or specific improvement could be noted, general progress was good and the "pulse" of the "patient" is strong.

Pig Iron.

The demand for pig iron this week is lighter than the previous week. The price has been firm and an increase is expected. Ten days ago the furnaces notified their sales offices that an advance in price must be anticipated, but so far the advance has not taken place. However, it is expected at any time. The condition of the trade is such that no new furnaces are likely to go into blast, hence the low production continues. No encouraging reports have been received from the foundries.

There is a spirit of optimism, however, existing among foundrymen and if this improvement becomes permanent it will have its re-action in the additional demand for pig iron.

Machine Tools.

The general conditions which govern the machine tool market at the present time are really national in scope, and from week to week only nominal changes can occur. Reports from various dealers are not in accord. One dealer says that September was the best month since May, but that October is falling back somewhat. Another dealer states that business is very quiet. Other dealers, who handle supplies as well as tools, report a very fair volume of this class of trade. Second hand tools are more in demand than new tools. In fact new tools have been rarely moved during the last few months. A general tendency exists to reduce prices, thus getting machine tools down to a lower level than has been prevailing, although nothing definite has been done in this respect. There is also a determined effort to improve the design.

Small Tools and Supplies.

Reports from various dealers in the above market give one a very confused idea as to the real condition in this field of business. Some dealers say that not only is there an increase in the number of enquiries, but an increase in the number of orders, some of these from buyers who have been out of the market for some time. The quantities specified seem to be larger and a generally satisfactory condition exists. Other dealers report business poor and very quiet. The balance issue statements between these two extremes. Prices are gradually becoming staple and price lists are again being referred to with some security. Business is scattered, however, and an analysis of it conveys but little information other than that conditions of the last few weeks show an improvement over that of the last few months.

Non-Ferrous Metals.

Copper seems to be the most active of these metals. Up till about a week ago quotations were being daily increased by about ⅛ of a cent. This stiffening in price has continued during the present week until a re-action in the London market occurred. The latter part of the week the British quotations were down one pound per ton. This was reflected in New York markets by tending to check the upward trend of prices. Business has been somewhat better in this market during the last ten days. The market appears staple and prospects for the continued improvement are good. However, with non-ferrous metals there is a certain speculative tendency that sometimes upsets all calculations in the nature of a forecast. No special features during the week were noted. Awaiting the more active operations of the foundries, the scrap market still continues to be very quiet. Practically no sales are reported and prospects are not encouraging for the winter months.

In a recent address before the members of the building contractors' at Hamilton, Ont., G. Gander, of Toronto, said that the revival of the industry depended largely on the co-operation of the various crafts engaged. He looked for an early revival and predicted that the industry would soon become active, as times, he believed, were gradually improving all the time.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	34 00	39 00
Spelter	7 25	7 50
Lead	6 50	7 50
Antimony	7 25	8 25
Aluminum	28 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 88	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 20%.

Standard couplings, 4-in. and under, 20%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	7.75	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	8.00	....
Fleur-de-Lis, 28 B. W. G.	7.50	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	....
Premier, No. 28, U. S.	6 75	6 25
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.	.....	34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21	Atlas	.18
Peerless	.22	X Empire	.15
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.13½
X L C R	.16½		

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White..17 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute).	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

Toronto, Ont.—About half the usual staff of the Massey-Harris Co. went back to work a few days ago to fill a foreign order. Nothing definite is stated as to future prospects.

The Durant Motors Inc. are said to be considering locating a unit of the Durant chain of factories in Montreal. Nothing definite in this regard is settled as yet. The Toronto plant will be in the market shortly for a limited amount of equipment according to information received.

The Toronto Harbor Commission have given an option on ten acres of property at $60,000 an acre. The type of industry which proposes locating in Toronto is so far a secret although the very location chosen leads one to believe the new plant will be engaged in the metal working field.

Mechanical Leathers, Ltd., 126 Garden Avenue, Toronto, are moving on October 20th, to the Empire Building (3rd floor) 64 Wellington St. W.

Tube and Pipe Bending Co., 65 St. Nicholas St., Toronto, expect to make a sale of their machine to Page Hersey and may be in the market later for a new one, which would have to be made from their own blueprints.

W. H. Banfield & Sons, 372 Pape Ave., Toronto, report business in their line as very good. They have just taken on 15 more men and are expecting some nice orders shortly.

The E. T. Woodison, Co., Ltd., Toronto report business as showing a definite upward trend and expect great things from November. They look for good business in the east from their new Montreal warehouse.

Belleville, Ont.—The Springer Lock Mfg. Co. are erecting a large eddition to their present plant.

St. Catherines, Ont.—J. Birchall who was formerly superintendent of McKinnon Columbus Chorn Co., and McKinnon Industries Ltd., has formed a company at 114 Queenston St., to be known as the United Chain & Mfg. Co.. They will manufacture tire chains and automobile parts.

Woodstock, Ont.—The Kirch Mfg. Co. Sturgis Mich., have located a branch factory here. They manufacture curtain rods and other articles used in draping of windows.

Chatham, Ont.—The Weaver Canadian Co., has been formed in Chatham by the parent American Co. and certain property has been purchased which will be used for factory purposes.

Chatham, Ont.—Fuel oil is now being used with success at the Corhill Bros. brick plant. The new burner used is the result of seven year experimenting and a combination of steam and fuel oil is employed. The bricks produced are said to be of a more uniform quality.

Calgary, Alta.—A permit has been issued to Maclin Motors for the erection of a garage on the south side of Eleventh Ave., the cost to be around $24,000.

The Feldspar Glass Co., Ltd., intend building a factory at Oshawa, Ont. This new plant will be built in units, the first to be 60ftx160ft. They will manufacture high grade glass and by-products and expect to be in operation in a few months. 50 men will be employed to start with but the staff will be enlarged as the plant increases.

Stanley F. Jacob, R. R. No. 3, Tillsonburg, Ont., wants to purchase the following equipment. One lathe and one drill press. He does not state what size, but those interested can soon find out by getting in touch with Mr. Jacob's.

The Ontario Diamond Drilling Co. of Sudbury, Ont., has been incorporated with $40,000 capital to manufacture diamond drills and other machinery. Thos. H. Hale: Albert Carlson and Geo. M. Miller are the men interested.

The Eastern Townships Smelting and Refining Co., which has been incorporated with a capitalization of $2,000,000 has obtained opinions on certain sites in Sherbrooke, Que., and it is said that construction is expected to start in the near future. According to reports, arrangements have been made for the smelters to handle the output of several of the largest producing properties in the west, special attention being paid to copper and asbestos.

The monthly tonnage report of the United States Steel Corporation, made public a few days ago shows 4,560,670 tons of unfilled orders on hand September 30th. This is an increase from unfilled orders on August 31st, which were 4,531,926 tons. This is the first increase in unfilled tonnage since July 1920.

Robt. Gardner & Sons Limited of Montreal, report business excellent. Mr. Braidwood, general manager for the above firm, informed this paper that orders are continuing to pour in, and they will be unable to give delivery on new business till February. All indications point to this being their biggest year since entering business.

Montreal, Que.—J. E. Wilder has been awarded the contract for the erection of a six-storey fireproof garage at the corner of Ontario and Jeanne Mance Sts. for the Bramson Auto Service Ltd. Reinforced concrete will be used in the construction of this garage.

The Brown Boggs Co. Ltd. of Hamilton report 9,000 sales during the past two weeks. Mr. Lavery the sales manager, informed this paper that they expect a steady increase in sales from now on.

The Kingdon Smith Co., Hamilton report a lull in general repair work, but increased activity in contracting. Several substantial orders have materialized recently.

F. Sloley, of the Hans Renold of Canada Ltd., reports that Mr. Hans Renold and his son have been touring the United States with the object of establishing an American agency. A charter has been issued, and this concern have incorporated with a capital of $25,000. C. C. Renold; J. R. Cantley; F. Cunningham Jr.; and Attorney Steel and others are the gentlemen interested. Mr. Sloley says that his Canadian business is moving along nicely and that he has no reason to complain.

Clare Bros. & Co. Preston, Ont. say that they are having a large demand for castings. This firm is busy at present making castings for theatre seats. They are also producing school and office furniture castings and say that they expect to get some passenger car work in the near future. They fully expect to keep their foundry running full blast all winter.

Norman C. Butterfield & Son, claim to have discovered a very large tract of almost pure iron. This discovery lies on the shores of Lake Athabasca. Analysis shows that the new find is 64.36 pure iron. It is said that 150,000,000 tons have been measured off, while 5,000,000 tons in the shape of loose blocks are lying on the surface of the ground ready for shipment. So far freight charges seem to be the chief difficulty.

The American Bushings Corporation, of Marysville, Michigan, a subsidiary of the Pressed Metals Co., of Canada, reports the receipt of orders which will insure the immediate doubling of production of the American plant. October production will run to 1,300,000 bushings, while the November schedule calls for 1,500,000. The officers of the company are hopeful for a continuation of the present active and profitable period. The American company last May with orders totaling 300,000 bushings per month, was increased to 500,000 in the next month, and there has been a steady increase in production since.

Preparations are under way for the third annual gathering of "School" men which will be held in Toronto on the 4th and 5th of November. Arrangements, this year, are being made on a much larger scale than in previous years and it is expected that among the long list of distinguished guests will be one or two of International reputation. Graduates are coming from all parts of Canada and the United States and it is expected that upwards of one thousand will attend the Reunion. At the Annual Meeting board questions relative to Uuiversity Policy, Technical Education and professional matters will be discussed.

It is reported that 200 men will be back to work at the Goodyear Tire and Rubber Co. plant, situated at New Toronto, Ontario, commencing about October 20th. The surrounding districts also report that a substantial amount of building is being done and an industrial activity is being created in that district.

The Allatt Machine & Tool Co., formerly situated at 109 Adelaide St. W. have transferred their office and equipment to 201 Queen St. E. Toronto. Mr. Allatt states that although business is not rushing with him he has a constant amount of work regularly passing through his shop especially in the lines of cylinder regrinding. He further stated that he expected that his business would increase this next month.

The Town of Georgetown, Ontario, is calling for tenders on a water system to include construction of reservoir, pump house, screen chamber, weir, mains, ditches, etc. Tenders are also asked for pumping machinery, two units of 400 gal. capacity each. All tenders to be in not later than Oct. 28th. Chipman and Rowers, Mail Bldg. Toronto are the engineers in charge.

While no contracts have as yet been awarded it is generally believed that the Federal Government will shortly let the balance of the Welland Canal Job in order to provide employment this fall and winter.

On Oct. 13th., at the C. P. R. Windsor St. Restaurant, the Engineering Institute of Canada, Montreal Branch, entertained six of their members, who were, later in the day, to have the Honourary Degree of Doctor of Laws conferred upon them by McGill University. The names of the gentlemen, who are well known to the readers of Canadian Machinery, are:—

W. W. Colpitts, New York City, Consulting Engineer; C. V. Corless, Sudbury, of the Mond Nickel Co. Ltd.; G. H. Duggan, Montreal, General Manager of the Dominion Bridge Co. Ltd.; Phelps Johnson, Montreal, Associate Engineer for the Quebec Bridge; Alexander MacPhail, Kingston Professor of Engineering, Queen's University; G. F. Porter, Walkerville, Associate Engineer, Quebec Bridge. The speeches were largely references to the advancement of Engineering in the last quarter of a century and its importance as one of the basic factors upon which modern civilization is built and sustained.

The Jenssen Engineering Products, Ltd., is the name of the new firm which has absorbed the Power Equipment and Supply Company. The offices of the new Company are in the Power Building, Craig St. West, Montreal. Four Engineering specialists comprise the personnel of the firm, L. N. Jenssen, J. C. Corcaran, F. W. Ward and J. A. Smith. The firm was organized as a body of consulting engineers who undertake to analyze practically all industrial problems; make recommendations and supply materials, machinery, equipment, buildings, etc. They specialize in pulp and paper development, hydro electric development, coal handling plants, grain elevators, manufacturing plants and in fact, practically all industrial lines with the exception of the textile industry. They also go into the design and supplying of special equipment, as well as standard lines. They are prepared to design and erect complete plants, and to make a scientific study of plants in operation with the idea of reducing overhead manufacturing costs.

The Eugene F. Phillips Electrical Works, Ltd., have arranged to remove from Montreal and locate in Brockville, Ontario. The reason for the change is said to be because of congestion in the Montreal plant, business having increased to such an extent that the Montreal factory has long since been outgrown. An agreement has been made whereby the company is to be granted a site of 132 acres and to have a fixed assessment of $20,000 for ten years. In turn the company agrees to locate its main manufacturing plant in Brockville, which will include the erection of buildings costing between $2,500,000 and $3,000,000, to give employment in normal times to between 500 and 600 hands and to distribute an estimated annual payroll of $500,000. The products of this concern are copper, electric wire, and cable, and in the manufacturing process they will require from 1,000 to 3,000 horse-power which will be obtained from the Hydro-Electric Power Commission. The consumption of this amount of power will cut in two the rate of other local consumers of power in Brockville. Work will be commenced on the first unit of the plant within four months, this being a rolling mill for the copper products.

The Canada Glue Co. Brantford, report some improvement in general conditions. This is significant in view of the fact that glue is produced to day in more different grades and qualities than the lowly and long-suffering pickle, and has contact with many industries. While at first glance one would say that furniture and allied trades form the essential market for glue as it is generally known, this is not altogether the case. Certain grades are used in the textile and paper industries; in making emery wheels and other abrasives for metal and woodworking, for hats, and boots and shoes and wherever there is sticking or sizing to be done. Glue, like the safety pin, has a wide range in usefulness, and it is important when an improvement is noted in its demand.

In going out of the horse vehicle business to devote his entire plant to the production of motor cars, an Ontario manufacturer points out that in selling buggies to farmers over a long term of years only ten per cent. is paid in cash, while the great majority usually took two annual payments. On the other hand, in purchasing a motor car, seventy-five per cent. of the farmers plank down the cash, while the remainder is credit. The life of a motor car, as used by the average farmer, is about six years, while a good buggy easily lasted twenty years. It was about five years ago that the credit system was introduced in the motor sales business and while the idea made for greater volume it has not eliminated any of the troubles of the business. It is estimated that in an average county having no exceptionally large centre of population, there are on an average, 2,000 cars being paid for on credit.

W. R. Yendall, Manager Canadian Richards Wilcox, London, has returned from a business trip in the West. He reports that conditions in British Columbia are better than he expected. Greater activity in building is evident there than in the East. In the prairie provinces the deflation in wheat prices has been discouraging and anticipating a rise, farmers stopped hauling grain for a while. As seems customary under such conditions, payments are somewhat backward. The political campaign is assuming some importance, reports from rural communities indicating marked development in strength of organizations in the farmers' interests. It is generally felt that there will be marked improvement in alll business with the coming Spring.

A very creditable Made-in-Hespeler exhibition was held in Hespeler this last week. The displays included furniture stoves, furnaces, plumbers; boilermakers; machinists; and blacksmiths' tools, stamped and enamel ware, textiles, lightning rod equipment—and naturally a baby show.

Ordered By The Million

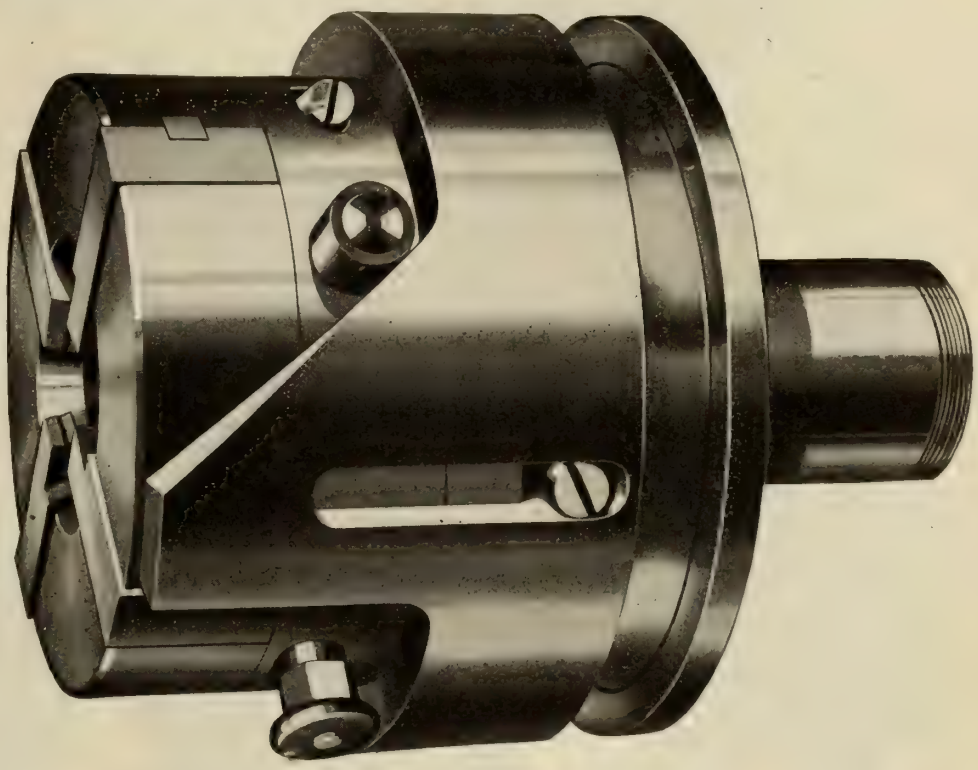
That's the way Studs for Automobiles are ordered from the Chapman Service Company. An order for one million Studs at one time is no novelty to these people, who specialize on Automobile Studs.

They Have To Get Quick Production Without Waste

How Do They Do It?

Geometric 9-16-inch Rotary Die Heads are the means they use for cutting ½-inch diameter, 20-pitch thread on alloy steel studs.

A Geometric Rotary Die Head Self-Opening and Adjustable



Tested for accuracy, there were only nine rejections out of 4,500 Studs, threaded at both ends.

WELL, THEY ARE GEOMETRIC DIE HEADS—
THAT TELLS THE STORY OF THEIR WORTH.

GEO MET RIC

Right on the Lead

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:
Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Toronto, St. John, N.B., Halifax, N.

In a Frame Building, 24 x 36 feet, A. B. Jardine & Co., Limited, Hespeler, had its origin 50 years ago. In fact the firm may be said to be in the first years of its second half century, for the founder, A. B. Jardine, began operations in 1870, though he did not go into the production of blacksmiths' tools until one year later. The business is today carried on by his four sons, James, President; Peter, Vice-president: Andrew, general manager, and John, secretary treasurer. At the Made-in-Hespeler exhibition last week, the display of products made by this firm probably occupied a space larger than that in which Jardine, the elder, began operations. And what surprise would be his if he could see the extent of the display, representing the development that has occurred in that time? His original intention had been to manufacture shuttles and other accessories for the spinning trade, but he realized in time that he could not hope to compete with English firms who had been many years in the business. Woodworking machinery claimed his attention for a while, but finally blacksmiths' tools became his specialty.

In those days there were probably ten blacksmiths where to-day there is one blacksmith and two public garages, and as a rule the maker of tools had also to get out and sell them. The years brought their changes both in methods of manufacture and selling and to-day the Jardine line embraces machinists', blacksmiths', boiler makers' and pipe fitters' tools and equipment, and the Canadian market has become considerably larger than that which could be comprehended by horse power days of fifty years ago—days of that more personal contact which is now represented to a larger extent by definite standards of quality.

Munition demands of the great war found the Jardine plant particularly well equipped for the production of shells. As manufacturers of taps, dies, and other precision machinery the exacting requirements of the emergency were soon met and a satisfactory output was maintained.

Asked what in his opinion had been the secret of their development in their business, John Jardine replied: "Secret? There is no secret. Quality is not a secret. It is an ambition. There you have the whole thing in a nutshell. That, and confidence in the line you are manufacturing. But you can't have one without the other."

The Canadian Detroit Twist Drill Co., Walkerville, has completed its initial year as a Canadian Industry. The infant has developed nicely in the matter of organization not only of its plant, but also in its relation to the Canadian market. Some particular attention has been devoted to the production of the Double-D rolled drill, developed for use on such work as hard drop forgings, cased steel castings and other alloy steels tough and difficult to drill. The tool is the perfection of 30 years' development. The high speed steel stock used in this drill is a high tungsten, high chrome steel, subject to careful chemical analysis before acceptance. A special hot rolled process is employed by which the flute of drill is formed in straight from the bar stock and which, it is claimed, produces a refinement and uniformity of the grain of the steel and gives a compression at the outer edge and in center which, after the drill is hot twisted in the final form, brings that portion of the steel, which is best adapted for unusual service, to the vital parts of the drill—the center and outer edges. At the same time the thickness has that uniform increase which is obtained in high grade drills of the milled type—a feature not secured in drills made from profile stock. The fluted blank is then reheated and twisted in a specially designed automatic machine, thus avoiding the inaccuracies of hand twisted drills. The graduated thickness of the web from the point to the end of the twist provides unusual strength of high torsional mixture.

A Few Days Ago a generator under test at the Canadian General Electric Co., Peterboro, Ont., exploded, causing considerable damage, and one death. Since that time the matter has been gone into carefully and an official estimate places the damage at about $150,000. The generator, valued at over $50,0000, is wrecked, a number of other generators being built in its vicinity are seriously damaged, and several machines and the instruments and records of the test department are destroyed. The generator, engineers say, was being operated at 100 per cent. over speed, about 1,000 revolutions a minute, when the accident occurred. This means that a given point on the rotor was travelling at the rate of about four miles a minute.

Robt. Gardner & Co., one of the large general machinist concerns in Montreal, are fairly busy and have orders enough on hand to keep them going until February.

Standard Machinery and Supply Co., Montreal, who are dealers and agents in machine tools, etc., report that September is the best month they have had this year, although the volume of business for that month was not in itself large.

Ingersoll Rand Co., of Montreal and Sherbrooke, Que., who are not doing anything at their plant yet, and who are selling accumulated stock, report that September was the best month they have had this year and present indications with them are such that they are feeling a good deal more optimistic than they have for some time past.

PERSONAL

G. T. Milne has recently returned to Great Britain from South Africa, where he acted temporarily as senior trade commissioner for Great Britain, for Canada and Newfoundland. He will leave London on Oct. 19th to take up his new duties.

John R. Shaw, vice-president of the Canadian Linderman Co. Woodstock, Ont., has been selected vice-president of the newly incorporated Canadian Austin Machinery Ltd. Woodstock.

A circular, issued by the Dominion Steel Corporation, says that the Spring Hill Collieries are transferred to the management of Arch. MacCall, general manager of the Nova Scotia Steel & Coal Co. J. J. MacDougall assist. general manager of Ocoria Coal Co. becomes assistant general manager for the Mainland district, M. Blue becomes general superintendant, for the district. A new man Thos. L. McColl of Edinboro has been appointed chief mining engineer for the district. This centralization of all the mainland collieries and plants under one executive will make for better efficiency.

OBITUARY

David W. Davies, general manager of the Canada Iron Foundries plant, Fort William, died suddenly the other day. Mr. Davies was 53 years old. He was born in Barmouth, Wales, and at an early age emigrated to Canada and took up his residence in Montreal. In the Quebec metropolis Mr. Davies entered the employ of the Grand Trunk Railway. He served with that company for several years and later became identified with the Canada Iron Foundries Ltd., and in several capacities while in the employ of the company resided at Three Rivers and Montreal. Some ten years ago Mr. Davies was chosen to take charge of the Fort William plant.

BUILDING AWARDS SHOW HEAVY DECLINE

Construction awards throughout Canada for September showed a large falling off from the total for the previous months, standing at $19,565,700, compared with $36,307,200 for August, and $20,820,100 for September, 1920, according to a report prepared by MacLean Building Reports, Limited. The value of contracts awarded during the first nine months of the year reaches a total of $185,377,800, as compared with $213,290,000 during the same period last year. If price recessions in labor and materials are taken into consideration the volume of new construction this year is estimated at about $5,000,000 greater than last year's total.

During August the wholesale price index of 48 building materials receded to 285.7, a drop of 16 points for the month, making a total of 117.3 points or 29 per cent. from the high mark of May, 1920. The peak prices reached fifteen months ago were 183.8 per cent. above 1913 costs, whereas material prices are now 100.2 per cent. above 1913 levels.

Aikenhead's

THE HOME OF FINE TOOLS

We can supply everything in tools



No Keys or Collets Required

The WAHLSTROM

A Chuck that Never Slips

This Automatic Drill Chuck increases production because being automatic it is not necessary to stop the drill press spindle to change tools. **Tool changes can be made in exactly two seconds.** All tools are centered automatically—a feature which alone means a 50% labor saving on some classes of drilling.

Then there is the **Walhstrom** clutch to consider. Its instant-acting jaws close with a grip that positively cannot slip. Yet there are no interlocking jaws to chew up your drills. The jaws grip on the **side** of the shank. And they grip whether the tangs are good or broken. Think what this means!—longer life, less tool expense!

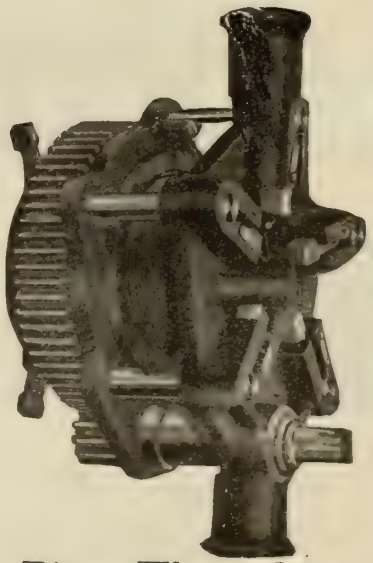
Wahlstrom Chucks are made in two different styles. One style holds No. 1, 2 or 3 Morse Taper Shank Drills—with or without a tang. The other style is made in three sizes, which hold all sizes of straight shank tools from ¼ to 1 inch.



International Electric Glue Heaters

The "International" not only keeps the glue in more perfect condition but soon saves its cost in time saved and in more economical current consumption. The one quart heater consumes only one cent's worth of current per day, while the 13 quart consumes less than the ordinary electric flat iron. Three heat—full, medium and low.

Ask for particulars



Pipe Threading TOOLS

Beaver Toledo, Jardine, Oster—we have them all. Tools that possess unusual efficiency and economy features. A receding motion of the cutter makes a perfect die with half the usua· exertion and with no friction whatever.
Let us explain them in detail.

AIKENHEAD HARDWARE LIMITED

17 Temperance Street, TORONTO, ONT.

PATENTS
Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

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MACHINERY
BERTRAMS LIMITED
SCIENNES EDINBURGH

"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd
Brantford, Canada

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SPECIAL MACHINERY
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Speedy Service—Phone Adelaide 2
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Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
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PILFER-PROOF CASE

The increase in the pilferage of goods in transit in the United Kingdom has led to the invention of a special packing case which is said to be pilfer-proof. Among other advantages claimed for it are: 1.—The additional cost of construction is small. 2.—It is 100 per cent stronger than ordinary cases. 3—As no battens are employed, the shipping measurements are not increased, consequently a saving in freight is effected. At a demonstration before the London Chamber of Commerce a sample case is said to have "resisted all efforts to get into it for 20 minutes, and could not be reclosed without leaving very clear signs of its having been forced."

THE ACTUAL COST OF RAILWAY EXECUTIVES

THE salaries made by railroad officials has always been, or at least has been made out to be, a deep mystery. Hints have been thrown around widely as to the fabulous sums made by railway executives, so that the following matter which appeared in a little sheet called "Talking Points" is indeed refreshing. This pamphlet, which is issued periodically by the Central of Georgia Railway, presents some comparative figures for operation costs of 1917 and 1921. As the subject is of interest to Canada generally, the figures to follow are well worth noting. Here is what they have to say:

Occasional references to "huge salaries" that are alleged to be paid to railway executives may, unless corrected, have the effect of creating an erroneous impression in the public mind. As a matter of fact, out of every dollar expended by the railways in 1920, executive and general officers received less than one cent. Therefore, if these executives and general officers had served the railways free, the amount saved thereby would have been, comparatively speaking, very little, certainly not enough to have an effect upon either freight or passenger rates.

To be sure, there are high-salaried executives and general officers in the railway world. It is safe to say that they earn their money and that their compensation would be even larger were their energies devoted to other lines of endeavor requiring like ability and imposing equal responsibility. To be exact, the average salary of general officers in 1920 was $5,542; that of division officers, $3.319. The average pay of passenger locomotive engineers in 1920 was $3,-310—only $9 less than that of division officers.

In order to secure the services of men of ability and ambition, railways must give an opportunity for them to earn incomes comparable with other kinds of business and professional activity. If railways are not sufficiently developed and managed, their services will deteriorate, and consequently, become more expensive to the public.

Wage Reductions

The public prints recently have placed much emphasis upon the huge sums that will be saved to the railroads by the 12 per cent cut in wages authorized by the Labor Board. Headlines teem with big figures, such as $400,000,000 and other sums that stagger the imagination and are really beyond the comprehension of the average mind. So much has been said that the public may lose sight of the fact that all these "savings" and "reductions" and "decreases" are yet to come instead of actual. Here are some figures from the other side of the sheet:—

It is now costing the Central of Georgia Railway Co. $487 per month to repair locomotives, as compared with an average cost of $187 in 1917. This is an increase of 160.4 per cent. It is now costing an average of $17 per month to repair freight cars, as against $5.81 in 1917. This is an increase of 192.6 per cent.

The average revenue for handling each passenger in 1917 was $1.03. In 1921 it was $1.59, an increase of 56 cents per passenger or 54.3 per cent; while the operating expenses per passenger increased from 71 cents in 1917 to $1.55 in 1921; an increase in expense of 118.3 per cent.

The operating revenues from each ton of freight handled, increased from $1.32 in 1917 to $2.40 in 1921, an increase of 81.8; BUT the operating expenses for each ton of freight handled, increased from 92 cents in 1917 to $2.13 in 1921; an increase of 131.5 per cent.

These figures show why decreases in expenses are absolutely necessary if the railroads are to survive; and why the wage cut of 12 per cent is merely a relief and not a cure for the transportation situation.

MACHINE TOOL TRADE BETTER THAN IN 1913

Despite a heavy falling off in tonnage of general machinery imports and exports of Great Britain in 1920 and 1921, as compared with 1913, the trade in machine tools has actually increased, according to figures compiled by the American Consulate in London, England. Imports of machine tools during the first six months of 1921, says the report, were 10 per cent. above the figure for the first six months of 1913, while in exports the corresponding increase was 52 per cent.

Machine tool imports were 3.63 per cent. of the tonnage of all machinery imports in 1913; 16.8 per cent. in 1920; 6.36 per cent. in 1921. Similar figures for exports show 2.47 per cent. in 1913; 4.95 per cent. in 1920; 4.69 per cent. in 1921. In value, these figures would be slightly increased, due to the fact that machine tools average higher in unit value than the balance of the machinery entering into British imports and exports.

Textile machinery formed the largest single item shipped out in 1913, 1920, and 1921, with 88,082 tons, 21,139 tons, and 79,282 tons respectively. Agricultural machinery provided the largest tonnage of imports in 1913 and 1921, with 18,007 tons and 4,911 tons respectively: and, with 4685 tons in 1920, stood second to machine tools, with 7176 tons.

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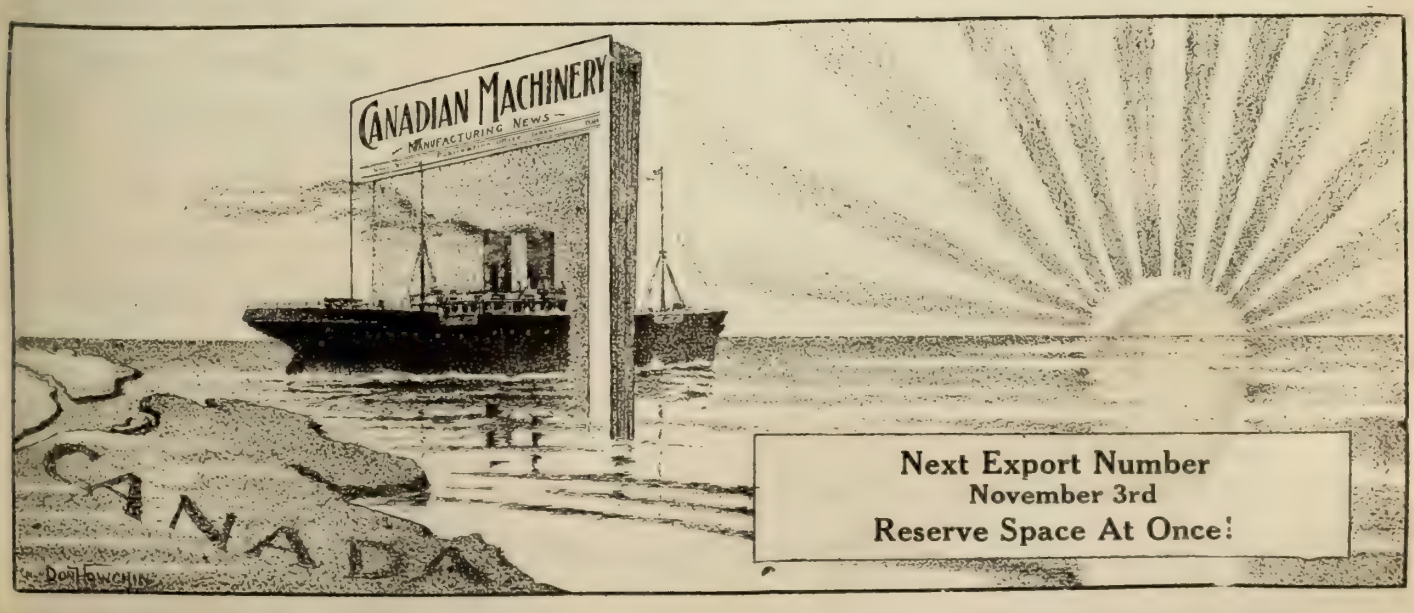
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1—16″ x 8′ Prentice, Taper, collets and oil pan.
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30—No. 1 1/2 Star G.F.H., 1 1-2″ Cap., Power Feed Turret, oil pan and pump.
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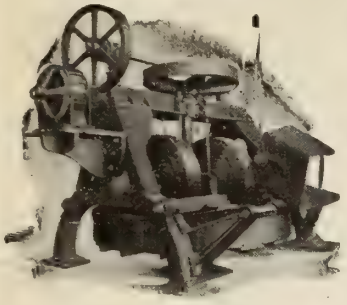
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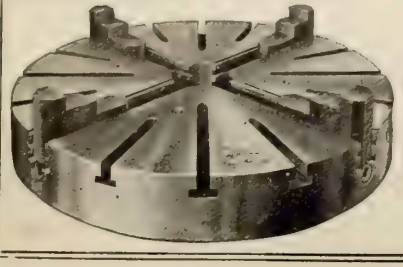


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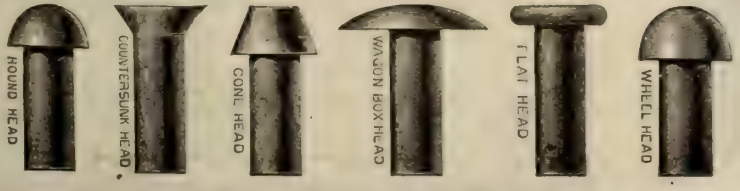
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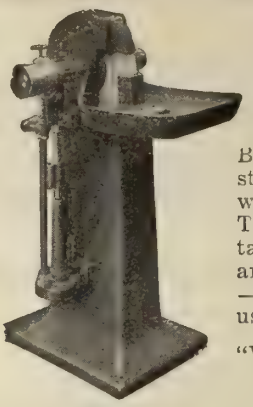
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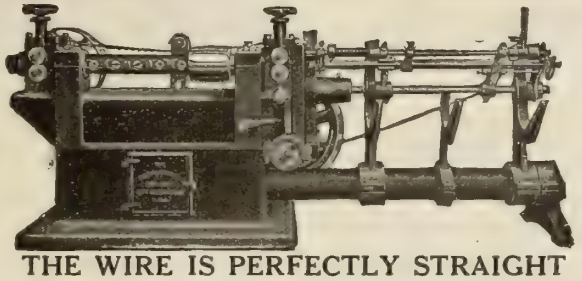


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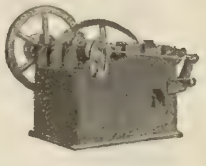
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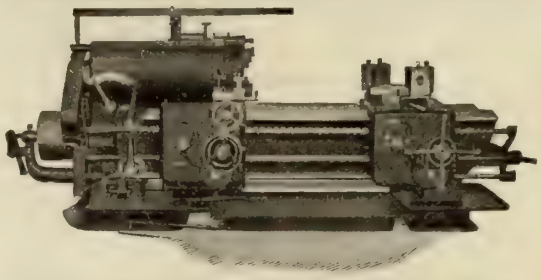


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Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

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International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., B. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que
Ont.

Diamonds, Importers.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springf

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bellevue Industrial Murnace Co., Detroit, Michigan.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.
Cunningham Co., R. H. Walkerville, Ont
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Spring

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Renold (Hans) of Canada, Ltd., Montreal, Que
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Skinner Bros. Mfg. Co., Inc., St. Louis.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting
Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co. Duncan Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation
Diamond State Fibre Co. of Can., Ltd Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
[illegible] Rack Co., Brantford, Ont.

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto. Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oils
Canadian Oil Companies, Ltd., Toronto Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Imperial Oil Ltd., Toronto. Ont
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd. Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co, Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plumbers' Brass Goods
Furo Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
StreNger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn,
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto,
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R. Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal. Q.

Screens
Can. Wire & Iron Goods Co., Hamilton.

BUYERS' DIRECTORY

Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
[illegible] & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton] neering Service, Ltd., Hamilton, t.
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

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Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

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Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
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Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

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Can. Fairbanks-Morse Ltd., Montreal. Q.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.

Washers
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
All-Weld Company, Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

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British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

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The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont.

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MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co. Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

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The Garlock-Walker Machinery Co., Toronto, Ont.
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R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.

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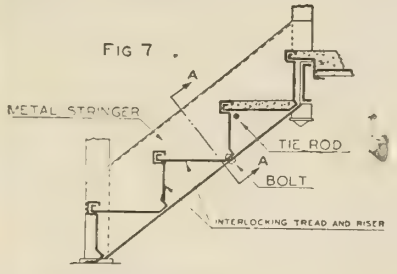
A rearrangement of your patterns might cut their cost 25 per cent.; a different method of molding them might double your production at no increase in molding cost. We can advise you and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

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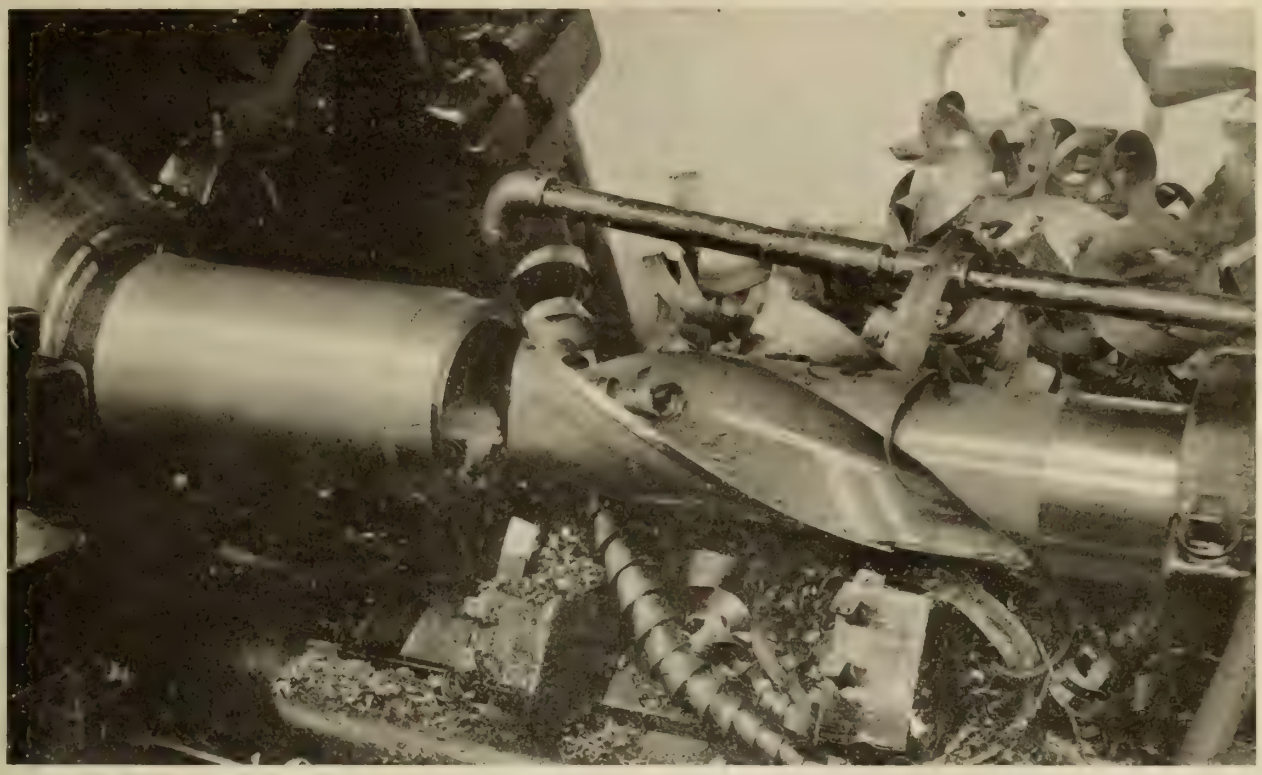
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CANADIAN MACHINERY
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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page



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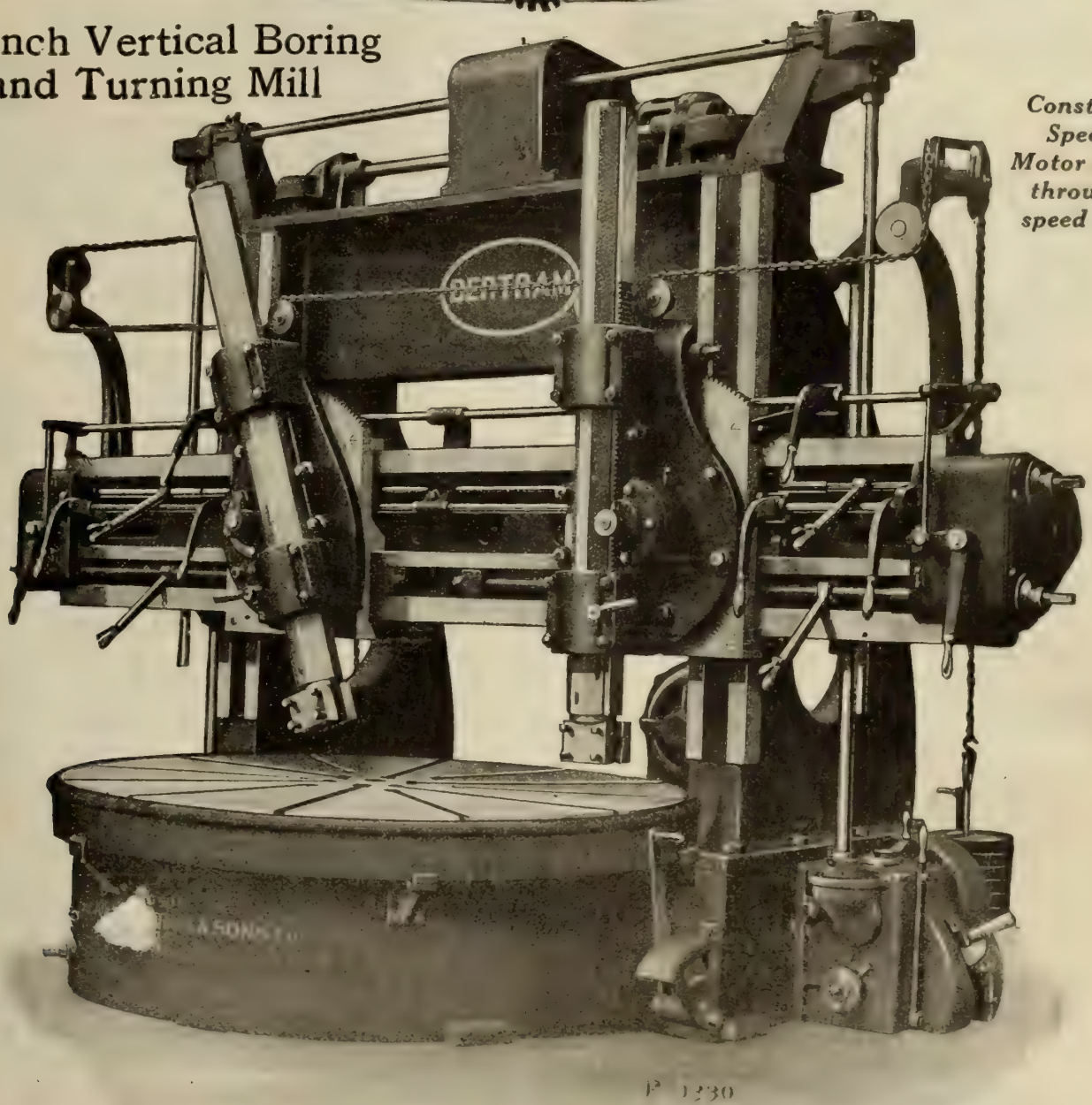
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The BERTRAM Page

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P 1230

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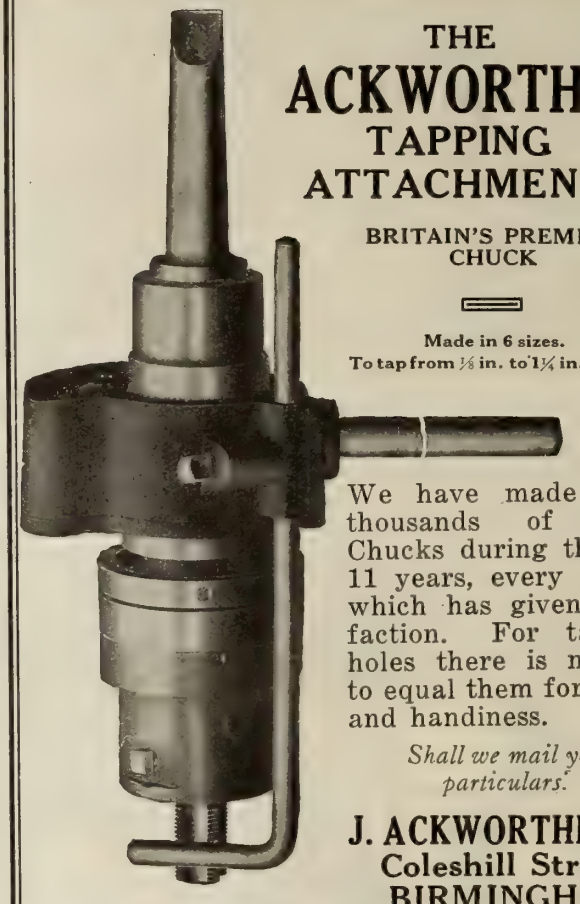
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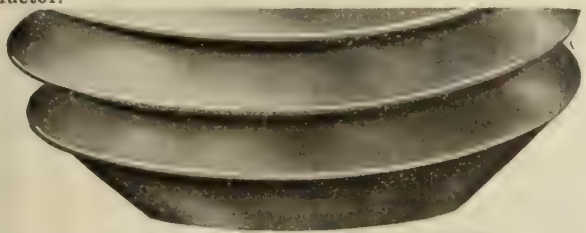
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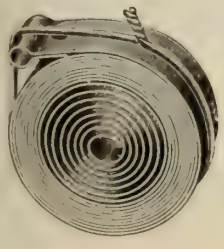
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WIRE
BARNES CANADIAN SPRINGS
STEEL

Better Springs!

For over half a century the policy of our plant at Bristol, Conn., has been—"Better than the Average." and the Canadian plant will hold to the same principle. If you require Springs for uncommonly severe duties—or for better service on ordinary work, get our quotations. All sizes for all purposes.





FIFTY YEARS OF QUALITY

The Wallace Barnes Co.
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GASOLINE TANKS
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TANKS
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Heavy and Light Steel Plate Construction erected anywhere

Acetylene and Electric Welding

STEEL PLATE CONSTRUCTION
T.I.W.

THE
TORONTO IRON WORKS
LIMITED
HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

Made in Canada

Beams and Channels Angles, Zeebars, Rounds and Squares and Flat Bars

Open Hearth Alloy Steels

Chrome-Vanadium, Chrome-Nickel, Nickel

All These Steels We Supply in HOT ROLLED BARS

We Also Furnish in
BLOOM, BILLET AND SLAB FORM

Sulphuric Acid **Nitre Cake**

The Quality of ALGOMA Open Hearth Steel is traditional for its quality throughout Canada. You can rely upon it on every occasion

ALGOMA

Steel Corporation, Limited

Sault Ste. Marie, Ontario

Sales Offices:

MONTREAL
606 McGill Bldg.

TORONTO
Bank of Hamilton Bldg.

NUTS

S·A·E and A·L·A·M

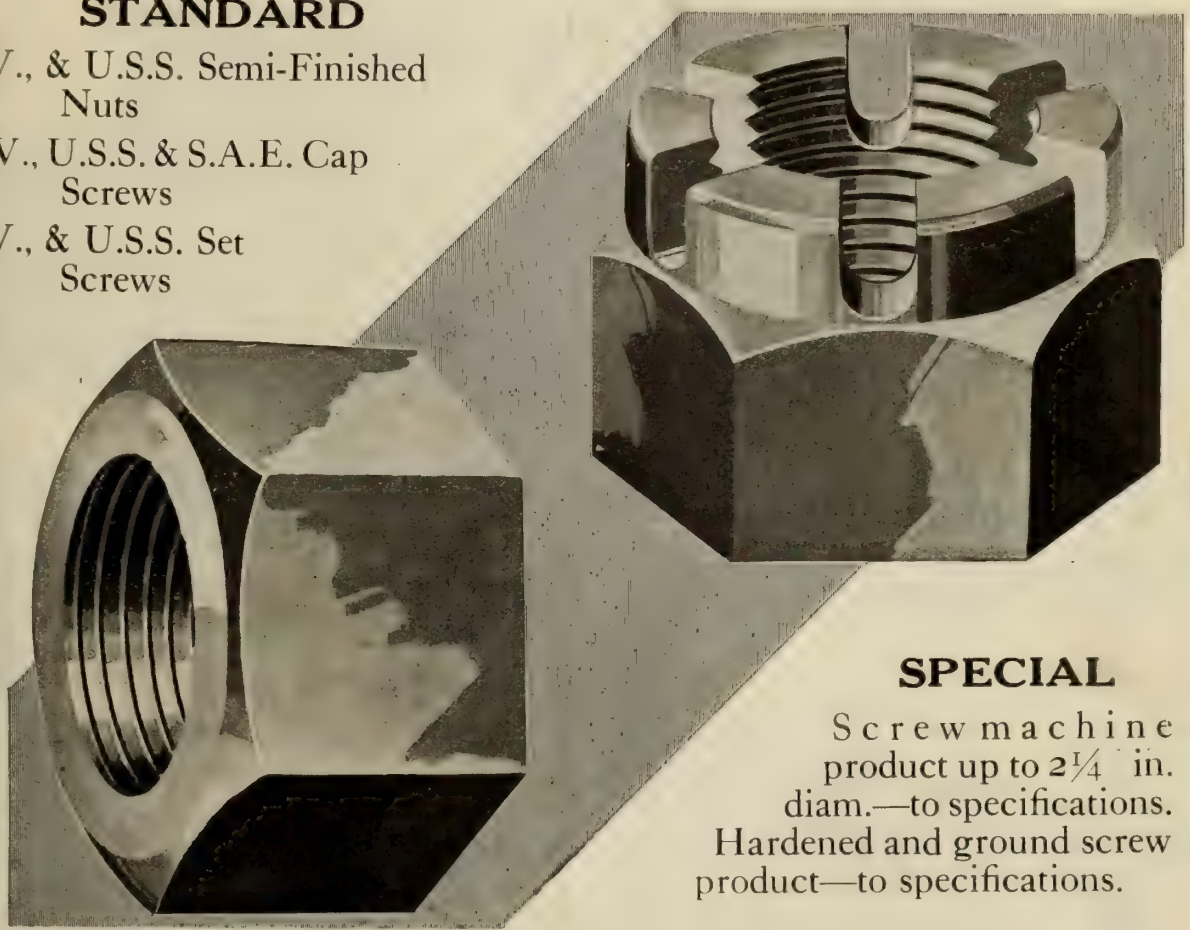
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STANDARD

V., & U.S.S. Semi-Finished Nuts

V., U.S.S. & S.A.E. Cap Screws

V., & U.S.S. Set Screws



SPECIAL

Screw machine product up to 2¼ in. diam.—to specifications. Hardened and ground screw product—to specifications.

THE NATIONAL ACME COMPANY

MONTREAL, QUE.

ANNOUNCEMENT.

WM. BEARDMORE & CO., LTD., OF SCOTLAND,
are prepared to supply to the trade, through their Canadian office, the following products at manufacturers' prices:

Steel Shafting and Forgings up to all sizes. Tyres and Axles. Lap-welded Furnaces, corrugated or plain. Sheets. Ship and Boiler Plates and Sections. Boilers, Scotch and Locomotive. Centrifugal Pumps, direct connected and belt driven. Semi-rotary Wing Pumps. Lighting and Generating Sets.

IMMEDIATE DELIVERY

WILLIAM
BEARDMORE
AND COMPANY · LIMITED ·

285 BEAVER HALL HILL
MONTREAL - QUEBEC

HEPBURN
PATENT FEED PUMPS

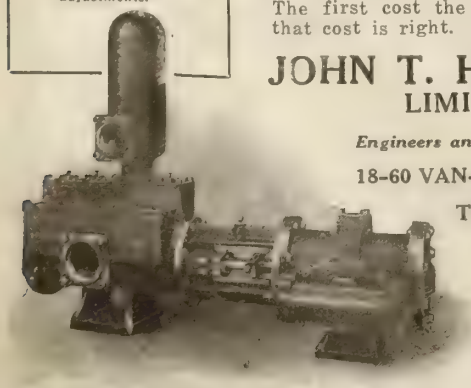
First cost the Whole Cost!

The great thing about using a Hepburn Steam Pump is that once you've paid for it you don't have to keep spending additional money for adjustments.

THE Hepburn Steam Pump is built to Pump—and Pump it Does. The steam chest is located on the side of the cylinder and the low ports automatically drain away all condensation. This prevents water hammer in the cylinder; insures a perfect cushion for the steam piston, and gives a full stroke all the time.

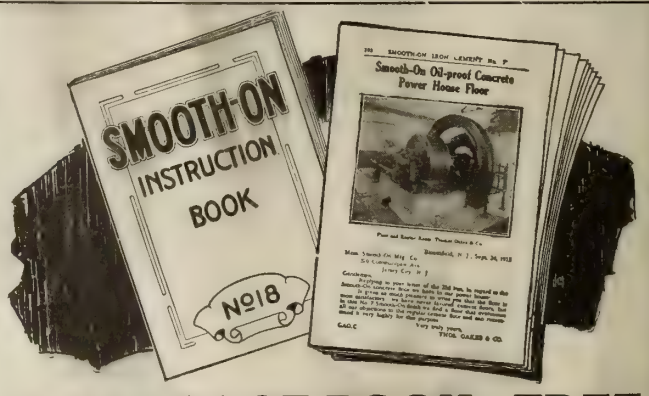
No levers or tappets to get out of order.

The first cost the whole cost and that cost is right.



JOHN T. HEPBURN
LIMITED
Engineers and Iron Founders
18-60 VAN-HORNE ST.
TORONTO, CAN.

We also make: Vertical Engines, Compressors, Winches. Cut Gears, Derricks, Brick Machinery Hydrants, Forgings, and Grey Iron Castings.



A 144 PAGE BOOK—FREE
Written *by* and *for* Engineers

This latest edition has been completely revised—new material inserted, new repair problems described.

The Smooth-On Instruction Book No. 18 is the most valuable book of its kind. Its 144 pages contain sound practical and money-saving advice on various power plant and boiler room repairs. Its compilation has been contributed to by engineers the country over.

Your copy is waiting—all we want is a word from you and we will send it along.

SMOOTH-ON MFG. CO.
Jersey City, N. J., U. S. A.
Canadian Distributors:
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Montreal - - - Toronto, Canada

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Have you a problem in the metal stamping line? We can make your dies, tools and jigs, stamp out the parts, assemble, finish, pack and ship your product, direct to you or your trade.

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TURRET LATHES
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For Chucking and Bar Work

AUTOMATIC TURRET LATHES
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REAMERS, "SOLID ADJUSTABLE"
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BORING BARS
With Adjustable Cutters

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For Time Recording in Factories

Separate Catalogs on each Product

Send for the ones you want

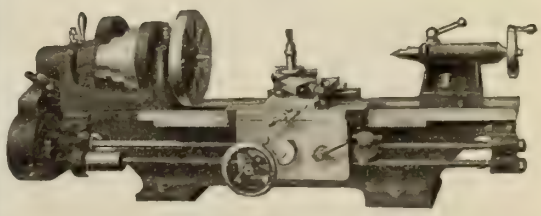
GISHOLT MACHINE CO

1207 E. Washington Avenue

Madison, Wisconsin, U. S. A.

"DALTON SIX"

Type B-6



"The Small Lathe for the Big Job"

Actual Swing - - -	8¼ inches
Between Centers - -	18½ inches
Collet Capacity - - -	¾ inch

Send for Bulletin BC-651

Also Manufacturers of Type B-4 Lathes

Dalton Manufacturing Corporation
Sound Beach - Connecticut - U-S-A
Cable Address - "Aledal - Stamford"

THE JOHNSON FRICTION CLUTCH



Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

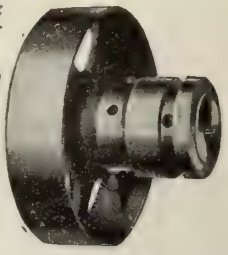
Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building." and our Yellow Catalog.



FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

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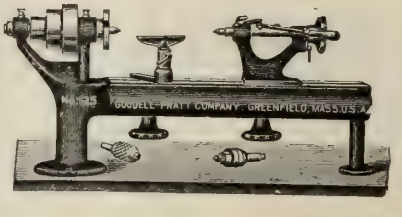
The Factory--The Foundry-- The Machine Shop

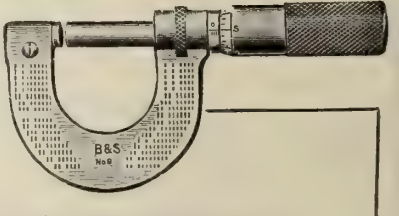
FOR the Factory and the Machine Shop we can supply you with the most up-to-date tools by makers such as Brown & Sharpe, Starrett, Goodell-Pratt, etc. For the Foundry and Constructional purposes we carry large stocks of Bar Iron, Machine Steel, Cast Steel, and miscellaneous lines of Asbestos Sheathing, Roofing, etc.



Victor Hack Saw Blades Cut Fast

Through the toughest metals these durable blades cut fast and true. They stay sharp longer than ordinary blades and produce more work for the same cost. Made in three grades, fine, medium and coarse. In ordering please mention the kind of work blade is required for.





English Millboard

For building purposes we can supply this high quality English Millboard in 3-16 in., 1-4 in., and 5-16 in. Ask for samples and prices. Also Asbestos Sheathing.

RICE LEWIS & SON, LTD.

Established 1847

19 Victoria St. - Toronto, Ont.



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

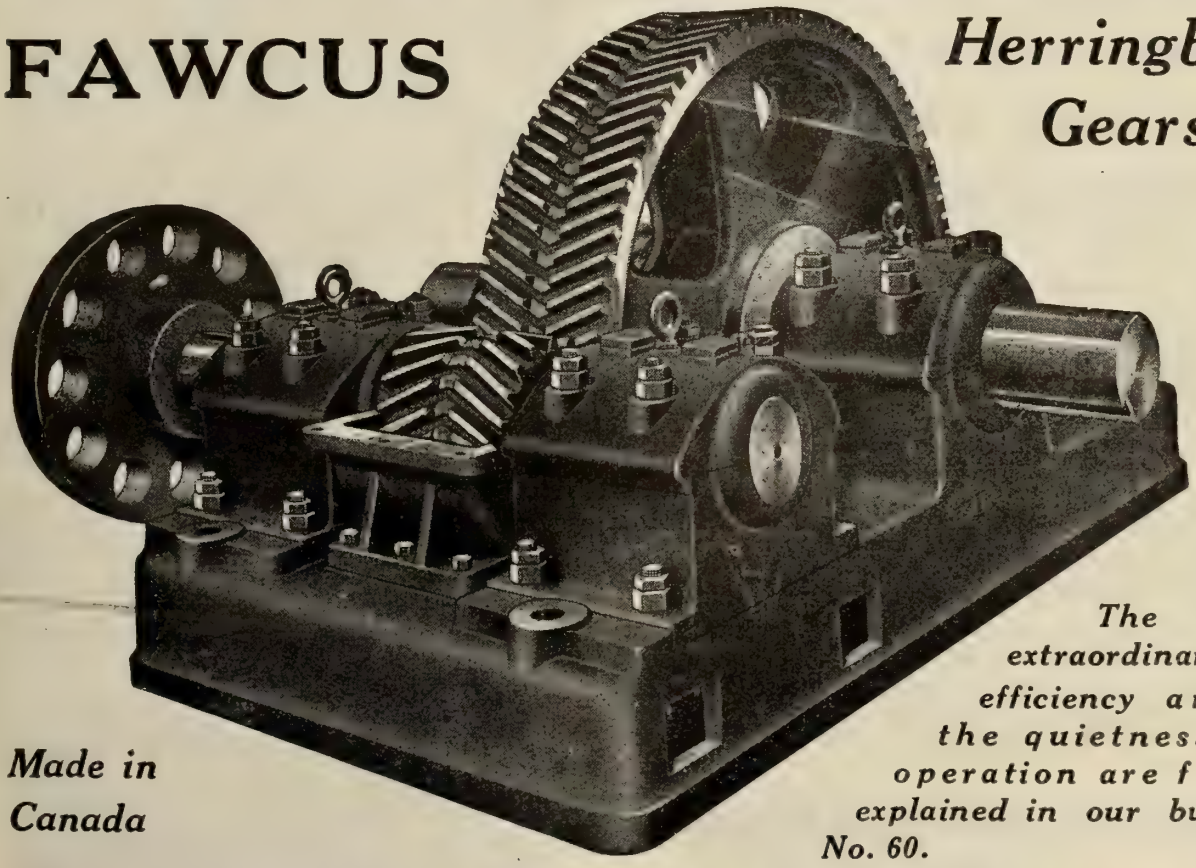
Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

FAWCUS

Herringbone Gears

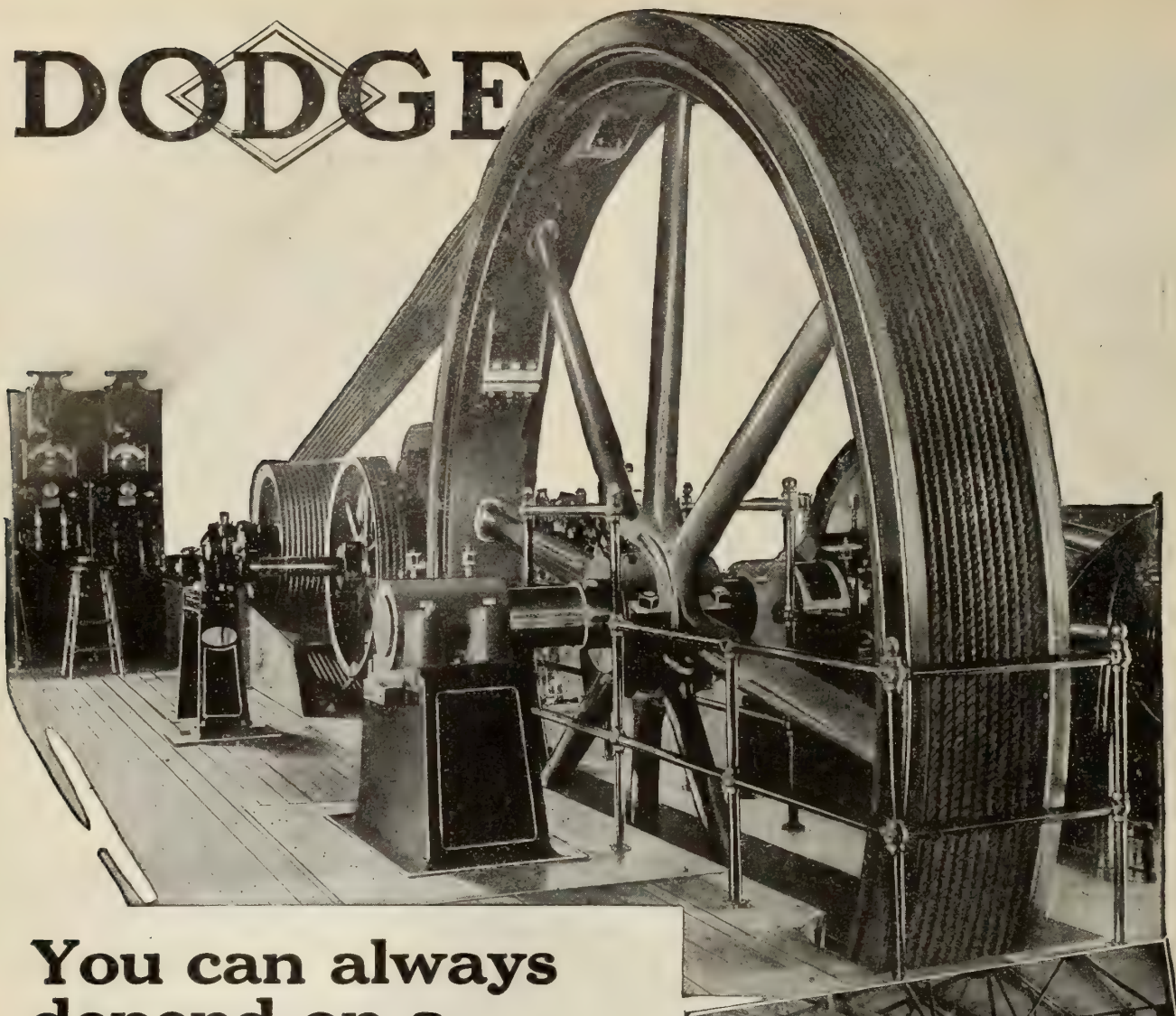


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The extraordinary efficiency and the quietness of operation are fully explained in our bulletin No. 60.

DOMINION STEEL PRODUCTS CO., Ltd. BRANTFORD, Ont.

DODGE



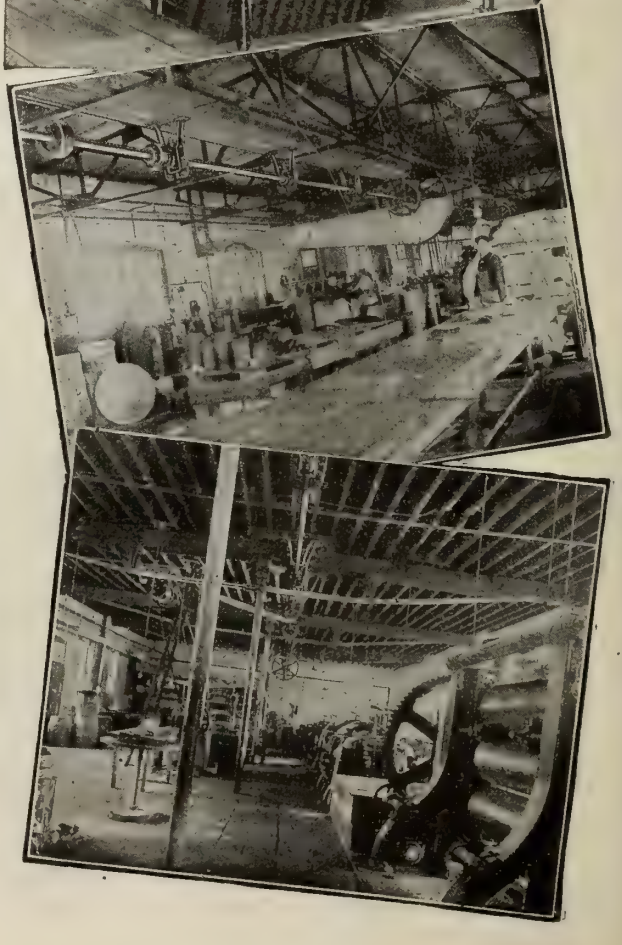
You can always depend on a Dodge Rope Drive

Dodge Rope Drive dependability is not spasmodic. Time-tested in hundreds of plants, Dodge Rope Drives have always stood up to every demand that continued hard service can make.

And service-assurance is not the only reason why a Dodge Rope Drive is the logical prime mover in any shop.

The economy of buying rope by the pound against replacing belt of excessive width is of equal importance—as is also the fact that the rope delivers more nearly 100% of the engine power than does the belt.

However short the center-to-center distance; however complicated the problem of carrying power around corners or from floor to floor, a Dodge Rope Drive may be depended upon fully and continuously to be the simplest and most economical means of accomplishing the desired results.



Dodge Manufacturing Company of Canada, *Ltd.*

Works and Head Office, Toronto, Ontario
Eastern Branch, Montreal, Quebec

ELK
BRANDS FIRE BRICK

Our Brands:
"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
"Keystone"
"M.D. Elk"
"Rotex"
"Elk Dust"
"Keystone Dust"
"Rotex Dust"

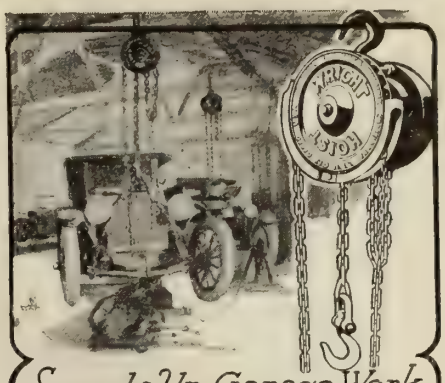
Elk Service Means Lower Costs

There are two important things to consider in buying firebrick—**price and quality.** When you buy ELK BRAND FIREBRICK we take a keen, unprejudicial interest in seeing that you get the class of firebrick you need. If a moderate-priced brick fills the bill we never recommend a brick of higher quality at higher price.

We make bricks in all standard sizes and shapes.

Elk Brands Firebrick are reliable. Specify them in your next order.

Elk Fire Brick Company of Canada
Limited
Sun Life Building, HAMILTON, ONTARIO



Speeds Up Garage Work

This is the high-speed hoist that is doing so much for the garage men throughout the country by saving their time. With it a load can be lifted in half the time required when an ordinary hoist is used.

Let us tell you more about it.

WRIGHT MANUFACTURING COMPANY

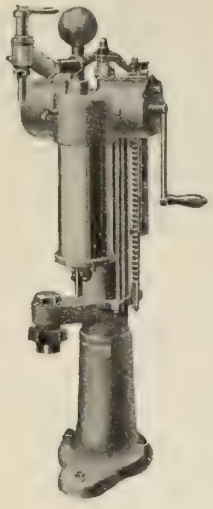
Lisbon, Ohio, U. S. A.

Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force cannot replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every month will keep you posted on the latest developments for machinery equipment.



Better Gasoline At Less Cost

The installation of Bowser Piston-Type Measuring Pumps for storing and handling gasoline in your plant will mean economy in every sense of the word. By measuring accurately all disbursements, they keep an absolute check on consumption. Pumping the gasoline directly into the distributing container, they eliminate spillage in transfer.

Bowser Equipment also effects worth-while savings in gasoline costs—enabling you to buy in carload lots and at quantity prices.

Bowser stores gasoline safely underground, while pumps may be located at any convenient points. Their accessibility saves time and labor.

Write for Illustrated Booklet C-13

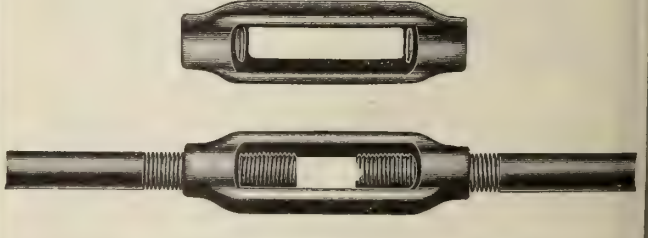
Bowser Equipment is MADE IN CANADA by
S. F. BOWSER CO. Ltd., 66-68 Fraser Ave., Toronto, Ont.

BOWSER ESTABLISHED 1885
PISTON-TYPE MEASURING PUMPS



CANADA FOUNDRIES & FORGINGS LIMITED

Drop Forged Steel



SOLID—NOT WELDED

16 Sizes { with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.

Bilton

GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

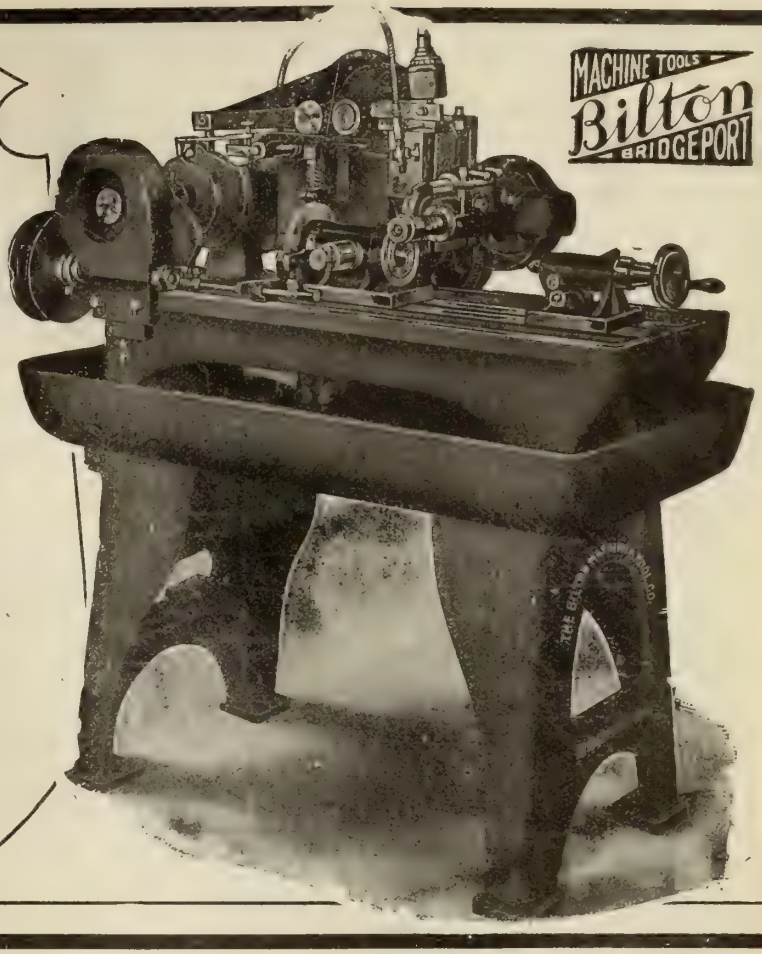
Big business everywhere is adopting the Bilton for high production on accurate work.

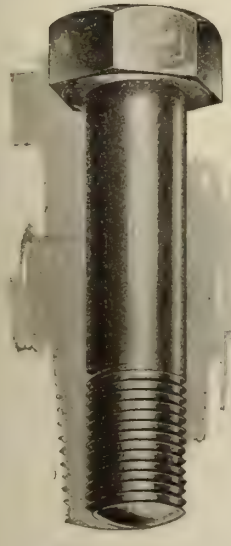
May we send you our catalogue?

Bilton Machine Tool Company

Bridgeport, Conn., U.S.A.

Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co., Ltd.
M. Mett Engineering Co.

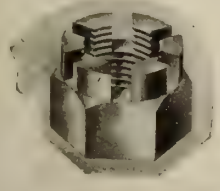




ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

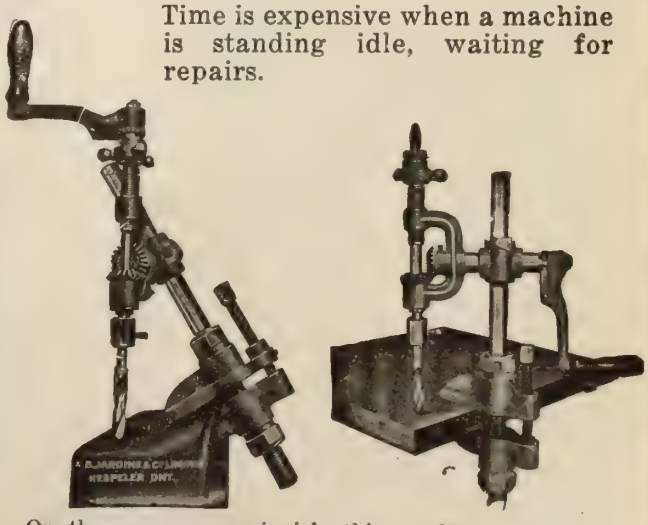
GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.

Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.

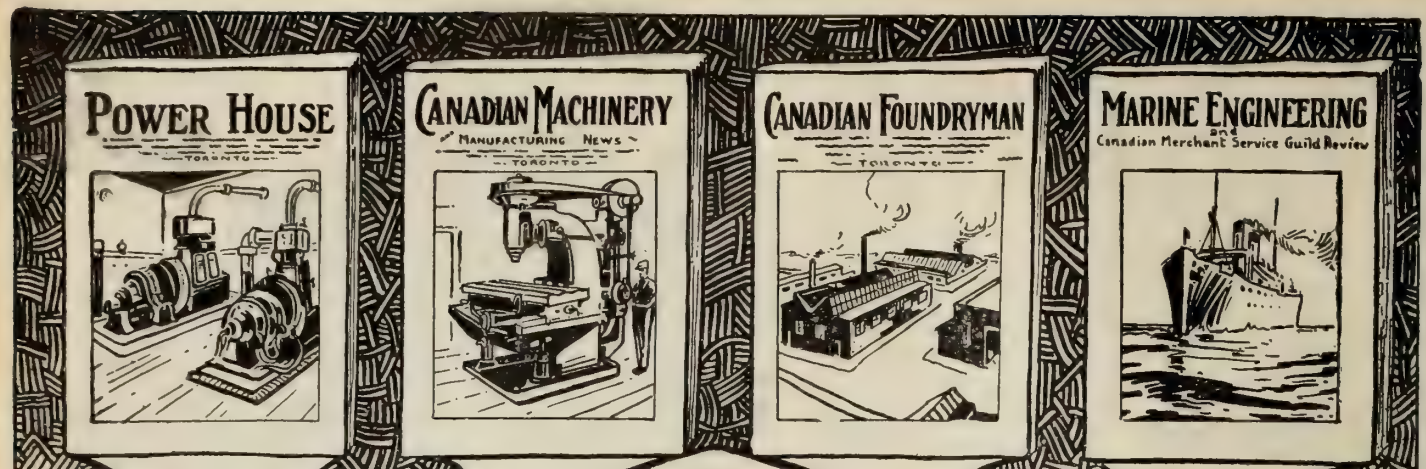


On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO



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Self-Promotion And Sales Promotion

Are you interested in any of these fields—power—metal working —marine? As a manufacturer, or purchasing agent, as a superintendent or foreman, as an ambitious mechanic or engineer?

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They will keep you strictly up-to-date in all branches of mechanical engineering. Edited by practical men. Cheerful, inviting, instructive, authoritative.

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Serves the power plant engineer—Steam, Electric, Refrigeration, Hydraulic.

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Covers the metal working field—serving shop executives, purchasing agents and owners. First-class mechanical paper and market paper combined.

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Monthly—$2.00 per year.
A paper for the foundry owner, superintendent and foreman. Claimed by its readers to be unexcelled.

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Monthly—$2.00 per year.
Interprets marine engineering in its broadest sense, serving the shipbuilders, navigation companies and their officers. (The editor holds an extra first-class B.O.T. certificate.)

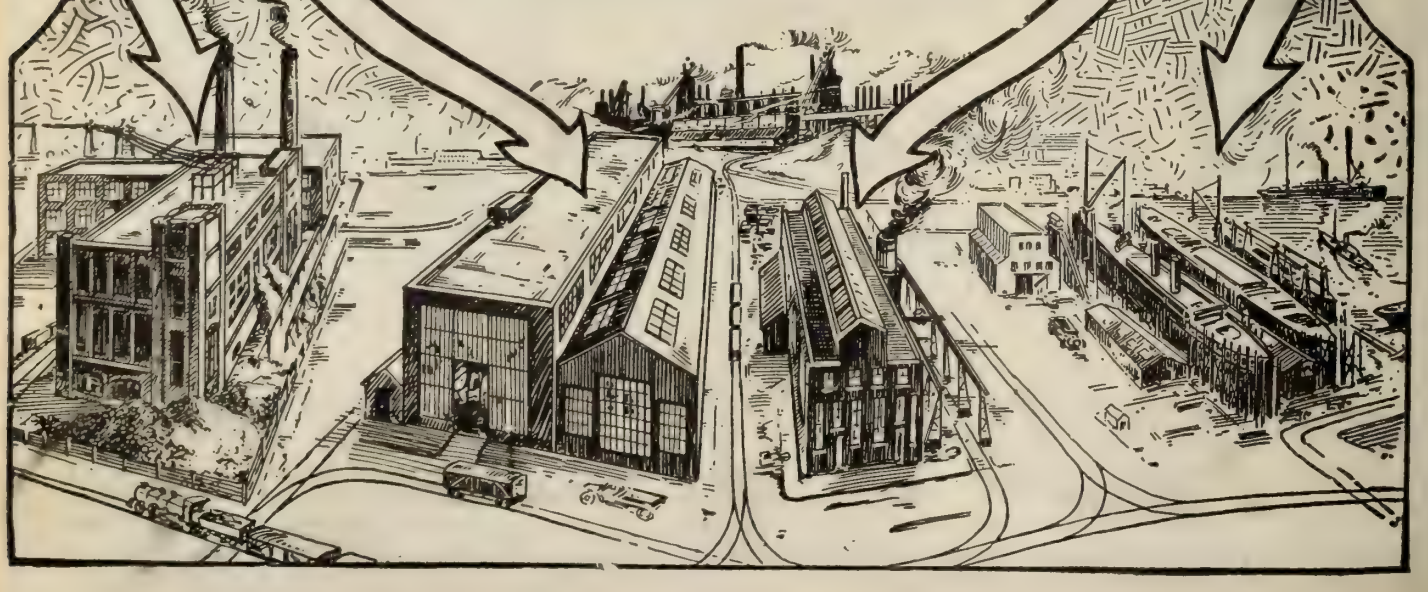
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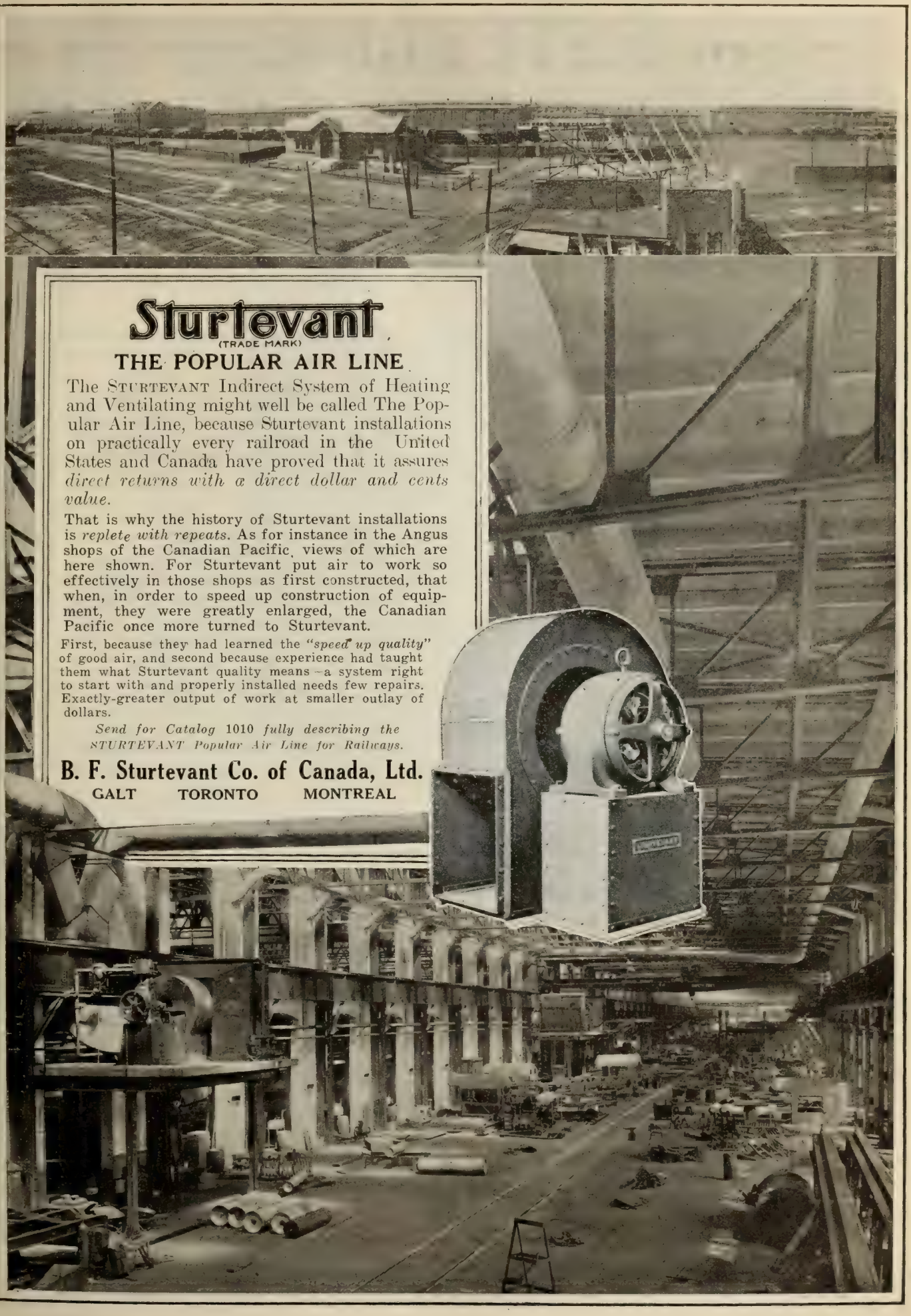
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A company whose idea of service has made it the largest concern of its kind in the British Empire.
Thirty years' experience and dozens of practical men in your own line, stand ready to serve you. Let them! Subscribe for your paper to-day.

Men with selling problems will find a profitable tip in the statement made by a prominent manufacturer recently, "I use MacLean Publications because I am satisfied that papers with such a high standard of editorial excellence, MUST have an influential following."





Sturtevant
(TRADE MARK)

THE POPULAR AIR LINE

The STURTEVANT Indirect System of Heating and Ventilating might well be called The Popular Air Line, because Sturtevant installations on practically every railroad in the United States and Canada have proved that it assures *direct returns with a direct dollar and cents value.*

That is why the history of Sturtevant installations is *replete with repeats.* As for instance in the Angus shops of the Canadian Pacific, views of which are here shown. For Sturtevant put air to work so effectively in those shops as first constructed, that when, in order to speed up construction of equipment, they were greatly enlarged, the Canadian Pacific once more turned to Sturtevant.

First, because they had learned the *"speed up quality"* of good air, and second because experience had taught them what Sturtevant quality means—a system right to start with and properly installed needs few repairs. Exactly-greater output of work at smaller outlay of dollars.

Send for Catalog 1010 *fully describing the STURTEVANT Popular Air Line for Railways.*

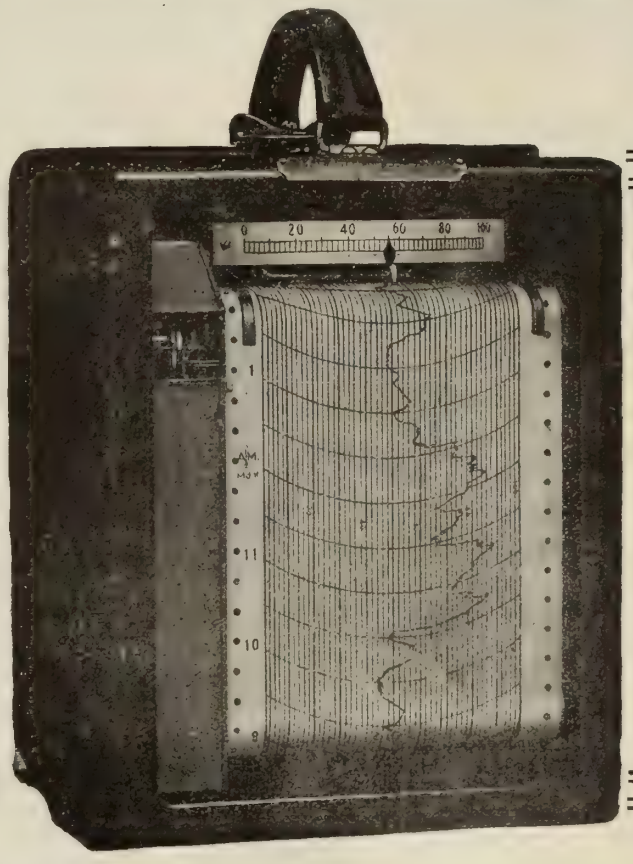
B. F. Sturtevant Co. of Canada, Ltd.

GALT TORONTO MONTREAL

ESTERLINE

Means Economy in Plant Operation

Portable and Switchboard Types



Graphic Wattmeters **Graphic Voltmeters** **Graphic Power-Factor Meters**

¶ Big savings can be effected by arranging power drives so that all machines are properly loaded. The best means of knowing what your equipment is doing is by taking readings with Esterline True Recording Wattmeters.

¶ The illustration shows one of the Portable Type, which is placed in an aluminum case with a glass face. The clock has an eight-day lever movement controlling the chart which is six inches in width and twenty-six feet long. A special inking device has been arranged for the marking of these charts. The holder will contain a supply for eight days and the ink is drawn through a tube to the pen by capillary action.

Write our nearest House for full information

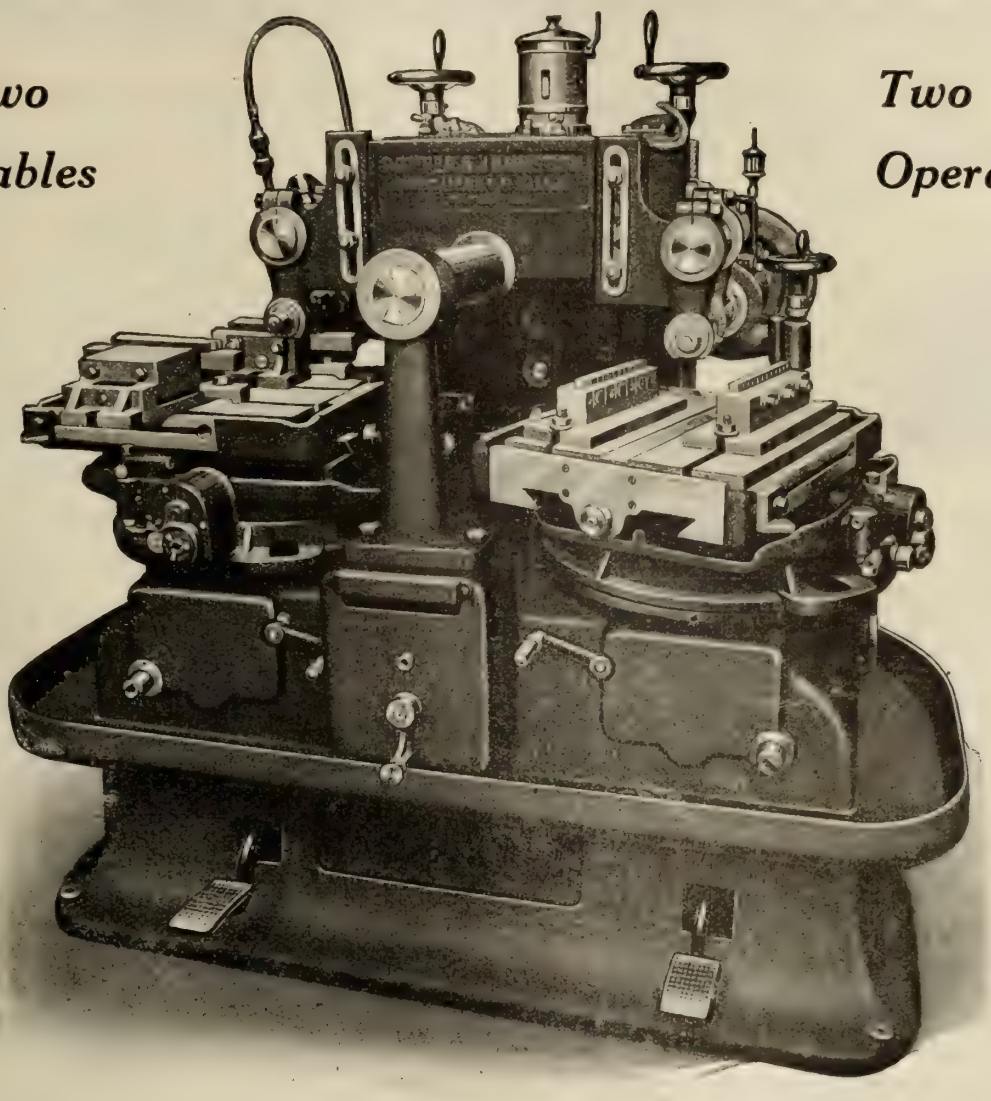
Northern Electric Company
LIMITED

MONTREAL QUEBEC TORONTO HAMILTON WINNIPEG CALGARY VANCOUVER
HALIFAX OTTAWA LONDON WINDSOR REGINA EDMONTON

NO WASTE MOTION

Two Tables

Two Operations



P. & J. I-M Milling Machine

is turning out work every minute it is in operation. There are two tables enabling two operations to be performed without waiting for one operation to be completed. No power wasted—no time wasted. No marks from returning cutters. This machine has a history.

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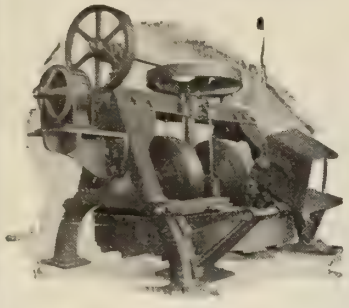
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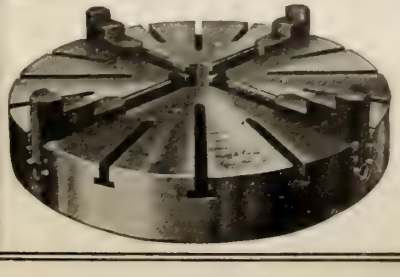
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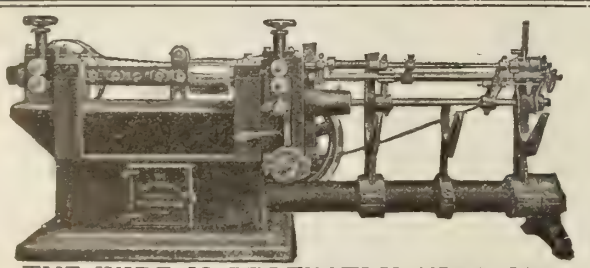
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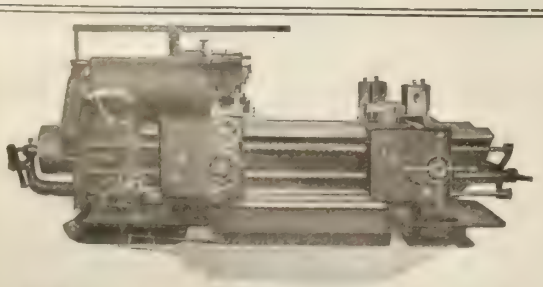
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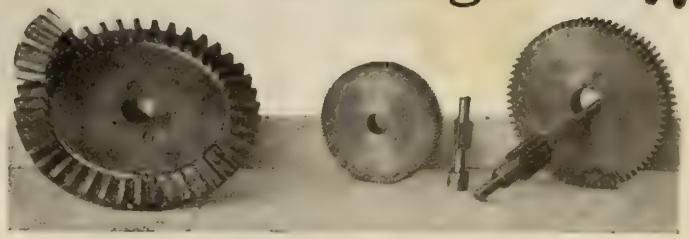
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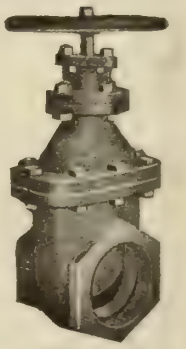
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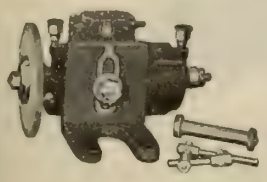
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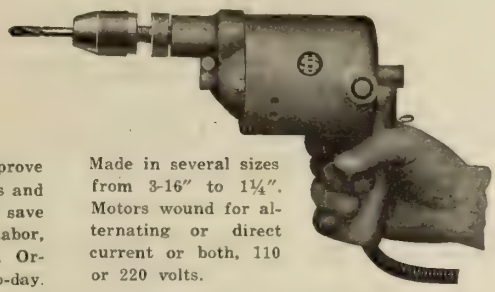


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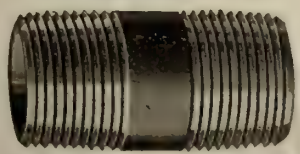
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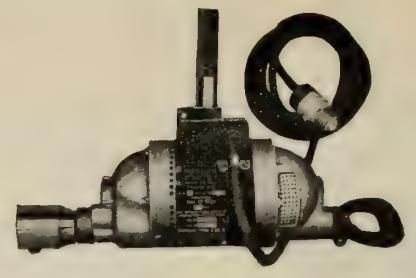
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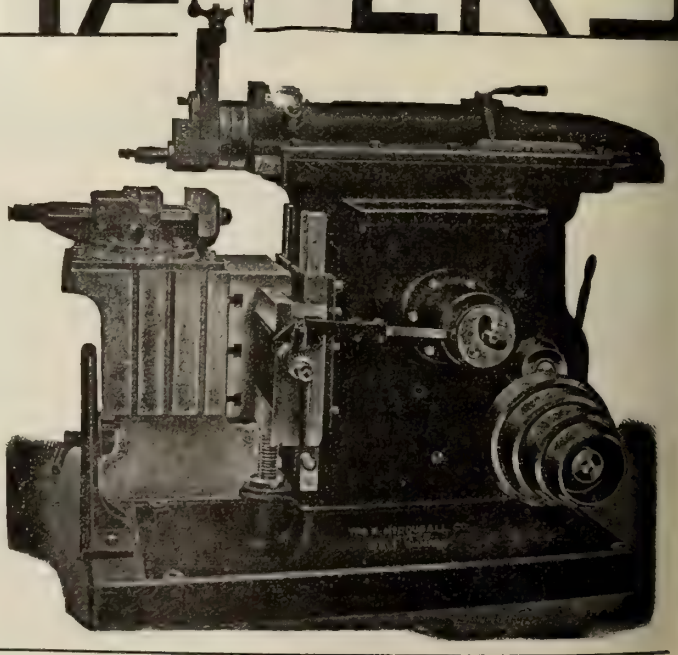
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VOL. XXVI. No. 17 OCTOBER 27TH, 1921.

Cutting the Time in Three by Disc Grinding

Disc Grinding Can Often Reduce Cost of Operation—Suitable Fixtures are Important If Production Is to be Increased—Disc Grinding Scale Bases—Counter Tare—Door Frame

By J. H. MOORE

THE variety of work which can be successfully performed by the disc grinding process, rests to a large extent upon the designer's ingenuity. In many cases parts which have been thought unsuited for disc grinding have to be re-designed in some simple manner, with the result that the pieces can be produced on the disc grinder at a much lower cost, not to speak of the better finish secured.

When producing any part on such a grinder there are several important factors which must be watched. The amount of stock to be removed should be carefully considered; the distribution of the surface to be ground is important, and wherever possible the piece should be designed to take care of, and absorb the heat from the portion of casting being ground. As a rule the allowance for disc grinding varies from .005 to .050 in. In exceptional cases as high as ¼ in. has been removed from cast iron and brass surfaces, although such a heavy grind is not to be recommended as good practice.

As can be readily understood the amount of material which can be profitably removed from a piece, depends upon the nature of the material; the speed of the abrasive; and as stated before the distribution of the surface to be ground. Cast iron is usually easier to grind than rolled or wrought metals, but when iron castings are very thin in sections, they are often harder to grind.

Another point to watch is outside scale. This should be removed as much as possible from the castings before disc grinding, for scale is hard on the abrasive disc. Where the scale is exceptionally heavy it pays to use some form of grinding wheel before completing the part on the regular disc.

Importance of Fixtures

As disc grinding is a heavy production asset, nothing should be placed in its way, so far as rapid handling is concerned. Many a disc grinding machine today could give far better service were it equipped with suitable fixtures to handle the work. It is hardly necessary to plead the cause of fixtures, for the benefits which have been derived from the use of the same are apparent in every industry. Without accurate fixtures we could never have secured inter-



Fig. 2.—Disc grinding face of cylinder scale base.

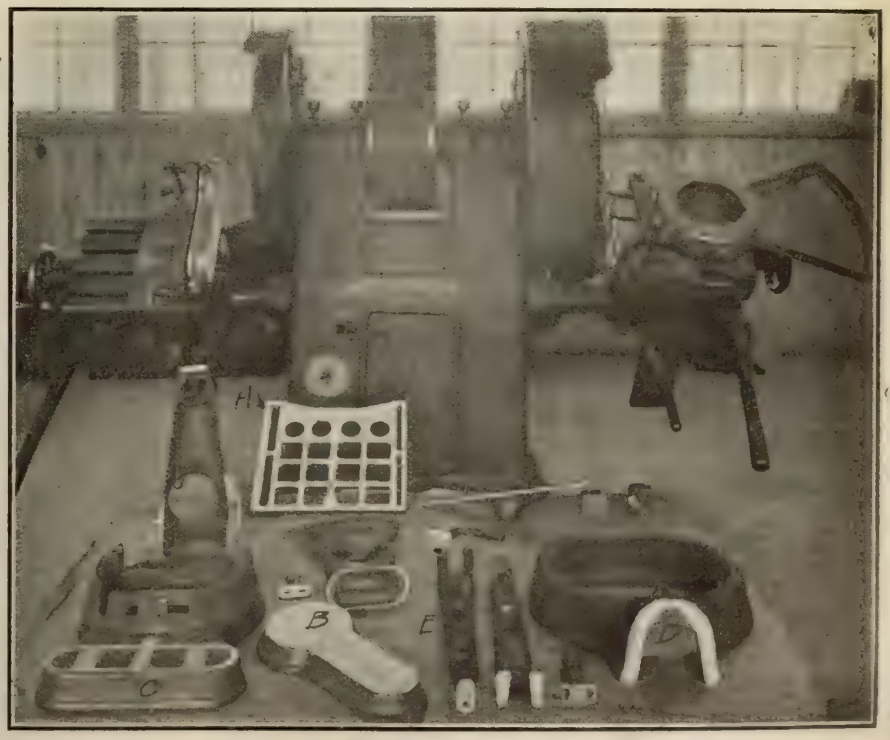


Fig. 1.—Collection of parts finished on disc grinder.

changeability, and without the latter we could never have brought production costs to their present low level. A foreman therefore should see to it that his grinder is equipped with the necessary jigs which will not only locate, but handle the parts efficiently. Any expense incurred at the start will soon be wiped out by the profits made through increased production.

Without dwelling any longer on the necessary preparations, we will next consider some actual examples of disc grinding as performed in Canadian plants. The photographs to follow are reproduced through the courtesy of the Ford-Smith Machine Co., Hamilton, Ont., who are designers of the equipment. In general manufacturing there are very few materials that do not lend themselves to the process of disc grinding, so that the field of usefulness is extremely wide. For example, look at Fig. 1. In this group is shown a collection of parts machined on the disc grinder by the Brantford Computing Scale Co., Brantford, Ont. It will be noted in the photograph that the surfaces to be ground are lighter in color, these having been chalked up in order to show the surfaces plainly in the illustrations. An idea of the scope of work completed at this plant alone by disc grinding is self evident. The piece A, which is seen resting against the machine is finished on both sides, and is completed in ten minutes. The part B is a candy scale base and the entire top of this piece is finished in 4 minutes. C depicts a 20 lb. fan scale housing base, and in place of a former milling time of 12 minutes, this part is now completed in 3 minutes.

At D is shown a skeleton base which is ground in three minutes on both ends, against a former milling time of ten minutes. Part E was formerly milled



Fig. 5—Disc grinding door frame of electric range

in 8 minutes, but is now disc ground in half that time. This view also gives a good idea of how fixtures serve to increase production. Imagine an operator holding up the various parts shown to the disc. He would soon tire of the work and his production would drop, but with the fixture holding the piece accurately and firmly, all the operator needs to do is move his table back and forth, thus passing the part to and fro on the disc.

At Fig. 2 we see the operator grinding the face of a spring cylinder scale base, while Fig. 3 shows the disc grinder producing a very important part of the scale, known commercially, as the counter tare poise. This work must be continually weighed, which explains the scale to the operator's right hand. The Brantford Scale Co. reported to the author that by grinding in this way they secure an excellent job; it enables them to keep the poise square, and it also allows them to quickly ascertain the weight.

Fig. 4 is also very interesting. In this case the operator is grinding the face of a meat slicer and the original method of face milling took 6 minutes, while with the disc method, the piece is now completed in one third the time. The new system is also claimed to be the most satisfactory.

At the Canadian Edison Co., Stratford, Ont., they produce a great variety of parts by the disc grinding process. One of these, the door frame of an electric range, is shown at Fig. 5. The size of this frame is 18¾ in. x 12¼ in., and the face of the range door only is ground. The thickness of the edge face is 3-16 in., and the average time of operation is 4¼ minutes. The disc runs at 1350 r. p. m. and is 24 in. diameter.

The remaining illustration, Fig. 6, shows an 18 in. machine being used at the Hydro Electric works in Toronto. This concern use these machines for practically every conceivable part of electrical equipment. Speaking to the foreman regarding their use, the author enquired if he, the foreman, believed in the necessity of proper fixtures. This question was asked because it was noted that all the machines were being operated by hand, that is as far as holding the work was concerned.

The reply, while not couched in ideal language, was just what we wanted, "I'll say I do," said the foreman, "and what's more I would have them on now, but the machines have just been installed. In spite of this inconvenience however, I couldn't wait for the fixtures which are



Fig. 3.—Disc grinding the counter tare poise.

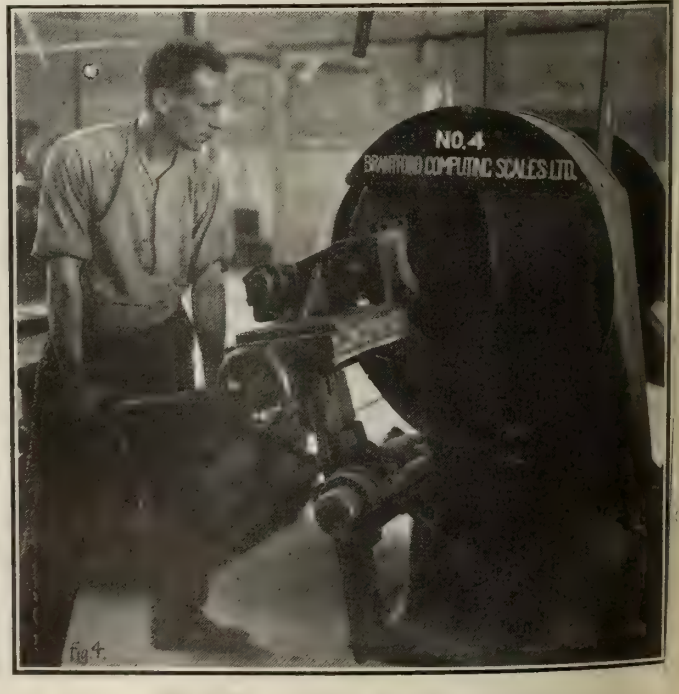


Fig. 4—Disc grinding face of a meat slicer.

being made, for even holding the parts by hand, we find that production has considerably increased." This testimony stands on its own. If, without fixtures, such a condition holds good, what will happen when everything is installed?

Before leaving the subject, we will consider the question of the proper discs to use. Abrasive discs can be secured in various combinations and grades. As a rule, manufacturers number their various discs, and are only too anxious to supply a user of a disc grinder with full information regarding what the various grades are best suited for. You cannot expect the same grain of disc to work equally well on two extremes, such as brass and steel stampings, therefore the best plan is to consult the manufacturer; secure from him a list of the abrasive discs handled; their uses, etc., then keep this information for future reference. You would hardly expect a poor quality carbon drill to drill as quickly as a first quality high speed steel product, therefore to get the most out of a disc grinding machine you must feed it with the very best discs obtainable.



Fig. 6—This disc grinder is used for grinding all sorts of electrical equipment.

What is the Money Value of Experience?

By Donald A. Hampson

WHEN the men of the U.S. were registering under the draft law, they were requested to fill out an extended questionnaire, among other things placing themselves in certain classes with reference to liability for military service. These voluntary classifications were later changed in accordance with the views of the draft board members, who generally doubted the soundness of the registrant's reasons as stated to show their right to deferred classification.

In the case of men in mechanical lines, the reason given by them was that of "experience," more or less extensive. Lawyer members of boards were prone to believe that men with ten years of machine shop or drafting room experience could not be replaced by any sort of labor gathered up. And it is true that most of the actual PRODUCING was done by green help, BUT the green help could not produce until the experienced had planned and built, and was guiding the work throughout. Some of the most notable cases of delay and of rejections followed the attempts of Army men and theorists to produce accurate mechanisms without the aid of the despised men of experience.

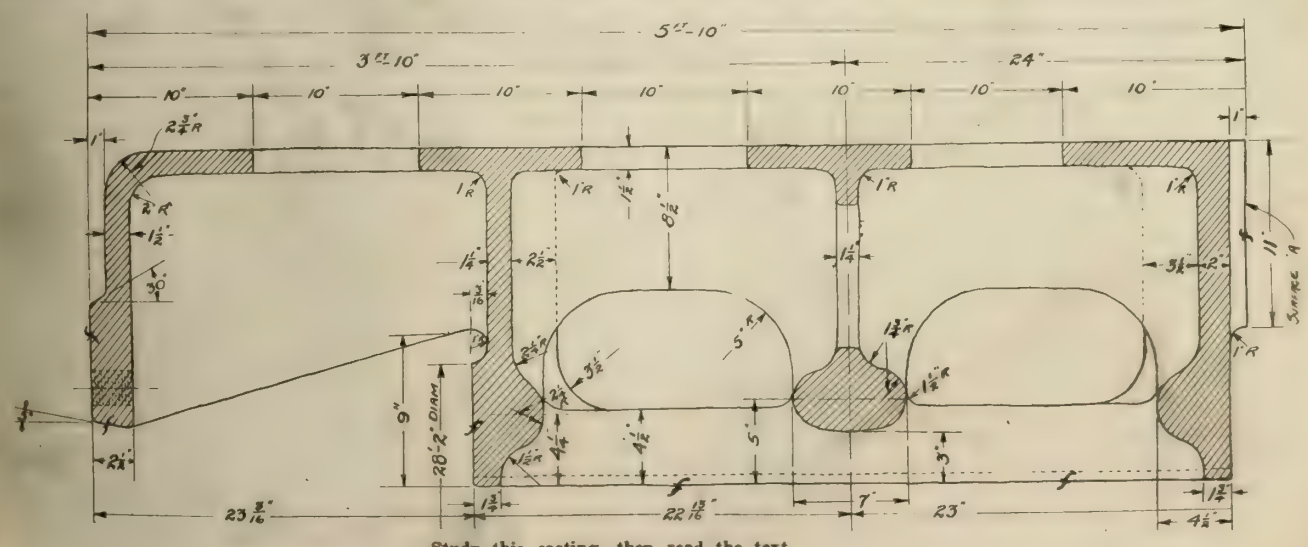
This same "experience" is an elusive thing—it cannot be purchased as can another commodity, it is not found in textbooks; based upon practice, some slight change in conditions may necessitate an entirely different procedure such as experience only can direct. Experience affects our attitude toward quantities as well as toward different materials and local conditions. As an example of how experience forewarns, consider the part shown by the drawing—a simple grey iron cast which is to be finished on the ends after the sides have been machined—twenty-five pieces in the batch.

Here is how the man of little experience would reason out his procedure. "The piece is finished all over when I get it except for the ends—now all I've got to do is put a vise on a milling machine, setting it by the marks, grasp the castings one or two at a time and finish both ends by means of two straddle mills which I can easily set by using the sample piece for a gauge in setting the cutters." That reasoning appears sound and it is, within the powers of most people with a smattering of all around experience. Now let us study these proposed moves for the trouble which is certain to come.

Actually What Happens

First the zero and the 90 degree marks on the vise are not close enough for accurate work—the tongue on the under face of the vise may be a loose fit in the T-slot or it may be battered—dirt or burrs or bruises will tip the vise when they exist unnoticed on the bottom and they will tip the work pieces when they exist between the jaws. Someone rises to remark that these sources of error could not exist in a first class plant; but all of us know that they do and always will after a machine has seen a few months of general service. The only way to start an accurate job is to go over the surfaces concerned with a smooth file, removing any burrs, and then to check the setting with a square both ways against the column of the miller. Following this, a trial piece or two are run through and the ends checked both ways with an accurate square.

(Continued on page 36)


5"-10"
3"-10"
24"
10"
10"
10"
10"
10"
10"
10"
1"
1"
1

The Plugging of Holes in Cast Iron Surfaces

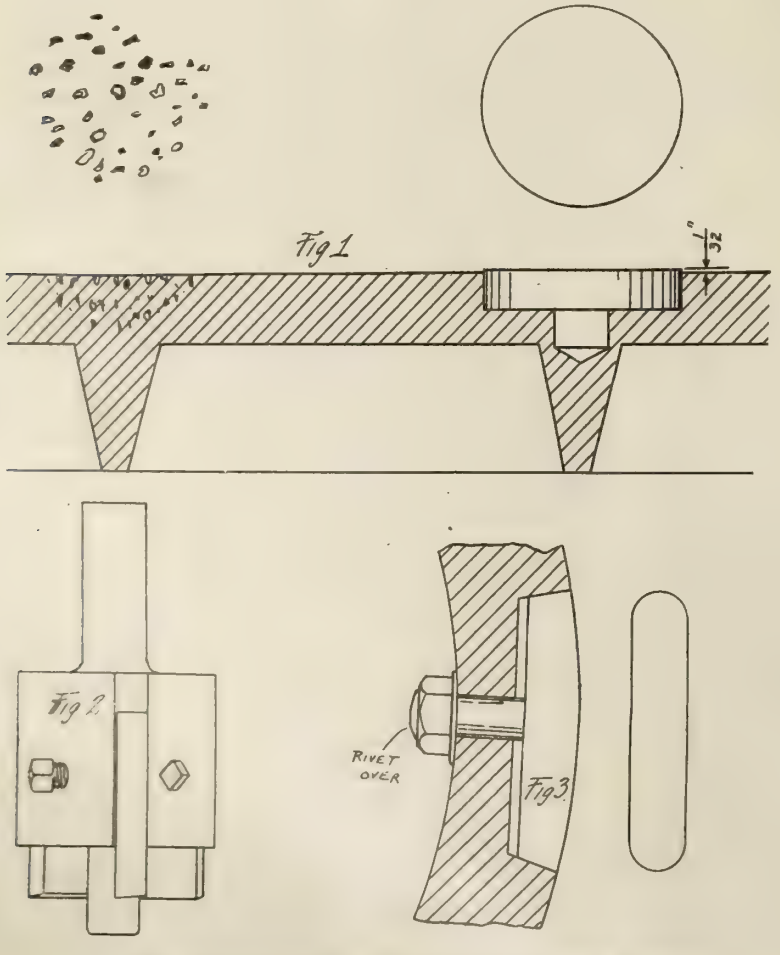
Holes May be Plugged in Many Ways Such as Filler—Burning—Welding—Mechanical Repairs, etc.—The Best Method for Each Case Explained—Sketches Showing How to Accomplish Repairs

By DONALD A. HAMPSON

CASTING defects always have existed and there is every reason to believe that they always will. When they are not so bad as to impair the casting's strength or utility, it is customary to doctor up the pieces in such a way as to render them acceptable. Confining ourselves to holes in castings, the methods of repair or salvage may be enumerated as follows: Iron filler, burning, welding, machine filler, or putty, and mechanical repairs such as plugs, patches, and inserts. These methods may be adopted for new work and for repair jobs, the particular one that is selected depending upon the nature of the service in which the casting is used.

Iron filler is sold under various trade names. It is much used in foundries for filling up holes and indentations before sending out castings. When the surface of a casting does not have to be machined and the cross section is amply strong, iron filler may consistently be used since it adheres tenaciously to the adjoining iron and becomes to all intents as hard as the rest of the casting. But where the part must be machined to become an important surface, iron filler is objectionable both on account of its different appearance from the rest of the cut and of its insufficient wearing quality. This filler, in the bulk, appears like a flour composed of cast iron and graphite; in use, this flour is mixed with water to a pasty condition and then worked into the cavity to be filled. The machine cut that runs through iron and filler leaves the filled spot of a rusty color.

Iron filler is also used on exterior surfaces that must present a smooth appearance. This is done in the finishing room after all the work on a machine is completed. The filler is worked in the depressions with a putty knife, allowed to harden, is sand papered off, and finally painted over when the rest of the machine's surface is painted.



Follow the text matter, as it explains these sketches thoroughly.

Burning In

Burning, or burning-in, is a foundry "stunt" that has been practised for generations and was the nearest to welding that was known up to the time of the twentieth century welding processes. It is practised chiefly as a means of saving castings that show large holes from a shifting of sand in the mold or from other causes, though a good many repair jobs have been accomplished in this manner. The writer has seen the most substantial repairs made in this way on the heads of retorts, broken flanges, plates, etc.

Burning is done in the foundry exclusively. Briefly the process consists of building a temporary mould about the defective portion of the casting with a large head above and suitable provision for a run-off below. Hot iron from the cupola is poured in the mould, strikes the defective casting, and passes off below; in its contact with the casting, the iron heats the latter and when enough has passed to raise the adjacent section to a full red heat, the outlet below is stopped and pouring is discontinued when the risers are full as with any other casting. When cool, projections and sprues are chipped off in the usual manner.

Welding is for the most part confined to the oxy-acetylene process, with electric welding practised in the bigger shops and thermit welding in special cases. But in the great majority of plants—where there is work enough to keep only one or two men at welding, or welding part of the time—the "gas" weld is the process employed. It is the recognised all-around method. Holes in castings may be readily filled up by the torch and welding rod. It is a simple cheap way of saving thousands of castings. There are cases where a weld will not do any good where a defective casting must be scrapped, as for instance, a hole in the ways of a lathe bed or in the face of a surface plate or where a casting is subjected to tensile stress and its position does not permit of any increase in section.

Machine filler is a product of the paint maker. It is distinctly a surface coating intended to assist in the preparation of a smooth exterior. Applied with a putty knife to holes and with a brush over a surface generally, it fills up the hollows and general roughnesses so that when hard it may be sanded off ready to receive the finishing coat of paint and take its part in the smooth exterior we so admire on machine tools, motors, and other high class machinery. But machine filler does not adhere as well as some other

fillings and for that reason large holes are better filled by welding. Filler parts subject to jar are better not built up with either non-filler or machine filler unless holes or under cuts are put in to anchor the paste.

Mechanical filling of casting holes usually takes place after the part has being machined or as a repair job on a casting that has been damaged in service. The mechanical repair is generally confined to those parts where an accurate surface and a good finish are desired; the repair adds nothing to the strength of the part—rather, it takes away from it for it is customary to drill and chip away more of the section in order to get definite faces to plug. The hole to be filled up is enlarged by drilling one hole or else by several holes and chipping out between them; then a plug is made to be a driving fit in the new hole, is forced home, peened carefully around the edges and filed or machined to the original level.

Work for the printing industry calls for mechanical filling of holes to a greater extent than any other. The demands in this line are so exacting and so different and the business is so wide spread, reaching into the smallest hamlet, that some of the work will be detailed. Printing is all done by the impression on type between two metal faces. Both of these faces may be flat, as on a job press or the plates of a Washington hand press, or one may be flat and the other cylindrical, as with the common cylinder press, or both may be cylindrical, as the presses of great metropolitan dailies or the presses for the various ornamental and advertising processes. In some of these processes, ordinary type is used—others make use of linotype matter or plates but no matter what the process, the surfaces must be so good that every dot and serif must show on printed matter.

Increasing labor costs have made it necessary to use larger and larger presses and these have forced a corresponding increase in the size of other press and composing room equipment. As a result quantities of large castings have to be turned out with surfaces well nigh perfect. To produce castings with from 4000 to 9000 square inches that don't have so much as a pin hole showing after being machined is something of a triumph! And it is done right along with cylinders and flat beds, though the vast majority of such beds have tops made of marble. Many of these marble tops, if turned over would startle the visitor with the carved letters, "In memory of.." but these are being replaced at the rate of about five a day by cast iron tops which do not abrade like the cheaper marble.

A full size section of one of these iron imposing tops is shown by Fig. 1. These must be machined true within "less than a piece of newspaper" and any spongings or holes filled up to form an accurate working surface and to resist the hammering they get. In keeping with the large sizes of presses, these surfaces now average 3,500 square inches, a size that with their light section makes it difficult to cast so that they machine up sound—a close grained iron poured from gates scientifically arranged into a mould properly heated and vented—all these things are necessary to success. Then if the casting warps, the tool cuts so deeply into the high parts that spongy sections show up over the rib crosses.

Above Fig. 1, at the left, is shown how the surface appears over one of these crosses after considerable metal has been removed. A few holes might be plugged with ⅛ in. pins but generally the structure is so spongy that the iron surrounding pins would not stand the pounding in a print shop and the whole section has to be cut and plugged to save a casting that cost nearly a hundred dollars. This defect is noted, of course, before the finishing cut is taken on the planer and is repaired at that point, in the manner illustrated at the right of Fig. 1. A hole from 1 in. to 1½ in. is counterbored and filled with a turned plug of cast iron which is left slightly higher than the rest of the surface so that it can be peened down at the edges, filling any crevices left at the mouth of the drill. Subsequent cuts with a flat tool may remove as much as 1/32 in. but where the work has been done by a skilled workman, it is impossible to detect the repair except under a strong light and then only by one accustomed to such things.

Whereas a spongy surface even with minute openings will not pass as a "second," the trade willingly accepts a surface plugged as we have described as the highest class product. The secret of success with this work consists of putting in a tight plug, carefully fitted, of the same material as the plate itself, and doing it on the planer so that the finshing cut runs over all. The work might be just as well done afterwards and the surface worked down by hand without scratching but then the workmanlike finish—"looks like a pair of striped trousers," one visitor remarked—would be broken by circles of another shade and the plug would fairly scream for attention.

Pin holes can be filled with ⅛ pins without making themselves noticeable. Larger holes and soft spots are filled with ⅜ in. and ½ in. plugs that are turned up in the form of rods for the purpose. Still larger ones are filled as described, in which process a ½ in. pilot hole is first drilled for the counterboring tool of Fig. 2. This tool has a carbon steel body with three inserted high speed blades. An electric drill speeded at 500 R. P. M. or less will put in these holes without tieing up a planer very long.

The method of plugging imposing surfaces has been dwelt upon in detail because they are the most annoying pieces in the list to repair and because such methods are employed or may be employed for a variety of work. Cylinders are plugged in like manner though in shops which grind the faces rather than finish with a tool, steel or wrought iron plugs are often employed for the grinder finish looks practically the same on all three materials.

A repair job cannot be expected to bear the same finish that a new one does and so the machinist puts steel plugs and inserts in proof presses and cylinder presses. Fig. 3 shows a patch used in the field by men of the Miehle works and others. The reason for patching is always the loosening of material in the form and the material's getting on top of the type and thus being squeezed into the platen or cylinder of the press. This patch is used to build up the dent left by a steel quoin that "went through the press" necessitating an oval shaped repair.

THE CLYDE'S LARGEST DREDGER

The largest dredger ever built on the Clyde was launched recently. It has a hopper capacity of 80,000 cubic feet and carries a suction pipe by which dredging can be done to a depth of 45 feet. Special arrangements have been made to enable dredging to be continued when the vessel is going either ahead or astern. This dredger is designed for dealing with light sand at the mouth of an Indian river, and an ingenious device has been fitted to trap this light sand so that none of it is wasted in the overflow. Everything in the hull and equipment is A. 1. at Lloyds. A complete system of electric lighting, including one searchlight, has been installed. The pumps are driven by a special set of triple expansion engines and are capable of raising and discharging about 5,000 tons of sand and silt per hour.

BRITAIN'S LATEST AEROPLANE

The latest type of British passenger-carrying aeroplane has an enclosed cabin for eight passengers and an open cockpit for the pilot and mechanic. It is a biplane driven by a single engine of 450 horse power. The seats are made collapsible so that practically the whole of the cabin space may be used for cargo if desired. An interesting detail is that for the benefit of passengers liable to air sickness a small concealed self-emtying basin is provided close to each seat. Windows to open are fitted on the full length of each side of the cabin and heating is provided by hot air muffs round the exhaust pipes. The pilot's cockpit is fitted with a complete wireless telephone and telegraph installation. This machine when fully loaded, takes only 9 minutes to climb to 5,000 feet, at which height its speed is 118 miles per hour. Fuel and oil sufficient for a journey of 400 miles are carried on board.

Use of Ball Bearings as Adapted to Grinders

Plain Shop Grinder—Grinding and Polishing Head Applications —Disc Grinder—Use of Self-Aligning Ball Bearings in Housings — Vertical Surface Grinder Application— Precision Grinder

By DONALD A. HAMPSON

THE introduction of ball bearings into various machine tools, and their great success in this direction, has aroused in the minds of keen engineers and progressive manufacturers the spirit of interest that formulates itself into two questions, viz.: Where else can ball bearings be used to advantage, and what improvements will they effect?

Briefly enumerated, here are some of the salient features of improvements and economics that ball bearings have effected in the manufacture and functions of various types of grinders and buffers.

1, Lower production costs; 2, increased output; 3, higher efficiency; 4, maintained accuracy; 5, infrequent and easy lubrication; 6, reduction of maintenance cost, by elimination of adjustments, renewals, stoppages for repairs, etc.; 7, saving in first cost by eliminating countershaft and belts.

Ball bearings being narrow and compact, the finished bearing seat is usually less than one-third the length r quired on a cast iron, babbitt, or bron bearing. The length of the bearing ca ings necessary for stability when oth

*Mr. Jones is manager of the S. K. F. Ball Bearing Co., Toronto, Canada, and it is through their courtesy that this matter and illustrations are reproduced.

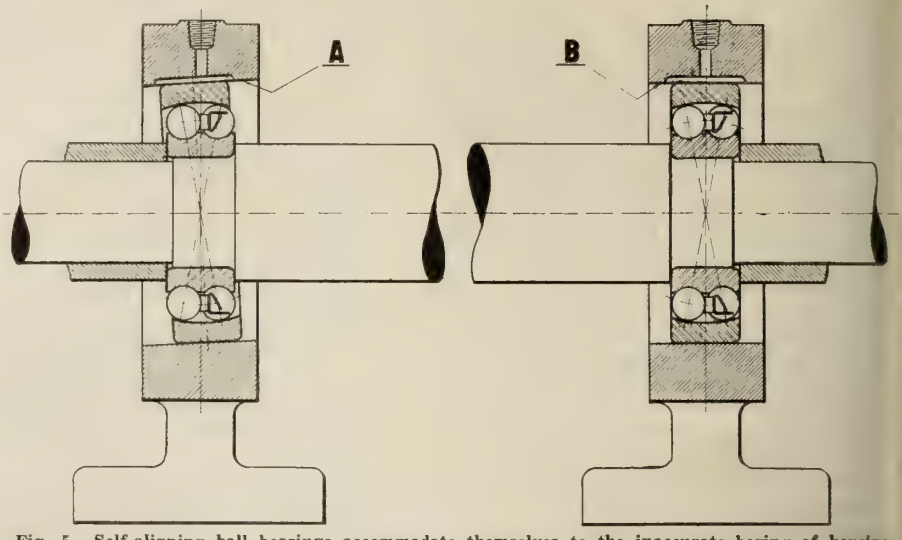


Fig. 5.—Self-aligning ball bearings accommodate themselves to the inaccurate boring of housing

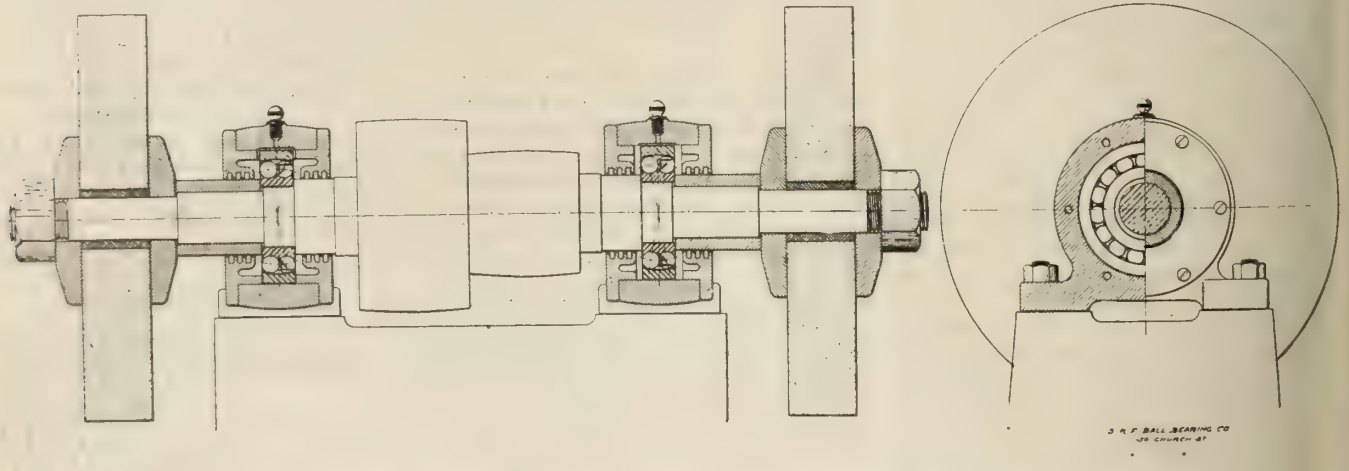


Fig. 2.—Grinder head fitted with two step cone. A groove housing cap prevents dust from entering bearings.

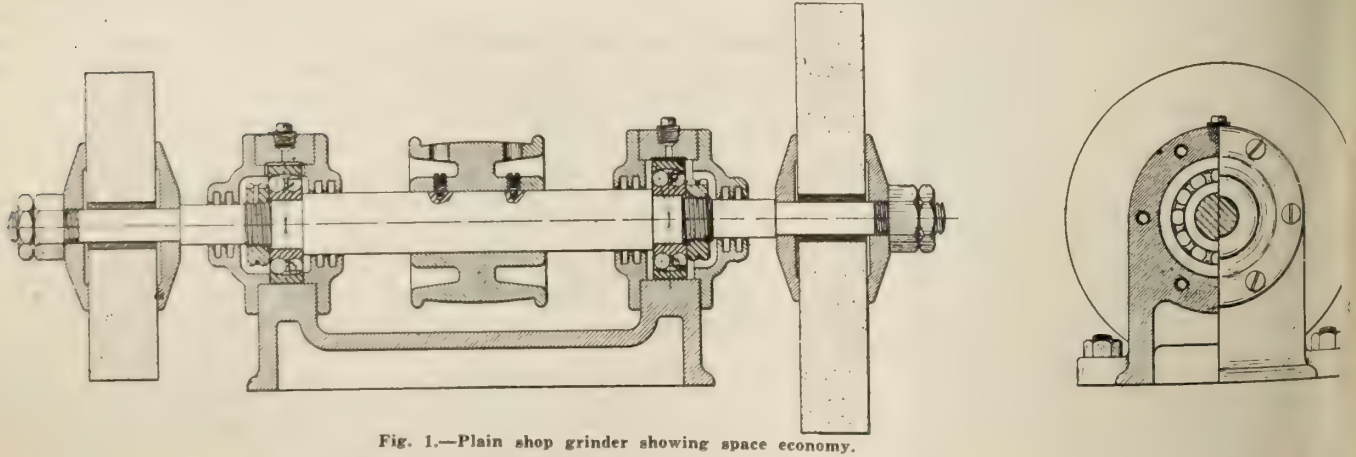


Fig. 1.—Plain shop grinder showing space economy.

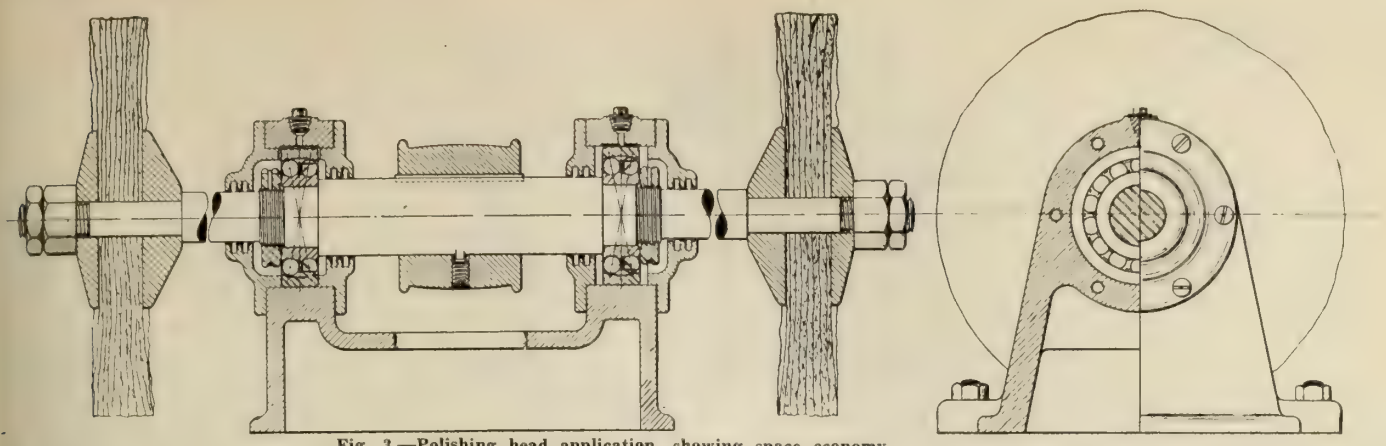


Fig. 3.—Polishing head application, showing space economy.

types of rigid bearings are employed is proportionally decreased. This means reducing the cost of machine work and shortening the machine length, see fig. 1, with the resultant saving in floor space and weight, therefore a reduction in the cost of manufacture.

Instead of machining the whole length of the journal box, placing and scraping the bearing lining, and machining a corresponding length of shaft for this box, the manufacturer can substitute the simple process of boring and reaming short housings for reception of ball bearings.

Reduce Cost of Material

In machines using sleeve bearings running at high speed, to resist wear from rubbing friction, the shaft must be made of fine grade material. There is no wear on the shaft when ball bearings are used. Friction is eliminated by the extreme precision with which they are made, and by substitution of rolling action in place of rubbing friction. Consequently on a ball bearing machine, cheaper material for the shaft may be used, which is a very important item of economy. It means cheaper production and increased profit with increased efficiency and durability.

In Fig. 1 a plain shop grinder is shown with a single pulley, which is driven direct from the lineshaft eliminating the expense of countershaft and belting and removing a very unsightly overhead arrangement of gear. It is an established fact that it takes less power to run a ball bearing grinder continuously, than to run a plain loose pulley on the countershaft; besides this, power and workman's time is saved starting up the machine each time he wishes to use it. The replacement of the wheel (which is very seldom) is done when the shop is idle, or by throwing the belt off the driving pulley.

Plain bearings supporting short shafts generally have to be bored in one operation to obtain concentricity of both bearing seats, and ensure correct alignment. On long shafts when the bearings are placed far apart, alignment is frequently secured by ball seated journals or aligning cradles, both of which are costly to manufacture and troublesome to maintain. Where self aligning ball bearings are used, they provide automatically for instantaneous alignment and adjust themselves to proper alignment, even if the housing bores are not absolutely concentric. See Fig. 5.

Saving of Power

Shafts in sleeve bearings frequently become set if a machine is idle, and it takes from 50 per cent. to 200 per cent. of normal running power to start a plain bearing machine from rest. The frictional resistance on a properly constructed ball bearing of high grade materials is practically constant at all speeds: i.e., the frictional resistance to be overcome at starting is no greater than when a machine is running at full speed. Consequently the machine is easy to start and operates at the highest possible efficiency. Rubber belts are cheaper than leather, but as they cannot be used advantageously where there is a possibility of oil leaking from a plain bearing and rotting them, leather must be used on plain grinders. With a ball bearing machine this condition is changed, the housings being proof

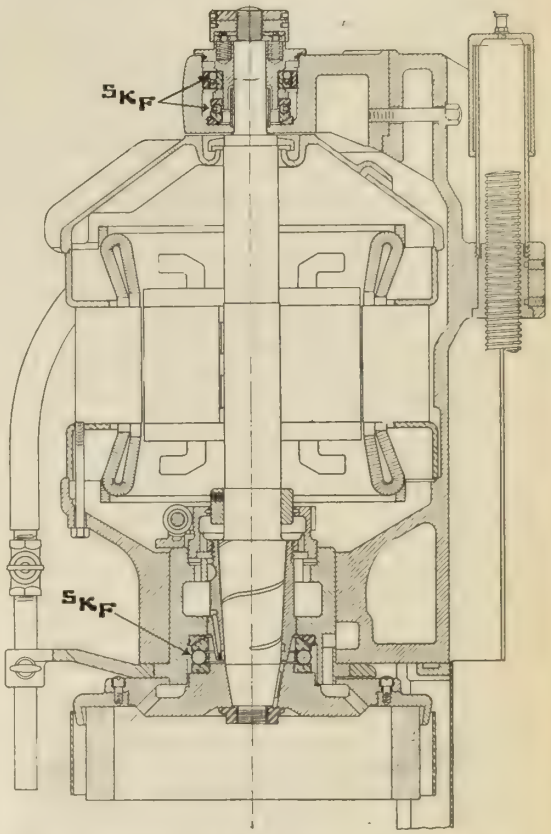


Fig. 7.—Application of ball bearings to vertical surface grinder spindle.

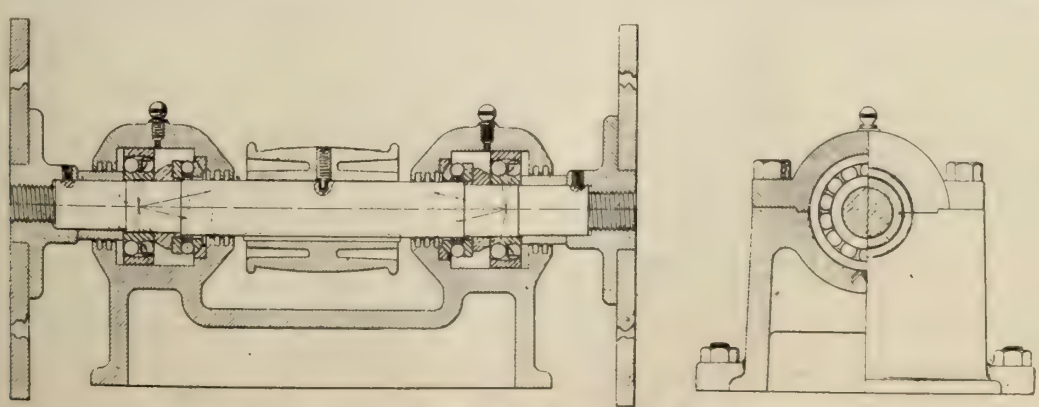


Fig. 4—Disc grinder equipped with radial and thrust bearings.

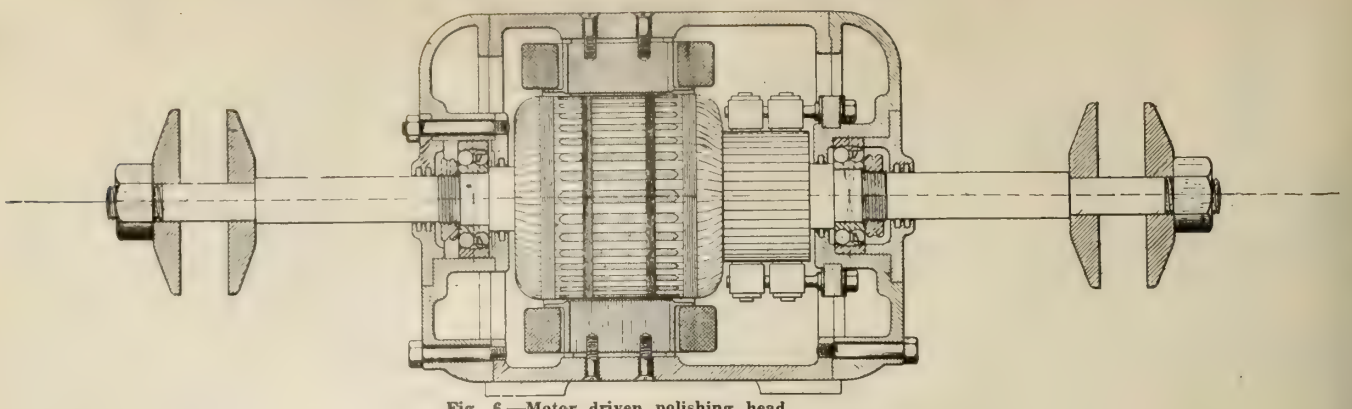


Fig. 6.—Motor driven polishing head.

against the escape of oil or the intrusion of dust into the bearing housing. There is no lost power in slipping belts, there being less resistance to overcome. Belts need not be run under such heavy tension.

Everyone in a machine shop is familiar with the chatter and vibration from the plain floor grinder, after the bearings have worn slightly, and it is interesting to see how far this is tolerated by the men who use it; in fact it seems to be tacitly understood that nothing short of a burst wheel or a vibration which makes it impossible to hold a tool against the wheel, will induce anyone to repair the bearings. All this means waste of power, time and poor work. There is no reason why a grinder should not run as smoothly and with as little trouble as an electric motor, which is easily accomplished by a trouble proof machine properly made in the first instance and equipped with bearings which are free from initial clearance and wear from sliding friction. Grit from grinding wheels, shop dust and other abrasive substances which in plain bearings cause wear on journal and shaft, cannot possibly intrude into a ball bearing housing properly designed. Lubrication is needed only at infrequent intervals, consequently they require less oil and attention. Oil rings are unnecessary. There is no binding, no failure of lubricant, no heating and no stoppage for repairs.

The foregoing explanation of advantages to be gained by the use of ball bearings on the simplest machine in the average machine shop. "The Floor Grinder," and the actual saving in the first cost made possible, should certainly lead designers of machine tools to examine their present viewpoint in the light of developments taking place in such specialties as covered by this article. We are all too easily misled by the idea firmly held by the average purchasing agent—"what is the price?" and even machine designers, in many cases, are skeptical when you can cheapen a machine by using a high grade article in its construction, which is done in a great many cases, for instance the lowest priced, as well as the best.

For its work, "the Dumore," with which we are all familiar, was made possible by the use of a high grade bearing, in other words, it was not possible to construct such a machine to work at 32,000 r.p.m. until the ball bearing had been developed to its present day efficiency. Figs. 7, 8 and 9 show three distinct types of applications for precision machines. The first, is a vertical surface grinder, all the pressure from the wheel and weight of the spindle, being taken on ball thrust bearings, the taper bronze bearing being used to secure easy adjustment. The high speed

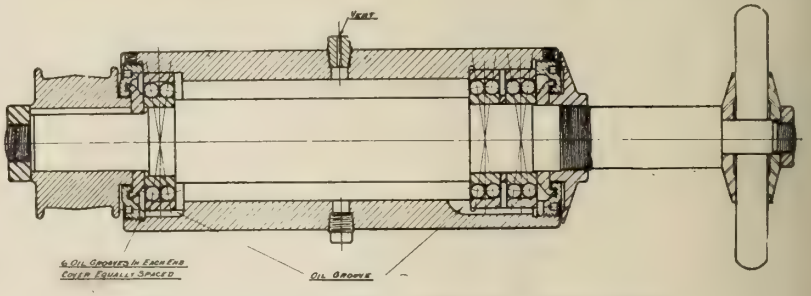


Fig. 8.—High speed precision spindle with take-up feature.

application shown in Fig. 8, is one where extreme accuracy of grinding is essential and where a small wheel necessitates a high speed of rotation. The two bearings at the wheel end, are adjustable against each other, in order to prevent even the finest amount of play that might develop. The design shown in Fig. 9 is one developed in the ball bearing factories, and is used for grinding the raceways, where accuracy of

(Continued on page 36)

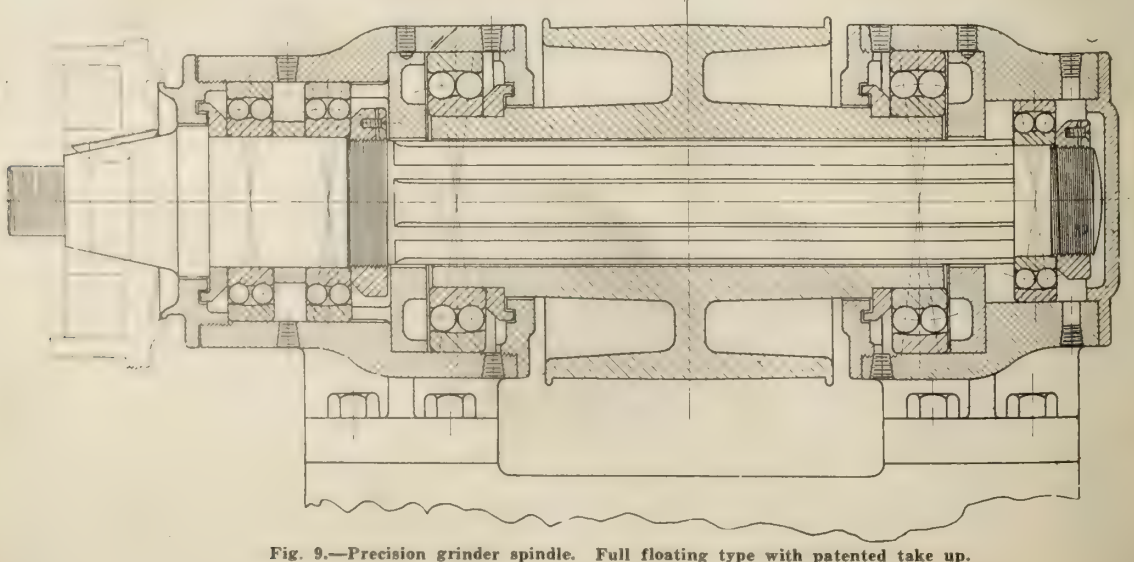


Fig. 9.—Precision grinder spindle. Full floating type with patented take up.

The Need of Gauging for Modern Manufacturing

Continuation of Previous Article—Limits in the Tapped Hole—Go and Not Go Gauges—Measuring Machines Past and Present —Definite Limit of Microscopic Magnification

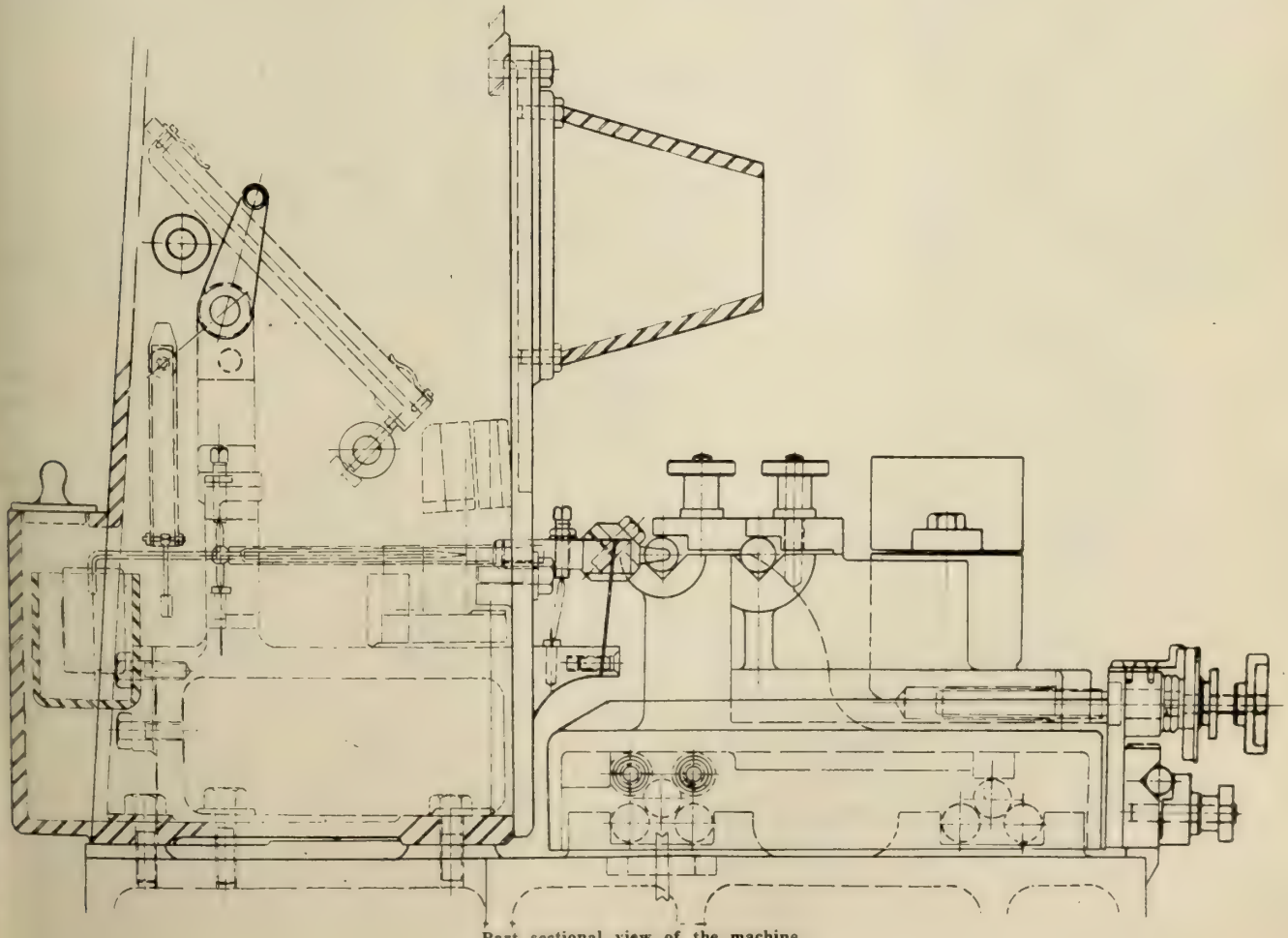
By A. C. WICKMAN B. Sc.

IN the former portion of this article, which appeared in the Sept. 29th issue, we discussed the gauging problem up to the point of describing a certain class of snap gauge. Let us next look after the limits in the tapped hole. This is best accomplished by using a screw plug gauge of a double-ended type, one end being to the full form of the particular thread in use, while the other end is formed so as to test the effective diameter only, its size being larger than nominal by the limit which can be allowed for proper working. We now have a system for screws which has been in use for plain shafts and holes for some considerable time, viz., that called the "Standard Hole System." We keep our tapped hole a standard, i.e., we make it pass the "Go" and "Not-go" screw gauge, and, for different qualities of work in the same way as we make an allowance on the shaft for different kinds of running-fits, push-fits and driving-fits, we can make an allowance with the adjustable thread snap gauge and turn out screws of any quality we like without sacrificing interchangeability in the least way. The absurdity of having "Go" and "Not-go" gauges of the full form type is shown by the following:

I came across a firm some little time ago who were producing brass water cocks, the thread of which was specified to be within standard size and plus .002 inches. The gauges that were supplied to them for this work were both of the full form type, merely different in size by the limit. Therefore, it would have been possible to have completely turned all the threads out of the hole and still pass the gauges. Obviously if a proper "Not-go" effective-only gauge had been used they would have found that the limit allowed would have necessitated making the article in the tool-room and not in the shop. On the particular thread they were producing they could easily have had a limit on the minimum effective diameter of up to .012 in., and still be producing a better article than the one which would pass their gauges.

This system opens out a very large field indeed in the production of screws, and seems, so far, from all evidence we have, to be the first practical system that has been evolved. The gauge can also be used to great advantage in the inspection of taps and it is clear that a large amount of research work is still open, both for tap manufacturers and tap users, as to what limits of accuracy a tap can be commercially produced. We have shown how essential it is to have a periodical inspection of gauges, and it will be obvious that such a periodical inspection should be carried out at a minimum cost with a maximum accuracy.

Measuring machines of past years have suffered from several defects. Firstly, they were designed with an idea of time being no object, also they were limited to the comparison of such things as plain length and diameters, and in the few cases where attachments were supplied for examining the various elements of screw gauges the method used was that of microscopic examination, the magnification being extremely low, about 25 to 1, so that the process was not only slow, but by no means ac-



Part sectional view of the machine.

curate enough for the inspection of the highest class of reference gauge.

It is true that six figure measurements were obtained, but due to the fact that these machines relied on the personal elements of the measurer to produce the given result, repeat readings by the same person and by different persons did not agree, even to the fourth figure. Also machines required such delicate handling that the system of measurement was looked upon as a laboratory experiment rather than a necessary tool room process.

It will be as well to point out, that there is a vast difference between obtaining a measurement, and that of obtaining a size. A measurement in itself means no more than a reading of a certain number of figures, and the number of figures that can be read depends only and solely upon the size of the graduated dial from which they are taken; but when we have to deal with actual size, a totally different problem confronts us.

The Definite Limit.

In the first case we must have a machine whose magnification is so large that no operator, however unskilled, could vary in his or her estimate of the period at which movement of the micrometer wheel shall cease and a reading be taken. Now there is a definite limit to which miscroscopic magnification can be taken, due firstly to the loss of illumination and secondly the extremely low focal length which becomes necessary. Also such an instrument is very sensitive to vibration, and in most buildings wherein machinery is in motion, the field would be entirely blurred.

If we make our magnification a mechanical one, the first thing that happens is that however we carry out this magnification, the movement of the last lever will have a certain amount of stickiness, and this will be multiplied by the leverage of the mechanism. This will cause considerable residual strain to be left in the mechanism, and when such an instrument is set to zero and tapped with a pencil, the last lever will move from the zero mark as the residual strain in the mechanism is released by the vibrations set up by the tappings. The speed of the last lever will also be very high, and considerable overthrow will occur on the points of reversal of its motion, the mechanism will also be easily affected by vibration, and would necessitate it being mounted on a concrete base in a building entirely removed from any outside disturbing influence.

Up till a few years ago the line standard was considered to be the acme of perfection, and this of course necessitated the use of machines with microscopic magnification. This is entirely due to the fact that no one had ever dreamed of the possibility of producing end standards to any degree of perfection. We are now, however, able to produce end standards to an accuracy far greater than that of any line standard of measurement, and when properly used they are practically everlasting, and for all measurements less than say 3 feet, are infinitely preferable to the line standard.

From these remarks it would seem that the kind of machine which is required for accurate tool room measurement should have the following properties:

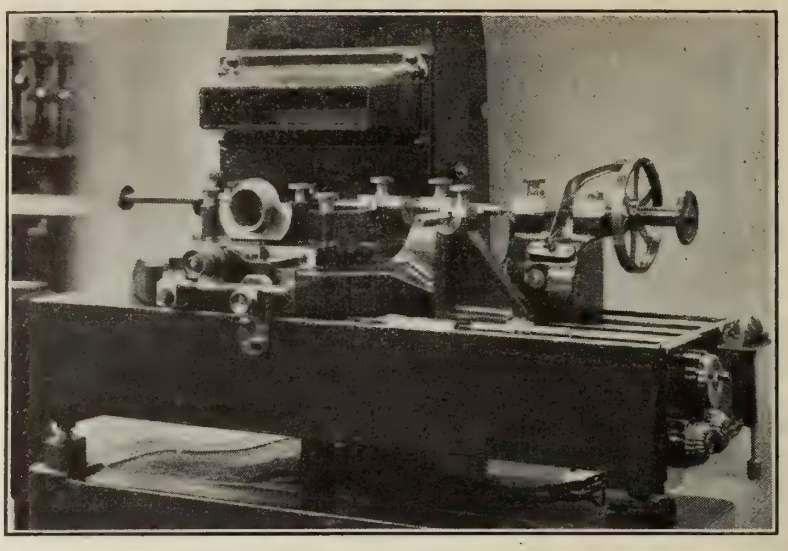
(1)—It should require no special building but could be put down in the tool room near to moving machinery. In order to accomplish this the machine must not be affected by vibration and therefore its amplifying mechanism should have practically no residual strain.

(2)—It should be quick of operation.

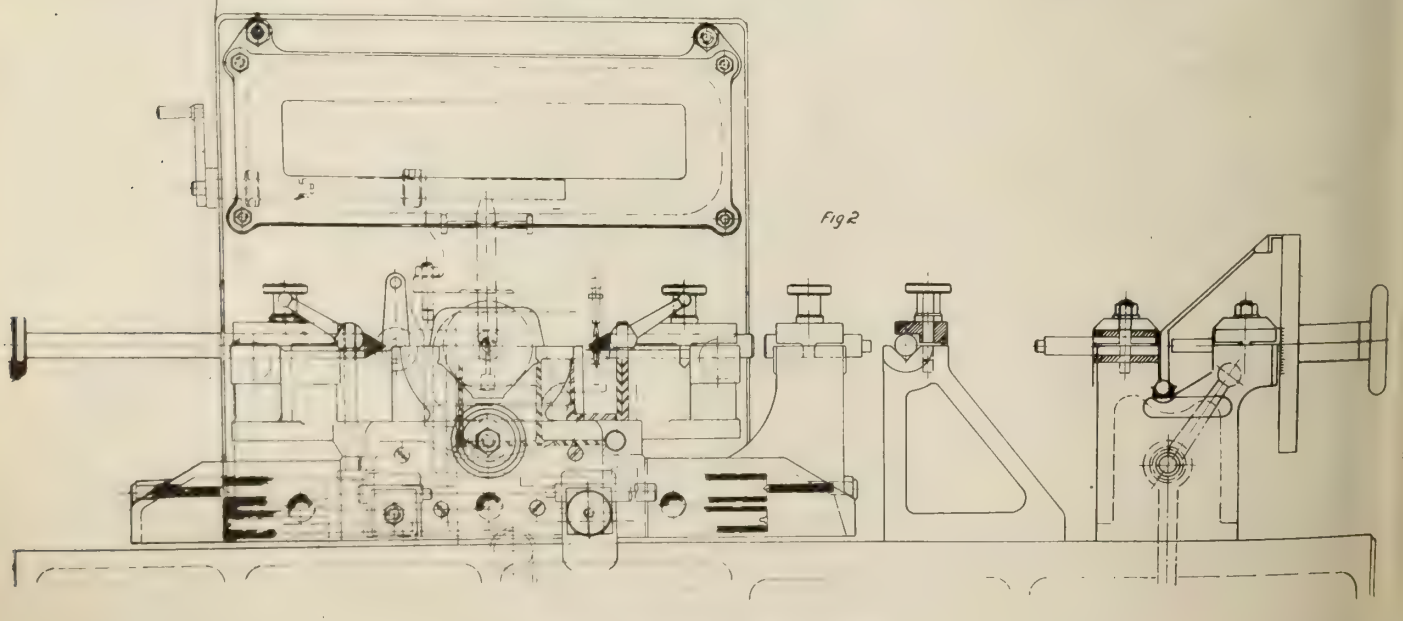
(3)—Its accuracy should be entirely independent of the operator.

(4)—Every measurement on it should emanate from some fundamental standard.

(5)—Its accuracy should be unaffected by changes in temperature.



Photograph showing the machine in actual use.



A view of the machine from the front.

(6)—Its anvil pressure should be as light as possible.

(7)—Its measurements should take in not only plain length and diameters, but also the pitch of screws, internal and external, also internal diameters, both screwed and plain.

Large Magnification

The machine shown in Figs. 1 and 2 was specially designed to fill this want, and like most things which are designed, was the outcome of absolute necessity. In this machine the magnification is 4000 to 1, and is carried out by a combination of mechanical and optical means, the mechanical being 60 to 1 and the optical approximately 70 to 1. The low mechanical magnification entirely overcomes the trouble of residual strain, and also enables the machine to be operated extremely rapidly, as the speed of the second lever is never excessive, and being made of duralumin is extremely light, so that no overthrow occurs at the point of reversal.

The stylus point shown, is mounted upon a flexible steel strip, which can bend backwards and forwards and be twisted torsionally, but is tremendously strong transversely.

To measure the pitch of a screw, thread by thread, a stylus is chosen so that the end approximately touches the effective diameter of the gauge mounted between the centres, and the top carriage is advanced by the screw until the stylus presses into the thread. The stylus on entering will slide down one flank of the screw, and on rotating the micrometer wheel and pushing the carriage carrying the gauge along, it will travel down the flank of the thread until it locates on the effective diameter touching both flanks.

While it has been travelling down the flank of the thread, the steel strip has been twisted torsionally, due to the side pressure on the stylus, and on continued rotation of the micrometer wheel, the strip will straighten itself and commence to twist in the other direction until not being able to twist any further, it will ride out of the thread over the top of the crest, rock over, slide down the next flank of the screw until it again engages with both flanks.

Now, at some time or other during its travel, the stylus will be in engagement with the effective diameter perfectly central, that is, there will be no torsion in the steel strip. The torsion of the strip is transferred into an angular motion of the second lever multiplied 60 times, this second lever carries on its extremity a square frame containing a hair line. This hair line and frame is in a parallel beam of light coming from a "Pointolite" lamp through a condenser lens, and immediately above the hair line is a projection lens of approximately 1 inch focal length, so arranged that the shadow of the hair line is projected upwards on to a mirror at the top of the chimney-like looking structure, back again to a mirror at 45 degrees, and out on to a piece of ground glass where it appears as a black band, approximately 1/10 inch width. In the centre of this illuminated scale, are two lines drawn so that the black band can be accurately positioned between them.

The mechanism is so arranged that when, as before mentioned, the stylus is in engagement with both flanks of the screw, and the strip has no torsion, the black band is placed between the two black lines on the lighted scale, and it is in this position that a reading of the micrometer wheel is taken. If we now traverse the carriage by means of a micrometer screw, so that first of all the steel strip twists to its limit, and the stylus then climbs up the flank of the thread over the crest down the other flank, when the black band is once more between the two black lines, we shall know that we are in exactly the same position in the next thread that we were in the last, and another reading of the micrometer wheel will tell us the error of pitch of that thread. This process is continued for the complete length of the gauge, and some idea of the rapidity of the measurement can be gathered from the fact that ten readings can usually be taken in less than two minutes.

The levers have a number of vanes dipping into oil dash pots, which make the complete mechanism very dead beat, and absolutely free from vibration. That residual strain is entirely eliminated is shown by the fact that on the machine being set to zero the bed can be hit anywhere as hard as possible with the fist, the shadow of the hair line being vibrated out of position and afterwards settling down absolutely to zero again. This kind of treatment is impossible with the usual type and this enables the machine to be put down in the tool room amongst machinery in motion, where it is not affected by the various vibrations which occur in the average works.

The main carriage has a movement of approximately 4 inches, and as it weighs with its centres something over 75 lbs, a special way had to be designed so that friction was reduced to a minimum, and the anvil pressure made as light as possible. The carriage is mounted on a patented way which consists of four hardened ground and lapped steel rollers, which extend the whole length of the carriage. Two of these being positioned in the bed and two in the carriage, they are so placed that the points of contact of the hardened steel balls which run between them make a guiding vee of 60 degrees. The balls are positioned in three groups of three. These four rollers make the two guiding points, the third point is composed of two smaller rollers positioned in the bed, the three steel balls running on a hardened ground and lapped flat steel strip which is positioned in the carriage, this making an ideal vee and flat carriage movement.

The ends of the rollers are easily measured for parallelism, and equality of height, the result being a motion which is free from sliding friction and which is extremely accurate. Some idea of the perfectness of this way will be given by the fact that the top carriage, which weighs, complete with its equipment, some 75 lbs., is easily started from rest and continued in motion by the pull of a piece of cotton running over a pulley carrying a weight of 1½ ozs. This has the effect of making the anvil pressure exceptionally light and so obviates distortion when measuring delicate objects such as N.P.L. needles.

The Bed Casting

The simplicity of the casting for the main bed will be seen, the top being scarcely machined at all, except just in the raised abutments which carry the rollers. The scale has not been broken across the bed, thus eliminating the period of seasoning which is so essential with all other measuring machines, as it is quite immaterial to the accuracy of the machine if the bed does warp within certain limits, but these limits are well within manufacturing possibilities. In spite of this the bed is heat treated or artificially aged before final machining.

For taking ordinary length or diameter measurements, we place between the centres what is known as an engaging member, this consisting of a piece of steel with an annular vee groove in it, into which the stylus engages in the same manner as it does in the thread. When the stylus is thus engaged, the movement of the main carriage, because it twists the steel strip, is magnified 4000 times by the movement of the shadow of the hair line shown on the lighted scale.

Suppose we wish to measure a length of 6 inch. We set the standard between the anvils and arrange the machine so that the shadow is between the two black lines on the scale; this need not be done to any great degree of accuracy, as ½ inch of movement of the shadow is equal only to .0001 inch, approximately of the movement of the carriage. A reading is now taken of the micrometer wheel, and the stop anvil, situated in front of the carriage, is set with a slight clearance. This stop anvil prevents the carriage from running in and closing up the gap. The 6 inch gauge is now placed between the anvils and the micrometer wheel turned until the shadow of the hair line is once more between the two black lines on the scale. Another reading of the micrometer wheel is taken, then the difference between our two micrometer readings is the difference between the known standard and the length of the gauge.

Referring again to our measurement of pitch. In most machines that exist at present for the measurement of this element which, as we have seen before, hand, is the most important one in the screw, another difficulty has to be faced In ordinary comparative measurements such as we have just made, we merely use the micrometer screw to make up the difference between our standard and that of the gauge we are measur-

ing, which never need be more than a few thousandths of an inch, therefore, any inaccuracy in the micrometer screw is negligible. But when we make a pitch measurement we have to use the full length of the micrometer screw in order to push the gauge past the stylus point and in this case our micrometer screw is our standard of comparison, and therefore it is quite useless having a machine which will measure pitch to 5 decimal places if the micrometer screw is not accurate to four.

Calibrating Screw

We have, however, a means of calibrating our screw against our reference standards in a manner which never need take more than two or three minutes. The method is as follows: The engaging member is placed between the centres as before and engaged with the stylus point. The machine is so set that the micrometer reads zero when the shadow is in position on the scale. Again adjust the stop anvil to a slight clearance and open out the micrometer to say 1/10 inch, the stop anvils will have closed and the shadow will have gone off the scale. Take a 1/10 inch standard, place it between the micrometer anvils, rotate the micrometer screw until the shadow is once more in its place, and if the wheel does not read zero, the difference of reading is the error in the screw.

This can be done in any steps up to the complete length of the screw, and on any progressive error being found a steel strip upon which the vernier arm runs, can be taken off and surface ground to any inclination so that as the vernier arm moves along it, it adds to or subtracts from the length of the screw, thus compensating for any error which may arise.

The micrometer has a hardened screw and nut, and is calibrated in the first place, but in course of time a progressive error is bound to wear into it, periodics tending to diminish as wear takes place. In this way it will be seen that our pitch readings can be referred to our fundamental standards. The anvil pressure of the machine is 1½lbs., and is obtained by means of a dead weight running in an oil dash pot. This means that the anvil pressure is constant for any position of the carriage. The weight also has a valve in it which allows the carriage to be moved outwards quickly, thus opening the anvils, but on releasing same and allowing the weight to drop the valve shuts and the weight can only drop down the dash pot according to the creeping of the oil through the valves. This obviates any possibility of damage due to the carriage being released and charging into the micrometer anvil.

For the measurement of internal pitch an attachment is provided which transfers the movement of the stylus point through a right-angle, and the ring gauge is mounted in the line of the centres, the operation being exactly similar to that of a plug gauge. For the internal measurement of ring gauges, the gauge is mounted on a mandrel, which is slotted to allow the stylus to engage the threads and has a standard size shank located in the central vee piece of the top carriage. Special stylus points are provided for measuring the major, core and effective diameters, the effective diameter stylus points varying with every pitch in the same way as needles do for measuring external effective diameters.

WHAT IS THE MONEY VALUE?

(Continued from page 27)

As to the length; setting the cutters by spacing collars to a length gauge held between the cutters would be all right if the arbor were true, the collars parallel, the cutters a neat fit on the arbor, and the cutter teeth ground square with the bore. In actual practice there is always some wobble to cutters so strong on an arbor, causing the cutters to cut a shorter piece than intended—this inaccuracy being in addition to the one which is greater or lesser according to the skill of "feeling" in setting cutters to a gauge. Under such every day conditions, it is necessary to cut and try, using dummies or previously spoiled pices for the process.

The pieces are of cast iron and this, coupled with a glance at the cross section, will tell the experienced man something that the novice would not suspect. The length is 13 inches, that of the miller vise probably used is 6 in. or 7 in. at the most, giving the pieces an overhang of over 3 in. at each side of the vise and at this extreme length the piece is caused to resist the stress of the cut. The last piece in the load is sure to be broken unless the feed is reduced to the most extravagant nibble. By placing a piece of steel in the vise, next the movable jaw, and further stiffening the set-up with two clamps to bind the steel and two work pieces into a more non-vibrating whole, the cut may be made at the highest feed and in perfect safety. The drawing shows this point.

Summing up, the experienced man took about an hour longer in making his trial cuts and in collecting his supplies than did the inexperienced one but he made this up when he got to cutting because he could use coarser feeds and he did not have to stop for broken pieces blocking the machine. And the preliminary time resulted in twenty-five good pieces at the end of the run instead of twenty out of square and varying in size besides the five that were broken.

The above is a case from an actual performance. The job itself is one of the simplest cases of shop practice that could be given—one that seemingly calls for a minimum of experience but actually calls for a great deal. In the shop where this was done, the job was given to a workman who had a smattering of shop practice and he broke or spoiled several castings before his real ignorance of so simple a task was discovered—the delay while new pieces were being obtained to fill the order cost the customer over $150, since he had promised certain work and based his promise on the machine shop's getting the castings to him.

BALL BEARINGS AS ADAPTED IN GRINDER

(Continued from page 30)

size and surface finish are very exacting.

The spindle is mounted on three bearings, two of which are adjustable against each other, and the third merely a carrying member. The driving pulley is carried on two radial bearings and transmits the power to the spindle through a series of keys. This arrangement is to prevent vibration from the belt being transmitted to the spindle and wheel.

DUST HAZARD TO BE CONSIDERED

Further attempts are being made to lower the present dust hazard in grain elevators. Canadian Government officials have asked the United States Dept. of Agriculture for aid in this research work and on the invitation of J. Grove Smith, Dominion Fire Commissioner, the latter department sent D. J. Price, engineer in charge of the office of development work of the Bureau of Chemistry, to hold a conference at Ottawa, September 30th, on the causes of dust explosions and methods of construction and management of elevators to prevent their occurrence.

The United States engineers previously had been called in by the ruins of the disastrous elevator explosion at Port Colborne, Ont., and to look over the great elevators at Fort William and Port Arthur. Engineer Price recently addressed a conference in Montreal similar to that to be held in Ottawa. Lessons will be drawn from the disaster at the Armour elevator in Chicago last March, in which six lives were lost and $4,000,000 worth of property destroyed.

BLASTING BY LIQUID AIR

Liquid air which was produced in Great Britain—as a result of the wonderful experiments of Sir James Dewar—has now became a commercial product. Some experiments of a most successful kind were carried out recently by a British company in the use of liquid air as an explosive. A paper cartridge filled with a material rich in carbon was used, after having been soaked for a quarter of an hour in liquid air containing eight parts in ten of oxygen. Cartridges of this type were charged into the holes to be blasted and were fixed by means of an electric spark. The combination of the oxygen with the carbonaceous material created a sudden and enormous volume of gas with strongly explosive effect.



WHAT OUR READERS THINK AND DO



REGARDING THREAD CUTTING

By Cecil H. Smith

Having read with interest Mr. Davies' article on thread cutting, in the August 25th issue of "Canadian Machinery," let me explain my own particular method of calculating gears. Of course, I believe the following method to be more simple, but let readers be the judge.

First arrange all the gear teeth numbers in fractional form. Place all drivers above the line, and all driven numbers below the line. Consider the number of threads per inch in lead screw as the numerator, and the threads per inch in screw to be cut as the denominator. For example:

Suppose we are cutting a thread 10 per inch with a 4 pitch lead screw. We then have 4/10, the 4 representing the driver and the 10 the driven. Multiply both figures by some number that will bring the total to suit the gears on hand. For example:

$$\frac{4}{10} \times \frac{6}{6} = \frac{24}{60}$$

To compound: To cut 40 thds' per inch with the same lead screw—

$$\frac{4}{40} \times \frac{5}{5} = \frac{20}{200}$$

As 100 would likely be the largest gear we have—

$$\frac{20}{100} \times \frac{1}{2} = \frac{1}{2} \times \frac{40}{40} = \frac{40}{80}$$

The gears would therefore be

$$\frac{20}{100} \text{ and } \frac{40}{80}$$

Another case. To cut 2 4/5 thds' per inch with a 5-pitch lead screw, having no 100-tooth gear, the numbers running in fours:

$$\frac{2\,4/5}{5} \times \frac{5}{5} = \frac{14}{25}$$

$$\frac{25}{14} \times \frac{4}{4} = \frac{10}{56}$$

As we have no 100 gear, and the gears run in fours, we take 4/5 of 100, or

$\frac{80}{56} \left(\frac{5}{4} \times \frac{8}{8}\right) = \frac{40}{32}$ gears then equal

$$\frac{80}{56} \quad \frac{40}{32}$$

To prove all gears, cancel the gear numbers as you would a fraction, when they should come back to the original. For example: Let us prove the last problem—

$$\frac{80}{56} \times \frac{40}{32} = \frac{5}{7} \times \frac{5}{2} = \frac{25}{14}$$

$$\frac{25}{14} \div \frac{5}{5} = \frac{5}{2\,4/5}$$

The number used to multiply the original fraction to bring it into gear tooth numbers must be selected to suit the gears you have. As a rule 4, 5, 6, or 8 are used. The above explanation in written form may appear complicated, but after use, it is, to my mind, very easily understoood.

TWO HANDY IDEAS

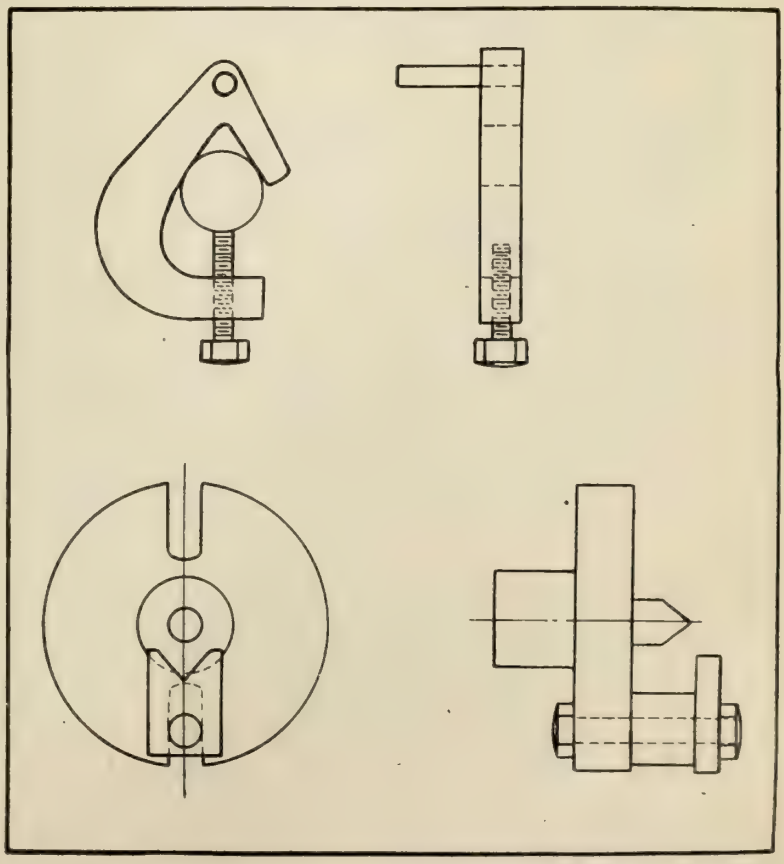
By Harry Moore

The sketch shows an unusual style of lathe dog which was designed for turning the ends of long rods. When working on rods of this nature they can be turned end for end very easily and quickly as the dog can be taken off and put on while the work is between centers.

The other view shows a support in the shape of a Vee piece of flat stock which has an elongated hole in it for adjustment. The support is fastened to the face plate, and the operator merely lays the work on the Vee block which holds it central while he adjusts his tailstock centre to push the work up properly.

NEW BRIDGE

The new Kidderpore Bridge which is now being built in Howrath will be one of the finest road bridges in India. The bridge will be a bow-string truss with a clear span of 237 ft. and an over-all width of about 8 ft. The structure will consist of two main girders spaced 36 ft. wide to accommodate two lines of trains down the centre, and a road for fast and heavy motor traffic on each side of the tramways. On either side, outside the main girders, there will be cantilevered out a roadway for slow traffic 8 ft. wide. Footpaths 10 ft. wide will be supported by the outer ends of these cantilevers.



Showing unusual form of dog and face place support



Black Finish on Brass

FOR the purpose of producing a black finish on small brass articles, says Mechanical World, it has been found that a sulphocyanate solution having the following composition is satisfactory:—Nickel ammonium sulphate, 8-oz. per gallon; zinc sulphate, 1-oz. per gallon; and sodium sulphocyanate, 2-oz. per gallon. It is desirable to keep in suspension an excess of zinc carbonate, which maintains the neutrality and the zinc content of the solution. "Black nickel" plating may be applied successfully to brass, either directly or after copper plating, to copper, and to steel which has been first coated with copper, nickel, or zinc. Where protection against corrosion is desired, the "black nickel" should be preceded by zinc plating. The wearing properties of the "black nickel" surface are largely determined by the quality of the lacquer subsequently applied.

* * * *

Lighting As An Investment

SPEAKING on the value of proper shop lighting, the National Safety Council states that good lighting is an investment, and not an expense as some would have you believe. They point out that in a plant which is properly illuminated accidents are less frequent; the employees work more efficiently and make fewer mistakes; a closer and better supervision of the men is possible; and the employees are contented and more stable in employment because of the orderly and pleasant surroundings which are sure to result from good lighting.

Adequate daylight illumination, properly applied, they continue, is the ideal light for the eyes. Light from above is generally better than light from side windows only. Skylights and monitor windows should, therefore, be provided wherever possible. Large window areas, equipped when necessary with awnings, window shades or blinds, and diffusive or refractive glass, together with light interiors are desirable in every work place.

The skylights and windows should be so spaced and located that daylight conditions are fairly uniform over the working area. Saw tooth roof construction gives an ideal daylight distribution. The intensities of daylight should be such that artificial light will be required only during those portions of the day when it is naturally considered necessary. Ceilings and upper portions of walls should be kept a light color. The lower portions of the walls may be darker, to rest the eyes.

Machines and work benches should be placed to secure the best light available. Benches at right angles to wall will often be found to improve lighting conditions. Close machine and bench work in centre of room. Machines should be so placed that the light reaches the workman from the side and falls naturally on the work, and that operators, benches and machines interfere as little as possible with the proper distribution of light to others farther from the windows. Lighting is improved by the removal of overhead belting.

Wired glass is recommended for practically all factory and mill windows where prisms are not required. Prism glass is of advantage where the windows are obstructed by buildings, especially if the room is deep. By its use a better distribution of the light over the floor area is possible. Wired glass shou'd be used in all skylights as a safeguard against breakage. Ribbed glass gives better diffusion than plain glass; in vertical windows it should generally be placed with the ribs horizontal, and will then act somewhat like prism glass.

Artificial light is required in factories and shops, on an average, about 20 per cent of the total working hours, not including overtime or night work. Where night work is carried on, the artificial lighting problem must, of course, receive particularly careful consideration. The development of new and improved types of lights, in many sizes, makes it possible however, to secure satisfactory and adequate illumination in any industry and under varying conditions.

* * * *

Reducing Noise in Factories

IN A recent number of a German technical magazine, says "Scientific American," an engineer named Walter Ritter, has suggested certain methods for reducing the inescapable noise in factories, machine works, mines, etc., to the lowest possible minimum. His basic idea is that it is less important to reduce the actual nose than to check the spread of the vibration to which noise is due, since in his opinion it is such vibrations that chiefly affect the nerves, having a more injurious effect than the pounding of a steam hammer or the buzzing of a motor.

The first law he lays down is that the foundation upon which a piece of machinery is erected must be absolutely solid and resistant to pressure, and he suggests that a suitable material for making such foundations is armored cement or else a masonry of slag set in mortar of pure cement. However, this foundation does not lessen the noise, since each of the two materials suggested is an excellent conductor of sound. One or the other of these materials is essential because of the firmness and solidity, but Mr. Ritter suggests the mixing of the cement with quartz sand and finally broken stones to form a sheet 10 centimeters in thickness as the first layer of the foundation. Upon this are placed successive layers having a slightly different composition, gray lime and kiesselguhr cement, each layer being firmly connected with the one below. The uppermost layer which should be from 10 to 20 centimeters thick, should consist of kiesselguhr cement. A foundation built in this manner possesses the property of deadening sound considerably and also reduces the vibration since the use of the kiesselguhr has the effect of imparting elasticity to the cement.

Vibration is further reduced by means of an insulating material. Rubber might be considered best for this purpose, but rubber does not assist in lessening the noise. The best material for laying under the machine has been found by experiment to be a thick wool felt, the so-called iron felt with an impregnated surface or crust. Such felt exhibits great resistance to pressure combined with a high degree of elasticity. It has been shown by experiment that this felt is not "deformed" by loads up to a pressure of 1450 atmospheres. Such favorable results have been obtained by this method of constructing machine foundations that it is to be expected their use will be rapidly extended.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Out of the many replies received to our October 6th contest, not one was correct. This means that two scales will be given next week in place of one. We have an important announcement to make in this respect. From now on, our scales will be enclosed in a neat case, so that we are thus adding to the value of our weekly prize.

CONTEST FOR OCTOBER 27TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—How to effect big savings.
2—Something that is saving men's time.
3—How to get over a problem.
4—A product with five features.
5—Something that looks like a pistol.
6—How to secure a cushion—but not a silk one.
7—Something that has been going on for over half a century.
8—A case where complete revision improved something.
9—Something that is quiet, but efficient.
10—A combination you can't beat.
11—Something that is traditional.
12—A product that maintains its goodness

These are Correct Answers for List from October 6th Issue

1—Dominion Steel Products Co.
2—Davis Bournonville Co.
3—Smelting and Refining Co.
4—Morse Chain Co.
5—Aikenhead Hardware Co.
6—E. C. Atkins Co.
7—Shore Instrumnet Co.
8—Geometric Tool Co.
9—A. O. Norton Co.
10—Photostat Corporation.
11—R. A. Hart Mfg. Co.
12—Diamond State Fibre Co.

Closing Date for This Contest is Nov. 17th



DEVELOPMENTS IN SHOP EQUIPMENT



HOT ROLLED DRILLS

The Canadian Detroit Twist Drill Co., Walkerville, Ont., have sent us some literature regarding their double D rolled drill, which, so far, we have never described. These drills are said to be the result of 30 years development, and are made by what is known as the "Hot Rolled" process. This method, according to the makers, produces a product of decided merit, and the high speed steel stock used in the "DD" drill is a high tungsten, high chrome steel, which must conform to special chemical specifications and analysis. The flukes of the drills are formed in straight from the bar stock, and then rolled hot on a machine with special patented feature rolls. This rolling is said to produce a uniform grain throughout, and helps the drill to accomplish severe service. Later the fluted blank is re-heated and twisted in a specially designed automatic machine. The helix angle on these drills is 32 degrees. This is said to help in deep drilling in tough or hard, heat treated material.

TILTING AND ROTARY TABLE

The Pawling & Harnischfezer. Co., Milwaukee, Wis., have placed on the market a new work table which is intended as a means of speeding up work and reducing machine shop costs. This table is for use with floor type boring drilling, and milling machines and is to be known as a universal tilting and rotary table. This accessory makes it possible to carry on machining operations on five sides of a piece and at any angle, with but one set-up.

It has an elevation of 90 degrees, and can be revolved a full 360 degrees at any position, whether flat or elevated. There is a graduated dial conveniently placed to enable the operator to locate the work accurately. The table top is elevated by means of two coarse-pitch spur gear segments driven by means of a worm and pinions; and it is revolved independently by a bevel gear and pinion. One revolution of the ratchet handle revolves the table 30 degrees, and one revolution of the elevating handle elevates the top 2½ degrees. Adjustment along the bed plate parallel to the spindle travel is accomplished by means of a rack and pinion. Tee-slots or table edges are used for locating the work, and the top of the table is provided with a trough to catch cutting compound.

PORTABLE HAND DRILL

A lightweight portable electric hand drill of 3/16 inch capacity with pistol grip, is the latest addition to the line of portable electric drills and grinders manufactured by the Cincinnati, Electrical Tool Co., Cincinnati, Ohio. This new drill is suitable for drilling in steel, brass, aluminum and sheet metal and for automobile body work, car building, window frames, wood boring, etc.

It is said to be simple in construction, and is equipped with universal motor, for use on direct and alternating current of the same voltage. The motor housing, end caps and handle, are made of special strength aluminum, insuring minumum weight. The armature and gear studs are mounted on ball bearings which practically eliminate all friction. Gears are of special analysis high grade steel. The switch is the "Cincinnati" special quick make-and-break type with 50% overload allowance. It is entirely enclosed in the handle and is operated by a trigger conveniently located in the handle.

VERTICAL TYPE WELDER

The American Electric Fusion Corporation, Chicago, have marketed a type V. W. vertical welder which is said to be suitable for either light or heavy work. The machine is box type construction throughout, and all mechanically moving parts are completely enclosed. All high voltage apparatus is also entirely encased, this making for absolute safety. These machines will weld material of any thickness from 2 pieces of No. 30 gauge up to and including 2 pieces of 5/16 in. clean stock. The machines can be operated by hand, foot, or by both at the same time without the necessity of disconnecting either one or the other operating levers. The lower horn of machine is adjustable, and four different throat depths can be obtained. The electrical equipment is all of the latest type, and several features are incorporated.

The Canadian Detroit Twist Drill Co., Ltd., Walkerville, Ont., have issued pamphlets describing their line of double D rolled drills. The construction and proper method of grinding is given together with the story of how this type of drill was developed.

SOME LEADING ARTICLES IN THIS ISSUE

Cutting the Time in Three by Disc Grinding 25

Disc grinding can often reduce cost of operation—Suitable fixtures are important if production is to be increased—Disc grinding scales' bases—Counter tare—Door frame, etc.

Plugging Holes in Cast Iron Surfaces 28

Holes may be plugged in many ways such as filler—Burning—Welding—Mechanical repairs, etc. The best method for each case explained—Sketches showing how to accomplish repairs.

Ball Bearings as Adapted to Grinders 30

Plain shop grinder—Grinding and polishing head applications—Disc grinder—Use of self-aligning ball bearings in housings—Vertical surface grinder application—Precision grinder, spindle, etc.

Need of Gauging for Modern Manufacturing 33

Limits in the tapped hole—Go and not go gauges—Measuring Machines past and present—Definite limit of miscroscopic magnification.

What Our Readers Think and Do 37

Answer to a query regarding thread cutting—Also two handy ideas for the lathe man.

Weekly Engineering Digest 38

How to obtain a black finish on brass—Lighting as an investment—Reducing noise in factories—Each subject suitably reviewed.

Developments in New Equipment 40

The latest in machine tool design is reviewed in this section. It pays to keep in touch with new machines, and the purchasing agent should find this section worth while.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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B. G. NEWTON, Manager
J. H. MOORE, Editor
T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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Friction's Greatest Enemy

ON ANOTHER page of the present issue appears an article on ball bearings as applied to buffing and grinding machinery. This only covers a very narrow field of usefulness, but starts one soliloquising on the many benefits which have been derived from the use of such bearings. Before the introduction of this style of bearing, friction was considered a necessary evil, and while very annoying, had to be put up with.

This idea has been rudely shattered, and now we have machines running at exceptionally high speeds and using ball bearings as the friction reducing medium. Friction creates heat, and heat in a fast running bearing invariably spells "trouble." In many cases we should have to reduce the running speed of certain machines if ball bearings were suddenly to become non-existent.

Of course there is no danger of this, for the use of ball bearings is becoming more widespread every day. There is a vast difference between the first ball bearing made and the highly developed and accurate bearings on the market today. Many improvements have been made and accuracy unthought of in the earlier days has been attained.

Each change in design has led to still further improvement until we now have balls and bearings that are marvels of accuracy. Industry owes a great deal to the manufacturers of these bearings, and as time goes on the world at large will no doubt still further benefit.

Flying—Is It Safe?

THE AVERAGE person is apt to consider the art of flying a decidedly dangerous one, and while not as safe, perhaps, as walking on terra-firma, it is by no means as bad as it is painted. Apart from the foolish stunts which some aviators persist in perpetrating, the commercial aspect of flying is becoming more rosy every day.

This is evidenced by the following authentic figures which have been issued by the Manufacturers' Aircraft Association, these results covering an aviation survey of the United States during the last six months.

It is stated that 1,200 commercial planes in operation have flown approximately 3,250,000 miles and that out of this number, about 1,000 are under the indirect supervision of responsible plane manufacturers or transportation companies. The remainder are the gypsy or foolhardy flyers some of whom have met with disaster, thus giving the industry, for such it is, a "black eye."

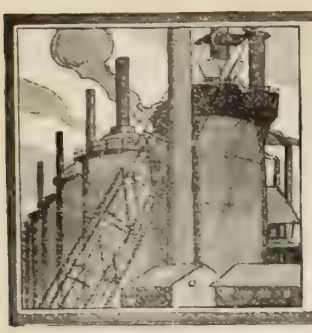
"Eight of the fatalities and thirty-two of the injuries in the last six months have been traced to the lack of terminals, routes and storm warnings, or to reckless stunting—errors which, according to the report, would have been corrected or prevented had there been a national air policy. In all the United States there are only 214 adequate municipal or civilian air ports, yet terminals are as necessary to aerial transport as they are to shipping or the railways. Deducting these preventable casualties, it is found that there was only one death for each 464,285 miles flown and only one injury for each 295,454 miles flown."

It is to be remembered that this record is for the United States alone. Britain has by no means been asleep in the development of commercial flying, and provided the various governments lend their support both by installing terminals, and providing financial aid for further experimental work, there is no reason why the next few years should not see a still further development in this industry. The airplane is invaluable in many cases where speed is the chief consideration, so that anything that will increase the safety of flying should be carefully fostered.

A 60,000 kva. 7000-volt, three-phase generator, rated at 1000 r.p.m., but designed to withstand 50 per cent. increase in speed, has been completed by the Siemens-Schuckert Works in Germany.



Get busy on the woodpile, old man.



MARKET DEVELOPMENTS



Market Situation Varies According to Locality

Production of Steel Ingots is About 35 Per Cent. Capacity—Sheets Have Stiffened Considerably but No Change in Price is Reported —Price of Rails Has Dropped Seven Dollars Per Ton

THE MARKET is very erratic this week. It is largely a question of locality, and reports from the various fields are inclined to conflict with one another. In Pittsburg, the production of steel ingots is around 35 per cent., this being 14 per cent. more than the rate last July. A further increase this year, however, is hardly looked upon as possible.

The sheet mills show the best operation of any branch of the finished steel trade, the rate of production varying all the way from 75 to 90 per cent. Tin mill operations are to 60 per cent. Pipe mills have increased somewhat, the to 60 per cent. Pipe mils have increased somewhat, the average being around 50 per cent.

Rails have dropped in price, the reduction being $7 per ton. This makes the present price $40. It is expected that this drop may cause the U.S. railroads to purchase tonnage now which they would otherwise have carried over into next year.

Finished steel prices in general show a stiffening tendency, although there are no clean cut advances.

It is believed that if freight rates were to come down, business generally would pick up immediately. The steel industry would naturally get its share of the increased activity.

Several good sized orders for rails have been secured by Canadian concerns during the past few days, these being for rails for the C.P.R. and C.N.R. railways. Further business in this market is also said to be within reach

The machine tool market in both Toronto and Montreal markets is very dull. There seem to be lots of prospects, but no actual orders. Some of these prospects should be breaking in the near future.

The small tool market remains fairly steady. Orders keep coming in and although they are for small quantities, in the aggregate they amount to something worth while.

The scrap metal market still remains dull and no improvement is looked for until foundries secure more orders than they have at present.

REDUCTION OF $7 IN PRICE OF RAILS— BUSINESS THIS WEEK NOT QUITE SO BRISK

PITTSBURGH, October 27.—While the production of steel has probably continued to increase up to date, or to within a week or two, the rate of buying of steel products at present does not seem to presage any further increase for the time being. The steel market is distinctly quieter, according to most members of the trade, although here and there mills report orders increasing.

Production of steel ingots is running at [illegible] per cent of capacity, this comparing with rates at 32 per cent. in September, 30 per cent in August, and 21 per cent. in July. There has been a fairly continuous increase in production rate for three months, but the probabilities are there will be no material increase during the remainder of the year and this means of course that there may be some recession. It is quite impossible, however that production should drop to the low rate of last July, for that represented an altogether abnormal condition. There was consumption then, but it was supplied in large part by stocks of steel in the hands of jobbers and manufacturing consumers, and of manufactured wares in various hands. These stocks being largely liquidated, demand upon the steel mills has been returning to a normal relation with the actual consumption, which has been proceeding right along.

The sheet mills continue to show by far the best operation of any branch of the finished steel trade. The American Sheet and Tin Plate Company, (Steel Corporation) has been operating about 90 per cent of its sheet mills, while the independents have been averaging 75 or 80 per cent. There has been a slight decreasing tendency in the past two or three weeks. Tin mill operations have decreased materially, the average being now about 50 per cent. Wire mills are operating at former rates, from 40 to 60 per cent. Pipe mill operations have increased somewhat, and now average close to 50 per cent. Merchant bar mill operations have been increasing, but are still very light.

Shape mill operations are lighter still, although there has been an increase in the past few weeks. In this connection it must be noted that the Bridge Builders' and Structural Society reports September lettings of fabricated steel contracts at 48 per cent. of the shop fabricating capacity, against 33 per cent for August, and an average of 28 per cent for the eight months ending August. Plate mill operations are still lighter than shape mill operation.

It is the low operation of bar, shape, plate and rail mills that pulls down the general average, for it would seem strange for steel to be produced at only about 35 per cent. of capacity when sheet mills are running at 75 per cent and more and wire, pipe and tin plate mills are going at far above 35 per cent.

As to rails, the railroads have not been specifying to any extent of late, and a considerable part of the rail tonnage put under contract for the present year was in line to be carried over to next year, partly because the railroads are short of funds and partly, no doubt, because the roads have lately been hoping that there would be a reduction in the price for next year. The United States Steel Corporation has in the past

few days announced a reduction of $7 a ton, from $47 to $40, in its rail price, and this may cause the railroads to take out some tonnage now which otherwise they would have carried over to next year.

As to finished steel prices in general, they show a stiffening rather than a weakening tendency, but there are no clear cut advances. Efforts are being made, more or less, to get prices up, but this is no easy thing when mills are so indifferently employed. In bars, shapes and plates the advance to $1.65 for bars and $1.75 for shapes and plates still hangs fire. The Carnegie Steel Company got up to this basis several weeks ago, and a few independents are adhering to the prices, but there are a few aggressive sellers at lower prices. These lower sellers have been endeavoring to accumulate enough business to justify their withdrawing the lower prices but it has been very difficult to gather up tonnage, except small orders for immediate shipment. For delivery in the Pittsburgh district and nearby, bars, shapes and plates can be done at $1.60 if the order is attractive in tonnage and specifications, but this is not the market for the whole country, since the usual "Pittsburgh plus" system is abandoned in much of the territory, at least for the time being. Thus there is a seller in the Buffalo district that will name delivered prices equivalent to $1.50, Pittsburgh, on bars, while in the west $1.75, delivered Chicago, has been done on bars. To meet this competition a Pittsburgh mill would have to sell at $1.37, mill, and of course this could not be done.

Just what will occur as to sheet prices remains to be seen. The great majority of independents have formally announced an advance of $5 a ton, but some would probably sell at the old price, and the Steel Corporation has made no advance. If the advance were effective it would raise black sheets from $3.00 to $3.25 and galvanized from $4.00 to $4.25. Superficially blue annealed sheets would seem to go up from $2.50 to $2.75, but in the actual market it has developed that blue annealed sheets can be bought at the $2.25 price ruling before the September advance was made.

That the steel market has been distinctly less buoyant in the past couple of weeks is now recognized in all quarters. Whether the demand, as a whole, has actually decreased is a question, but it is certain that it has not been increasing as it was a few weeks and more ago. Whether improvement will be resumed in the near future is uncertain. An opinion could be formed if it were definitely known what has arrested the progress of the advance. If it is the season of the year, then no further improvement can be counted on until the late winter. If it is the fact of freight rate reductions having come into nearer prospect, then a decided improvement in buying can reasonably be expected when freight rates are reduced. A general reduction would decrease somewhat the cost of producing steel, resulting in somewhat more attractive prices, while it would reduce the cost of moving steel, and that would reduce the cost to the consumer, for whatever the formal terms in a sale of steel the essence of the transaction is that the buyer stands the freight. If half of what has been said lately is true a reduction in freight rates would stimulate business in general, and the steel industry would naturally get its share.

POINTS IN WEEK'S MARKETING NOTES

Production of steel ingots is running at a trifle above 35 per cent. of capacity, this comparing with rates of 32 per cent. in September; 30 per cent. in August, and 21 per cent. in July. However, no further material increase is expected this year.

Sheet metals are fairly strong this week. The rate of production varies from 60 to 90 per cent. Tin mills are operating at about 50, wire mills at 40 to 60, and pipe mills around 50 per cent.

Rail prices are down somewhat, a reduction of $7 having been made a few days ago. This makes the new price $40. This movement may cause the railways to take out some tonnage now, which otherwise they would have carried over to next year.

Finished steel prices show a stiffening tendency, but there are no clear cut advances. Efforts are being made to get prices up, but with the mills running at their present rate, no immediate change is expected.

The steed market is less buoyant. Some think that if a reduction in freight rates took place, it would stimulate business in general, and of course the steel industry would get its share of the increased activity.

Several large orders have been placed with Canadian mills for steel rails during the past few days. It is rumored that there is still further business in this line, naturally the mills who have already landed orders, are going out after the rest of the business.

Sheets and plates continue to be active, both in the Toronto and Montreal markets. However this demand is not expected to continue after the weather gets too cold for building operations.

The machine tool trade shows little change this week. While business is being secured, the orders are few and far between, and are not of very large proportions.

The least said about the scrap metal market the better. Nobody wants to buy, and until foundries pick up, which will not be in the immediate future, no change can be expected in this market.

SHEETS ARE STIFFER MACHINE TOOLS DULL

TORONTO:—October 27th. Gathering up news on the market situation these days is no sinecure. The chief difficulty is to strike a fair average in the various lines. One man may be filled with enthusiasm, while his next door neighbor feels that all is lost. It's a very peculiar situation, and as week after week goes by, the same state of affairs seems to hold good. For example, we were speaking to one dealer this week, who was sure things had gone to the dogs, when suddenly, out popped a fairly good order from the envelope he was opening. Immediately the man's personality changed. Excusing himself, he proceeded to hurry things along, (for as usual it was an order that was held to the last minute, before being placed). We waited patiently, for we had a hunch what this fellow's attitude would be when he came back to his desk, and we wanted to prove our hunch. As expected he was full of pep and enthusiasm when he returned. "You know," he commenced, "when an order like that comes in, I begin to feel that things are not as bad as we picture them when we're feeling blue. Things cannot have gone all to the dogs, for Canada is a big country, with a big future. It may take time to recover, but recover we will."

This story about sizes up the general business situation. Every dealer is very much like an elevator, he is continually going up and down, depending on the traffic he is securing. The chief point of interest is, that once you back them into a corner, and ask them what they think of the future, they invariably say, "It's bound to be good, for Canada is a wonderful country." They have different ways of putting it, but in every case, they feel the same way about it.

The Steel Market

Sheets have stiffened in the local markets, and while no advance in price has been made, the demand for this commodity is very brisk. This is largely due to the fact that many buildings are reaching the finishing stages, and of course everybody is rushing the work through before the cold weather sets in. The number of tinsmiths needed, and advertised for, shows that this explanation is the correct one, for not only are sheets in demand, but also the men to put them in place.

Apart from this section, the steel situation is practically the same as last week. Orders come in steadily, but are not of sufficient importance to talk about.

Speaking on the possibility of a railroad strike in United States, one dealer said that while it would make a difference for the time being, they thought they could pull through without difficulty. "We have a fairly good stock on hand," he said, "and what we actually require we feel we could get through in some way." Should such a strike take place, it would have a tendency to stif-

fen prices, that is, for the duration of the strike. However, as the prospects for a settlement look somewhat brighter this week, we will hope that no emergency measures are necessary.

Machine Tool Market

Reports are very conflicting in this market. One dealer says things are better, while another tells you the very opposite. For example here are two reports as we received them. "We have had a splendid week. In fact the last two weeks have shown a considerable improvement. Our machine tools are selling fairly well, and our general supply line is moving along nicely. There is no change in prices, nor is there likely to be any."

Now comes the other side: "This is the poorest week we have had yet, although we cannot say we have lost hope or faith in Canada as a market for machine tools. We know the need is there, but our difficulty is to get the men who require the tools to spend the money." This about sums up the situation. Every dealer speaks about the prospects he has on tap, and which he hopes to close shortly. When these deals will materialize no one knows. One dealer was very busy trying to land a large order this morning when we called, and when asked as to the outlook he said, "Good—I think I'll land this order. If I do, it will be the best in months." The finest method of describing this market would be to say that it is very erratic.

Small Tools

This market is about the steadiest of all. While no large orders are being closed, it is the old story that many mickles make a muckle, in other words, many small orders make up for a large one. Dealers in this line are quite satisfied and report a slight improvement every week.

Scrap Metal Market

Until foundries throughout the country pick up, we can expect no great change in this market. From present outlook, we cannot see how foundries are going to increase their activities until the demand for other lines likewise picks up. When one considers that the foundry is really the starting point of many lines, it can be readily understood why the scrap market has remained so dull for such a long period. Nobody wants to buy, and as foundries are fairly well stocked up, things are at a deadlock.

GOOD SIZED ORDERS ARE PLACED BY RAILROADS—PLANTS WILL BE KEPT BUSY

MONTREAL, October 27th: — The general situation in the iron and metal industries for the past week has been devoid of any "thrills" or outstanding features of any kind. The volume of business reported compares very favorably with that of previous weeks which have shown gradual and steady improvements since midsummer. The point which really represents the best symptoms is not that of the slightly increasing volume of business, but of the increasing confidence of the buying public and the consumer in general. For a long while prices have been influenced by various factors described in many ways, such as profiteering, war prices, liquidation, etc., etc. All these conflicting elements created suspicion on the part of a purchaser. It is these disturbing features that are passing and thus enabling the bona-fide manufacturer and jobber to rebuild his business connections. The principal business passing this week is reported in steel rails. Elections have had a certain influence on the whole situation as is usual. The issue of the tariff is of such vital interest to the Canadian iron and steel industries that it is not surprising to know that business is being temporarily neglected to an extent that is greater than usual.

The rise of the Pound Sterling to over $4.30, manufacturers claim, due to the suggested settlement of many international problems at the Washington conference, although these matters seem far removed from domestic business problems, they appear, upon close examination, to be linked up closely with the future of the Canadian manufacturer. One jobber claims that if the suggestion of cancelling the war debts all round, or some similar suggestion is acted upon, that it will have a marvellous and almost magic effect on international commerce. Adverse exchange rates will be reduced and huge sums of money now idle in the U. S. A. will be put to work. Thus, business problems of the world will only be ironed out and settled by co-operative work on the parts of all civilized countries.

The Steel Situation

The Algoma Steel Co. have this week received an order for 32,000 tons of rails from the C. P. R. This amount is in addition to the 25,000 ton order from the same firm some weeks ago. The combined orders are expected to keep the firm busy till the end of the year.

The Dominion Iron & Steel are reported to have received an order from the Canadian National Railways for 20,000 tons of steel rails. Rumors on the street are the authority for stating that the National Railways are in the market for some 55,000 tons of rails in addition, and both the Dominion and Algoma firms are making every effort to secure the balance of the order.

Structural steel, and bars of all kinds are rather quiet. Only small hand to mouth orders are being received. Sheets and plates still continue to be comparatively active, and prices have remained steady. The call for sheets has been caused by the usual autumn demand and no doubt business will fall off a little toward the end of the year. The orders in plates seem to have come from a better turn in the shops where a fair amount of tank work is being done.

Prices have remained steady throughout, but there has been a hint for some weeks past that an upward revision would come through at an early date. It is, however, only reasonable to suppose that such is the case, as present prices are approximately production cost, or only slightly better.

Pig Iron

Foundries, except in few instances, report little or no change in business conditions. In some cases stocks purchased some time ago are still unused. Some foundries found themselves so overstocked after the business depression overtook them, that they disposed of their surplus pig. However, the present weekly sales are considerably in excess of those of the first six months of the present year. Pig iron after several advances has reached a point where there is a small profit in it for the producer. These prices are not, however, on a really satisfactory basis yet. Further increases will be in order before normal conditions are approached.

Machine Tools and Supplies

The industrial corporations are only working to partial capacity, and their machine tool equipment is more than ample to take care of present production. Only in few instances are the larger manufacturers purchasing machines. A few odd sales of various tools, are reported, but the purchaser is usually a small shop man. The railway shops have not yet entered the market. One machine tool dealer thinks that Sir Joseph Flavelle's report on the National Railways sizes up the situation correctly, and does not look for business from that quarter for a long time.

The small tool and supply business is continuing on a fairly active basis. The volume of business is slowly increasing. Manufacturers are gradually getting back to normal and prices are becoming more stabilized. Nothing of an outstanding nature however, has been reported for several weeks.

Practically no change in price has occurred during the past week in non-ferrous metals. Copper seems to hold its own, and have a tendency to strengthen in price. Tin is up one cent a pound. Trading for the week has been normal with little suggestion of a change in conditions. Stagnation still prevails in all kinds of scrap metals. The continued operation of the foundries at partial capacity and a plentiful supply of scrap in and around all shops has reduced the trading in scrap to almost nothing. Very few hopeful signs of an early improvement are in evidence and the prices continue at the low level.

The Stroberg Electric Co., Chicago, Ill., have published a bulletin, No. 214, which covers their process timing and signalling instrument No. 55. It explains that this device is used where the element of time is an important factor. The details of construction, etc., etc., are given.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	37 00	39 00
Spelter	7 25	7 50
Lead	6 50	7 50
Antimony	7 25	8 25
Aluminum	28 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	6 50	8 03	7 95	9 48
¾ in.	7 99	10 06	9 95	12 02
1 in.	11 82	14 38	14 71	17 77
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4 in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 20%.

Standard couplings, 4-in. and under, 20%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 75	6 00
Can. plates, all bright	7.75	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	8.00	
Fleur-de-Lis, 28 B. W. G.	7.50	
Gorbal's Best, No 28		
Colbornes Crown. No. 28.		
Premier, No. 28, U. S.	6 75	6 25
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$
1¼ in.	27 25	
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.		34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil, bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	21	Atlas	15
Peerless	22	X Empire	15
Grand	21½	Ideal	18
Superior	21½	X Press	13½
X L C R	16½		

Colored

Lion	13½	Popular	10½
Standard	12	Keen	9
No. 1	14		

Wool Packing

Arrow	35	Anvil	22
Axle	28	Anchor	17

Washed Wipers

Select White	17
Dark colored	13
Mixed colored	14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Imperial Steel and Wire Co., opened up in Collingwood on the 17th of the present month.

Installation of an artificial ice plant to cost $50,000 is contemplated by Chatham Crystal Ice Company.

The Peck Rolling Mills, Montreal, are equipping to manufacture angle iron and similar structural shapes.

The Government has announced its intention of re-employing all the railroad employees who have been laid off in the last six months.

M. J. Schmitt, sales engineer, Kearney & Trecker Co., Milwaukee, visited their Ontario Agents, The F. F. Barber Machinery Co., of Toronto, last week.

The Wonder Tractor of Canada, Ltd., of Montreal, Que., has been incorporated with $90,000 capital to manufacture agricultural implements.

The F. F. Barber Machinery Co., Toronto, have just secured the Ontario Agency for the Landis Tool Co., Waynesboro, Pa.

A contract for $82,000 for Indiana Limestone required for a hospital costing $2,500,000, for Ottawa, Ontario has been awarded.

The Canadian Irrigation, Ltd., Toronto, Ont., has been incorporated with $50,000 capital to manufacture irrigation machinery.

Kitchener, Ontario, is to erect a new collegiate institute. So far no cost has been stated, but we believe these figures will amount to something very substantial.

Montreal, Que. The Union Bag and Paper Corporation is now running at 100 per cent. capacity in all its plants, including St. Maurice Paper Co. This activity is on current orders, nothing being made for stock.

London, Ontario, is trying to raise $250,000 by issuing of debentures to enable the Western University to proceed with their new Art Building. It is expected that the approximate cost of this building will be $1,000,000.

Mr. E. W. Beatty, president of the Canadian Pacific Railway, interviewed on his Western tour when reaching Winnipeg, predicted a gradual return to prosperity in Canada and affirmed his faith in the soundness of the country.

The Forsyth Production, Ltd., Waterloo, is planning the erection of a large addition to their factory.

Peerless Machine Co., Racine, Wis., have announced a reduction in prices of their saws, this becoming effective October 20th.

Galt, Ont.—Men are busy at work erecting the new public utilities building which, with equipment, will cost about $200,000.

Fraser Brace Co., Cote St. Paul, Montreal, recently secured a contract totaling $10,000,000 for water power development in Winnipeg.

Thos. Lord, sales engineer for Gould Eberhardt, Newark, N. J., was in Toronto last week visiting their Ontario Agents, the F. F. Barber Machinery Co.

Vancouver, B. C.—The Burrard dry dock company has been incorporated, and a new dry dock may be built in the near future. The cost of the proposed structure will be about $2,500,000.

Bramson's Auto Service, Ltd., are erecting a large six story garage, in Montreal. It is understood however, that they will not purchase equipment for their repair work until after the first of the year.

The Skelton Tool Co., Syracuse, N.Y., makers of boring tools have amalgamated with the Chapin and Baker Manufacturing Co., Inc., of that city, makers of counter boring, spot facing and gear blocking machinery. The name of the new company is The Chapin-Skelton Corporation. New lines will be added.

Cars made at the General Motors plant, Oshawa, Ontario, will be on exhibition at the Olympia Motor Show at London, England. Colonel R. S. McLaughlin, president of the General Motors, is sailing from New York on the Aquitania together with Mrs. McLaughlin to attend this exhibition.

The plant and equipment of the Anthracite Briquette Co., Ashbridge's Bay, Toronto, has been purchased by the Financial Underwriters, Ltd., 88 Bay Street Toronto. The Anthracite Briquette Co., was until a few days ago owned by A. E. Gooderham and associates, and manufactured A.B.C. briquettes Under the new management a briquette made by a Dutch oil process will be produced. Mr. H. F. Clater, president of the Financial Underwriters, Ltd., states that in all probability the newly acquired plant will be added to the assets of the Nukol Fuel Company shortly.

F. E. Bartley, sales engineer, Blanchard Machine Co., Cambridge, Boston, is in Toronto this week calling on their Ontario agents—F. F. Barber Machinery Co.

The Canadian Bridge Co., Walkerville, Ont., have received a contract for steel work on towers for the New Brunswick Electric Power Commission, this commission being situated at St. John, N. B.

Industry on the Canadian Pacific coast is making good headway. In the last fiscal year British Columbia exported goods to the value of $83,558,649 as against imports to the extent of $81,615,288.

The contract for the structural steel works for the new seventeen story addition to the Chateau Frontenac, Quebec, has been awarded to the Dominion Bridge Co., Montreal. 2000 tons of steel will be required for this work.

Sydney, Nova Scotia, reports that a contract for the manufacture of 20,000 tons of steel rails at the Sydney Mills has been signed by the Dominion Steel Corporation and the management of the Canadian National Railways. This order alone will keep the steel plant going for nearly two months.

Burlington, Ont. The Globe Code Standard Electric Co., will soon start up in this town. This new industry will manufacture electric goods of all kinds. The principal line handled will be porcelain insulators, as used in the electric wiring of houses, factories and other buildings, poles, and towers. The factory will employ about 20 persons, to start with, but the number will be gradually increased up to 40.

Lumbering in northern Ontario and Quebec will be carried on during the coming winter on a much larger scale than was expected acording to the latest reports. This favorable change is in many parts of the country where men are being engaged in large numbers. The cause of the revival in activity is due to a large drop in wages. Skilled workers are being employed for $30 a month, while ordinary labor commands $1 per day. This means that lumbering companies are able to cut, and drive logs to their mills for approximately 40 per cent. of the amount paid a year ago. Working efficiency is also said to be increasing, this being due to the big surplus of men and the necessity of working hard in order to hold jobs.

Bridgeburg, Ont. The Canadian Tool Co., have located here. At present they are arranging for temporary factory space, but plan to construct their own plant at a later date.

Figures representing the total amount of contracts awarded in Canada during the month of September, 1921, totaled $19,565,700. $900.000 of this item was used for the erection of factories alone.

The Board of Education, Guelph, Ont., has approved of the plans for the New Collegiate Institute and Technical School. The estimated cost is believed to be $300,00. Construction work in connection with this will start next spring.

The Port Arthur Shipbuilding Co. intends to leave shipbuilding strictly alone for the present at least. They will continue the manufacture of pulp and paper-making machinery, and expect to enter into the manufacture of low pressure boilers for heating purposes.

Owen Sound, Ont. A $4,000,000 cement plant will be established here. This project has been on hand for some time, but now that the government has officially announced their intention to stay out of the cement making game, it is expected that the new plant will be proceeded with immediately.

The large concentrating mill of the American Molybdenite Co., has been opened up at Wilberforce, Ont, This plant so far has cost nearly $100,000, and the first unit, which will turn out 200 tons a day will be started this week. Later on the capacity will be increased to 600 tons a day.

It has been decided subject to certain formalities, to place with a Canadian firm, an order for 36 grain elevators for South Africa. It is understood that part of the machinery will be purchased in Great Britain, but almost the whole cost of the buildings, other than the structural steel to be used therein, will be expended in South Africa.

The Vesta Battery Co., of Chicago are coming into the Canadian field on a large scale. They are building a plant in Sherbrooke, P. Q., which will employ 100 hands for a start. Mr. G. R. Archdeacon, will be general manager, and on the board of directors. Mr. Perry, president of the Vesta Co., is much enthused over the prospects for the Canadian branch.

New plan whereby any person in the United States or Canada can purchase Black and Decker equipment on six months terms, without extra cost. This firm whose products consist principally of electric motor driven shop equipment such as portable electric drills, grinders, etc., have recently put into effect a National Credit Service. These products which are sold entirely through the jobbers, enable users to buy through their regular jobbers by paying 25 per cent. cash and the balance in six equal monthly payments without any extra charge or interest being added to the standard price.

Executive offices have been opened in the Royal Bank Building, Toronto, for the Durant Motors of Canada, Limited. Mr. Mark Daniel has been named as assistant secretary of the Canadian executive.

Plans of the Windsor and Walkerville joint technical school board to build a technical school at a cost of $800,000 have been approved by the Finance Committee, of Windsor City Council. Half of the cost will be borne by the Ontario Government.

The Dodge Sales and Engineering Co., Mishawaka, Ind., have published a very neat brochure, telling the story of "Shorty", and how he came to be portrayed in the form of the now well known statuette. Anyone interested will find it entertaining reading.

Additional contracts for an addition also a new wing to the technical school of Hamilton, Ontario, will cost $70,000. A contract has been let for a separate school costing $60,000. Another contract has also been let for a public school which will cost $300,000.

During the month of September the Canadian Chartered Banks opened 15 new branches and for the same period closed 10 branches. This leaves a net gain of 5 new offices for the month. The figures for the past nine months show that 174 banks have opened branches and 94 branches have been closed, leaving a net gain of 80 branches for the period.

The Kipawa Bleached Sulphite Mills, one of the Riordon plants, which has been closed down for some months in Montreal, has resumed operations with prospects of running on full time for an indefinite period. The market for sulphite has shown considerable improvement during the past few weeks and it is stated that the extreme depression in this particular branch of the trade is a thing of the past.

Mr. G. E. Pearson, one of our Montreal representatives, has been on a two months' trip to England, and reports that there is a most decided improvement in the general tone of business. Everyone seems to have a feeling of confidence, says Mr. Pearson. In fact so much so that they are no longer holding back but are striking out for themselves. For instance he says that the managing director of the Hans Renold Co. of Canada, states that their Canadian office is their only bright spot.

H. C. Cox, president of the Canada Life Assurance Co., has returned to Toronto from an extended tour which took him from Winnipeg to Vancouver. He has brought back a very optimistic report of the West and says that farmers are now buying freely. Business in the cities is also improving, and another encouraging thing, according to Mr. Cox, is the abundance of new building which is being undertaken throughout the entire West. In Regina alone 400 new houses are at present under construction.

C. C. Bradley & Sons, Syracuse, will next year celebrate their 50th anniversary as manufacturers of power hammers. A few days ago they discovered one of their first hammers, made in 1872 still going strong in a Syracuse factory.

The Toronto office of the Independent Pneumatic Tool Co., has been removed from 32 Front St. W, to 163 Dufferin St. This new location will give the company larger space and increased facilities for carying their tools and accessories.

The Algoma Steel Corporation is in receipt of an order for 32,000 tons of steel rails for the Canadian Pacific railway. Some weeks ago the same corporation received an order for 25,000 tons from the C. P. R. The industrial outlook at Sault Ste. Marie is now considered much brighter.

The Red Arrow Tires, Ltd., is a new company to establish its plant in Peterboro, Ontario. Land has been bought and plans for the plant are now being prepared. It is expected that the first unit will be in operation in the spring and that some 400 men mill be employed. The company will be incorporated for $2,000,000.

The Diamond Match Company of the U. S.; The Maguire, Madison Talmer Co., of Canada, who also manufacture matches in England and Ireland, and Bryant & May, of Great Britain, as well as prominent capitalists in both England and Canada are interested in a plant for the formation of a new match company to be situated at Pembroke, Ontario.

It is stated in Washington on high authority that the Interstate Commerce Commission has decided to force large reductions in grain rates. The order is being prepared and its official announcement may come any day. The reductions are expected to have an important bearing on imports of grain from Canada, which will be facilitated by lower rates.

The Seneca Falls Manufacturing Co., makers of lathes, became acquainted recently, with a persistent, if not belated reader. This man sent in a request for a certain woodworking machine which the company had not been making for ten years, and mentioned the date of the advertisement in which he had seen the machine described. One never can tell when and where a message is going to strike.

Jones Brothers and Company, Toronto, show case and store fixture manufacturers, for the period ending October 1st, 1921, had on file 920 orders for complete store equipment as against 916 orders for the same period last year. This, notwithstanding the fact that 1920 was the largest year in the history of the store fixture business in general and Jones Brothers in particular. R. J. W. Barker, the manager, states also that they have received more direct inquiries for equipment in the last six weeks than in the previous six months.

H. A. Harrison, 220 King St. W., Toronto, has just completed negotiations for the exclusive Canadian agency of the Critchley expanding reamers, which are manufactured by Chadwick & Trefathen, Portsmouth, N. H., U. S. A.

A few of the principal shoe manufacturing companies are now in a position to accept orders for delivery in less than six weeks' time. The manufacturers prices are firm and may advance. Such is the statement of Mr. S. Roy Weaver, manager of the Shoe Manufacturers' Association of Canada.

C. P. Lyman, of the Lyman Tube and Supply Co., Montreal, was killed a few days ago near Albany, N. Y. It seems that the automobile in which Mr. Lyman was travelling went into a ditch thereby causing his death. Mr. McNaughton, a business associate who was with him at the time, was severely injured.

Mr. Woodburn of Woodburns, Ltd., Montreal, has returned from a business trip to the coast and reports improving conditions there, although very few orders are being actually obtained in certain lines, there is a large number of enquiries coming in all the time. Mr. Woodburn secured quite a number of orders, and arranged several contracts for electrical resistance and insulated wire.

Fort William, Ont.—Work on the addition to the Northwestern Elevator Co., plant has been started and it is expected that the building will be completed by the spring, and be ready for actual operation by the middle of next September. This addition will cost around $700,000 and will consist of 60 concrete tanks 22 feet in diameter and 95 feet in height. This will give the entire plant an aggregate capacity of more than 900,000 bushels. Cleaning machinery will be installed adapted to clean 8,000 bushels of grain per hour. Machinery valued at approximately $180,000 will be installed to make the addition a complete unit. About one-half of the total construction cost, or $350,000, will be expended on labor, and this will provide considerable employment in Fort William during the coming months.

That retailers of men's clothing evidently feel the country is going to roll up its sleeves, slip into overalls and become a deal busier some day than it is at present, is indicated by reports that overall manufacturers are busy. Mr. Surman, of the Peters Overall Co., Welland, also thinks it is a response to a very marked reduction in prices to the retail trade, say about 60 per cent, which reduction was largely made by lower prices on cotton materials. The manufacturer who covered requirements at these prices protected himself to a certain extent against present rising tendency. The retailers also evidently feel that, stocks being low, nothing very much better in the matter of prices may be expected—so that industry sees the excuse for idleness eliminated in that it can secure its overalls again at comparatively reasonable figures.

Toronto.—A new concern, The Tools & Stampings Ltd., has started at 87 Jarvis St. They will manufacture dies, tool, and metal stampings, and will also handle electro-plating work. Mr. Wise is the owner of the new concern.

A Buffalo house, doing business with the foundry trade, reports a growing feeling of confidence in buying supplies—due in some measure to much lower prices and also to the feeling that business seems due for a recovery. As manufacturers of a certain kind of oil, they point out that the general demand seems to be developing from gallon, to barrel capacity, and they expect to see it gradually work back to the carload lot class.

J. E. Dalrymose, vice-president of the G. T. R., says that business in Eastern Canada is improving. The grain movement, says Mr. Dalrymose, is an important factor in helping the railways at present. Between July 1 and September 30 more than 40 per cent. of all the grain exported was handled by the port of Montreal, the amount being equal to the grain exported from all other ports in Canada and the United States during the period named.

Preston, Ont.—Mr. Kerr of Preston Woodworking Machinery Co. reports that they are being kept busy on full time. They are now employing 45 of their regular staff of 70 men. He also states they sold a sand riddle to Scotland and he is in hopes it will be a fore-runner of extensive sales in the United Kingdom. They now have an order in hand to supply the city of Toronto with 250 electric light standards.

On October 16th, the flour mill of Lawrence and Wakefield, Dresden, Ont., was completely destroyed by fire, along with eleven thousand bushels of wheat and two hundred bags of flour. The mill, which was Dresden's largest industry, was running twenty-four hours a day, six days in the week and had abundant orders booked to keep operating to capacity for some weeks to come. The loss is estimated at $80,000 and is partially covered by insurance. It is the intention to rebuild as soon as possible.

The Butterfield Company, Rock Island, Que., and Derby Line, Vermont, have just completed their new Derby Line factory which is to entirely replace the old Derby Line plant in the manufacture of their goods. Derby Line Vt., is just across the street from Rock Island, Que., where the Canadian plant of the firm is established. The new plant in the latter place has been in operation for about a year. The management have announced that the Canadian plant will in future handle their entire export business, a fact that will mean a considerable increase in their Canadian business. It is also reported that they have plans out for an extension to the Canadian plant to double the present size for this export trade, same to be built whenever business conditions justify.

The recent increased activity in the textile industries of Canada during the past five weeks is continuing. Observers of textile operations incline to the view that activity will prevail until the end of the year at least, and that developments in the near future will largely determine the course of events in the first half of 1922.

Anglo-Canadian Wire Rope Co., of Montreal, reports a number of enquiries within the past month. They have also secured several orders from these enquiries. This concern is getting in a supply of wire which will carry them through this winter and enable them to fill orders. They are looking forward to steady improved conditions from now on.

One concern in Montreal reports several rush orders for belting. Upon enquiring it was found that this belting was wanted not for immediate use but to be on hand in case of a breakdown. This would seem to indicate business in the future, as heretofore firms have been in the habit of allowing equipment to run on regardless of its condition, rather than spend money for spare equipment.

The big dam at Kenogamis Lake, near the head of the Mattagami River, has been completed. This dam is calculated to back the water up about thirty miles, and raise the level about 10 feet. Officials of the Northern Canada Power Company say this is adequate provision for ample hydro-electric power throughout the winter, provided the fall does not turn exceptionally dry.

The Northeast Coast steel manufacturers in England, have made a drastic cut of 70 shillings per ton in the price of ship plates. This is equal to about $17.00. The makers claim the price now quoted does not only wipe out profits, but incurs great losses, which they felt they must make in order to encourage trade.

The $5,000 000 Hydro-electric power plant at Twin Falls, which is helping to drive the paper mills of the Abitibi Power & Paper Co. at Iroquois Falls is now entirely completed. The Twin Falls power plant is the largest ever installed in this part of Northern Ontario, the generating capacity being approximately 28 000 h. p. thereby more than doubling the former amount of electric energy generated by the Abitibi Co.

Mr. M. J. O'Donnell, formerly local representative of Herbert, Morris, Crane & Hoist Co., Niagara Falls, Ont., is now connected with Rudel-Belnap Machinery Co., Ltd., 137 McGill St., Montreal. The most of his time will be taken up looking after their outside interests in the Province of Quebec and Eastern Ontario. Mr. O'Donnell has been connected with the machinery business for a number of years. He is a member of the Engineering Institute of Canada, and has specialized on equipment for the economical handling of material in the industrial field.

The British Columbia agent-general of London, England, has secured for his province contracts for structural timbers for naval dock yards. The director of naval dock-tracks also gives assurance that preference will be accorded dominion products in the awarding of future contracts.

Ottawa, Ont.—Fire brick dealers of Toronto, Montreal and Ottawa have interviewed R. R. Farrow, Deputy Minister of Customs and Inland Revenue protesting against the ruling that all fire bricks sold in Canada must be stamped with the name of the country from which they came. It is claimed that the indentation harms the fire brick, and adds to the cost. Nothing definite was accomplished, but their claim will be given careful consideration.

Some activity in the large railway shops of Buffalo is reported—but this is said to apply to minor repairs. Thousands of cars are standing in the Buffalo yards, some requiring brakeshoes and other minor but very essential repairs. A statement, made by one in touch with the situation is to the effect that the railways are buying brakeshoes by the hundred, instead of by the hundred thousand as in prosperous times. But the fact that the shops are being opened is taken to indicate that absolute necessity for repairs has become urgent and that gradually larger forces will be given employment.

On the American side of the line, there is some tendency to deplore, if not to resent, the tendency on the part of autocratic buyers to name their prices in buying and to adopt an accept-or-behanged attitude. Of course, such a development may have received some encouragement during a period of fluctuating prices, when there appeared to be no stability and the mistaken idea got abroad that a price was the result of a random shot but always allowed for a good profit. Prices on many commodities are now at a low level, competition has become keen, standards of quality are again a big factor, and in protesting against unreasonable dictation, manufacturers who have goods of merit declare that they are "going to be hanged" rather than submit.

Manufacturers in Western New York do not appear to view the threatened railway strike with a great deal of alarm. While there appears to be some doubt that a strike will be called, it is also felt that such a struggle could not come at a better time, as there are many men out of work. Industry is certainly not urgent, and there is an abundance of material from which to develope a substitute force to man the railways. The struggle had to come and if there is a showdown, manufacturers are of the opinion that the railroad men are going into it without that doughty ally—favorable public opinion. The fact that many old employees would also lose their pensions is also a consideration which should be worthy of a second thought.

Sault Ste. Marie, Ont. If present plans go through, $200,000 will be spent in dredging and other harbor improvements at the "Soo" next year. With an expected increase in the number of the lake carriers and Canadian locks sufficient to bear a 50 per cent. increase in traffic, the widening and deepening is planned, although a start will not be made until next year.

PECULIAR ERROR

Last week we ran the following item:—The Brown Boggs Co., Ltd., Hamilton, report 9,000 sales during the past week. Mr. Lavery, the sales manager, informed this paper that they expect a steady increase in sales from now on.

Instead of 9,000, the word 'good' should have been substituted. Read the item over with the word **good** in place, then see what a difference one word can make. The copy given to the composing room showed the word "Good," quite plainly, but the printer decided to improve on the copy, with startling results.

One of the most hopeful signs anywhere is that which points to the growing scarcity of lines on retail shelves. This condition is becoming evident not only in Canada but in the United States. A large pump manufacturer in Western New York sent a traveller south recently and in ten days out he had sent in orders amounting to a carload a day on small pumps.

MARINE NEWS

Thirty-three per cent. of all the shipping which passed through the Panama Canal during the financial year 1921 was British, and 32 per cent. of all the cargo handled was carried in British bottoms, according to a report received in Washington from the canal zone. The percentage indicated this year has been maintained pretty constantly since 1918, though British vessels carried from 41 to 45 per cent of all traffic through the canal in 1915, 1916 and 1917. The relative decline is explained by the rapid development of American shipping during and after the war in Europe. For the financial year 1921 the most important British trade served by the Panama Canal was that between Europe and Australia and New Zealand, with an aggregate cargo tonnage for both directions of 950 000. Second place was taken by the trade between Europe and the west coast of South America with 747,000 cargo tons. Then followed the trade between the United States and Australia and New Zealand, with 506,000 tons; the trade between the United States and the Far East, with 451,000 tons; and, finally, the trade between Europe and the West Coast of North America. These five trade routes account for 81 per cent. of all the cargo carried through the Panama Canal under the British flag.

SOUTH AFRICA REPORTS INCREASE IN IMPORTS

Speaking on the imports of South Africa for 1920, trade commissioner W. J. Egan, in the weekly bulletin of the Department of Trade and Commerce, says that that year was phenomenal in automobile imports, this also applying to tires, which increased in value from $2,407,000 in 1919 to $6,105,000 in 1920. Canada's trade more than doubled in the two years fro $242,000 in 1919 to $574,000 last year. The United States figures of trade in tires are remarkable indeed, the jump from 1919 being from $716,000, to $2,523,750. The United Kingdon are very little different, jumping from $965,000 to $2,262,000. Imports from France also increased from $401,000 to $707,000, while imports from Italy dropped from $78,000 to $23,000.

In waterproof cloth and sheetings there was the same remarkable increase of imports, though not in the same proportion. Last year's imports were to a value of $312,390, an increase of $227,000 over the previous year. Canada's exports under this heading increased from $2,835 to $9,600, the United States from $12,000 to $57,000, and the United Kingdom from $70,000 to $242,975. In other manufactured rubber goods, including tire rubber, the total imports last year were to a value of $704,000, which is about three times the total average annual pre-war value import. Canada's trade under this heading, which has increased, due to representation, from $50 in 1914 to $22,740 last year, just about held its own with the 1919 figures, which were $210 more in that year. The United States increased from $144,000 to $188,000, and the United Kingdom from $222,000 to $474,000. France and Japan still retain their share of the trade, which is however, in very small figures.

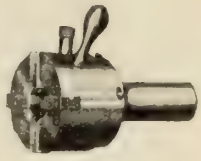
DEMAND FOR MORE MACHINERY

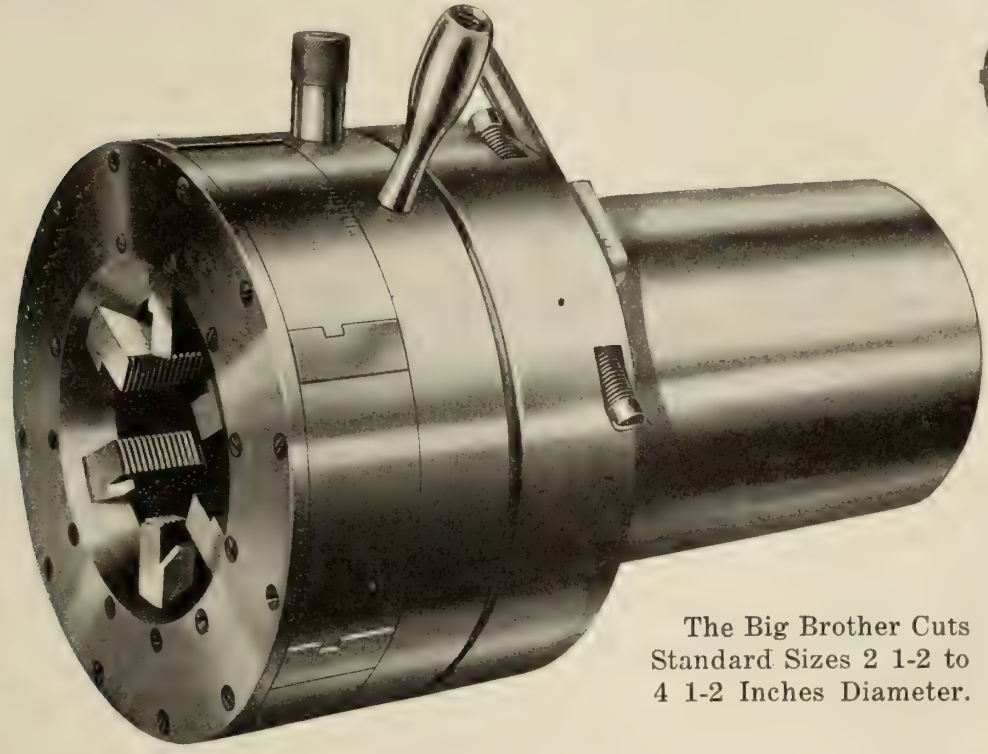
Spain is becoming a more important market for machinery every year, and all but a very small proportion is imported, says the British Export Gazette. The Spanish farmer, for instance, is just beginning to realize that he is a back number in regard to methods and appliances, and is slowly replacing his wooden ploughs and hand threshers, are all that local industry has provided him with, by implements of more modern type, importing them from America, Canada, Great Britain and Germany. The same is true of plants for other industries, such as water turbines, machine tools, centrifugal and other pumps, carpenters' tools and small motors, these being among the lines most in request, and for which there is the prospect of a big demand.

LITTLE, BUT O MY!

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The Little Fellow Cuts Standard Screw Threads from 3-32 to 9-16 inch Diameters, and Cuts Them Just as TRUE as the Big Brother.





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Geometric Thread Cutting Tools and Machines Are the Recognized Standard

THE GEOMETRIC TOOL COMPANY

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Canadian Agents:

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UNITED STATES ANTI-DUMPING ACT DETAILS SHOULD INTEREST EXPORTERS

SPEAKING on the subject of the United States Anti-Dumping Act, 1921, the weekly bulletin of the department of trade and commerce say that several enquiries have been coming into them regarding this piece of legislation. In order that readers of Canadian Machinery may have this information at their finger tips, we publish the details below.

The following sections of the act, which includes the Emergency Tariff, should be of interest to all exporters. The effect of the Anti-Dumping Act is to levy, under certain conditions given below, a special duty equal to the difference between the "foreign home value" of goods and the actual "sales price." Unlike the new schedule of duties in the Emergency Tariff, which are to remain in force only six months from the date of enactment, the anti-dumping law is a permanent measure. We will take the sections in consecutive order:—

Sec. 201. (a) That whenever the Secretary of the Treasury (hereinafter in this Act called the "Secretary"), after such investigation as he deems necessary, finds that an industry in the United States is being or is likely to be injured, or is prevented from being established, by reason of the importation into the United States of a class or kind of foreign merchandise, and that merchandise of such class or kind is being sold or is likely to be sold in the United States or elsewhere at less than its fair value, then he shall make such finding public to the extent he deems necessary, together with a description of the class or kind of merchandise to which it applies in such detail as may be necessary for the guidance of the appraising officers.

(b) Whenever, in the case of any imported merchandise of a class or kind as to which the Secretary has not so made public a finding, the appraiser or person acting as appraiser has reason to believe or suspect, from the invoice or other papers or from information presented to him, that the purchase price is less, or that the exporter's sales price is less or likely to be less, than the foreign market value (or in the absence of such value, than the cost of production) he shall forthwith, under regulations prescribed by the Secretary, notify the Secretary of such fact and withhold his appraisement report to the collector as to such merchandise until the further order of the Secretary, or until the Secretary has made public a finding as provided in subdivision (a) in regard to such merchandise.

Special Dumping Duty

Sec. 202. (a) That in the case of all imported merchandise, whether dutiable or free of duty, of a class or kind as to which the Secretary has made public a finding as provided in section 201, and as to which the appraiser or person acting as apraiser has made no appraisement report to the collector before such finding has been so made public, if the purchase price or the exporter's sale price is less than the foreign market value (or, in the absence of such value, than the cost of production) there shall be levied, collected and paid, in addition to the duties imposed thereon by law, a special dumping duty in an amount equal to such difference.

(b) If it is established to the satisfaction of the appraising officers that the amount of such difference between the purchase price and the foreign market value is wholly or partly due to the fact that the wholesale quantities in which such or similar merchandise is sold or freely offered for sale to all purchasers for exportation to the United States in the ordinary course of trade, are greater than the wholesale quantities in which such or similar merchandise is sold or freely offered for sale to all purchasers in the principal markets of the country of exportation in the ordinary course of trade for home consumption (or, if not sold or offered for sale for home consumption, then for exportation to countries other than the United States), then due allowance shall be made therefor in determining the foreign market value for the purposes of this section.

Purchase Price.

Sec. 203. That for the purposes of this title, the purchase price of imported merchandise shall be the price at which such merchandise has been purchased or agreed to be purchased, prior to the time of exportation, by the person by whom or for whose account the merchandise is imported, plus, when not included in such price, the cost of all containers and coverings and all other costs, charges, and expenses incident to placing the merchandise in condition, packed ready for shipment to the United States, less the amount, if any, included in such price, attributable to any additional costs, charges, and expenses, and United States import duties, incident to bringing the merchandise from the place of shipment in the country of exportation to the place of delivery in the United States; and plus the amount, if not included in such price, of any export tax imposed by the country of exportation on the exportation of the merchandise to the United States; and plus the amount of any import duties imposed by the country of exportation which have been rebated, or which have not been collected, by reason of the exportation of the merchandise to the United States; and plus the amount of any taxes imposed in the country of exportation upon the manufacturer, producer, or seller, in respect to the manufacture, production or sale of the merchandise, which have been rebated, or which have not been collected, by reason of the exportation of the merchandise to the United States.

Exporter's Sales Price.

Section 204. That for the purpose of this title the exporter's sales price of imported merchandise shall be the price at which such merchandise is sold or agreed to be sold in the United States, before or after the time of importation, by or for the account of the exporter, plus, when not included in such price, the cost of all containers and coverings and all other costs, charges, and expenses incident to placing the merchandise in condition, packed ready for shipment to the United States, less (1) the amount, if any, included in such price, attributable to any additional costs, charges, and expenses, and United States import duties, incident to bringing the merchandise from the place of shipment to the country of exportation to the place of delivery in the United States, (2) the amount of the commissions, if any, for selling in the United States the particular merchandise under consideration, (3) an amount equal to the expenses, if any, generally incurred by or for the account of the exporter in the United States in selling identical or substantially identical merchandise, and (4) the amount of any export tax imposed by the country of exportation on the exportation of the merchandise to the United States; and plus the amount of any import duties imposed by the country of exportation which have been related, or which have not been collected, by reason of the exportation of the merchandise to the United States; and plus the amount of any taxes imposed in the country of exportation upon the manufacturer, producer, or seller in respect to the manufacture, production, or sale of the merchandise, which have been rebated, or which have not been collected, by reason of the exportation of the merchandise to the United States.

Foreign Market Value.

Sec. 205. That for the purpose of this title the foreign market value of imported merchandise shall be the price, at the time of exportation of such merchandise to the United States, at which such or similar merchandise is sold or freely offered for sale to all purchasers in the principal markets of the country from which exported, in the usual wholesale quantities and in the ordinary course of trade for home consumption (or, if not so sold or offered for sale for home consumptin, then for exportation to countries other than the United States),, plus, when not included in such price, the cost of all containers and coverings and all other costs, charges, and expenses incident to placing the merchandise in condition packed ready for shipment to the United States, except that in the case of merchandise purchased or agreed to be purchased by the person by whom or for whose account the merchandise is imported, prior to the time of exportation, the foreign market value shall be ascertained as of the date of such purchase or agreement to purchase. In the ascertainment of foreign market value for the purposes of this title, no pretended sale or offer for sale, and no sale or offer for sale intended to establish a fictitious market, shall be taken into account.

Cost of Production.

Sec. 206. That for the purposes of this title the cost of production of imported merchandise shall be the sum of—

(1) The cost of materials of, and of fabrication, manipulation, or other process employed in manufacturing or producing, identical or substantially identical merchandise, at a time preceding the date of shipment of the particular merchandise under consideration which would ordinarily permit the manufacture or production of the particular merchandise under consideration in the usual course of business;

(2) The usual general expenses (not less than 10 per centum of such cost) in the case of identical or substantially identical merchandise;

(3) The cost of all containers and coverings, and all other costs, charges, and expenses incident to placing the particular merchandise under consideration in condition, packed ready for shipment to the United States; and

(4) An addition for profit, (not less than 8 per centum of the sum of the amounts found under paragraphs (1) and (2) equal to the profit which is ordinarily added, in the case of merchandise of the same general character as the particular merchandise under consideration, by manufacturers or producers in the country of manufacture or production who are engaged in the same general trade as the manufacturer or producer of the particular merchandise under consideration.

U.S. FOREIGN TRADE SHOWS A DECLINE

A review of the statistics of the foreign trade of the United States for the first six months of 1921 brings out the fact that the values of exports and imports have declined appreciably as compared with the high values of the first half of 1920. This was to be expected in the light of the sharp fall in prices of most commodities, together with a world-wide trade depression.

Month by month, beginning with January, 1921, the value of exports fell steadily, with one exception: the total for June was 7 million dollors higher than that for May. As compared with the values of a year ago export trade was off about 40 per cent. Although the break in the values of imports came early in the fall of 1920, a slight reaction occurred in February, March, and April, 1921, the imports increasing from 209 million dollars in January to 254 millions in April, only to drop during May and June. The value of the imports for the entire six months was less than half that for the January-June period of 1920. The balance of trade for the first half of this year was not far different from that of the first half of 1920, there being still a huge excess of exports, amounting to nearly one and a quarter millions in April.

CATALOGUES AND PAMPHLETS

The Northern Crane Works, Limited of Walkerville, Ont., have issued a very interesting bulletin, which describes their type "E" electric travelling crane. This bulletin No. 504-C is well illustrated, showing the various parts of the crane and its operation under varying conditions.

The Oakley Chemical Co., New York has issued a booklet entitled "Modern Cutting and Grinding." Some valuable information is contained therein and of course they tell how their particular product can be used to advantage. There are some interesting tables for the mechanic in the latter portion of the book.

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The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
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Consulting and Designing
Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.
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Oil Tempered Steel Springs
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Special styles of all kinds to Order.
THE CLEVELAND WIRE SPRING COMPANY
Cleveland, Ohio
U.S.A.

The advertiser would like to know where you saw his ad.—tell him.

RAILWAY CONDITIONS

Speaking on the subject of railway conditions in Russia, Railway and Locomotive Engineering says that out of a total of 19,106 locomotives in a good condition before the war, there are at present from 5,500 to 7,650 reported in working order by different authorities, or a decrease of motive power by 60 to 75 per cent. Of that number approximately 1,000 are idle owing to lack of fuel. Serviceable cars are reported at from 150,000 to 286,000, or a decrease of from 48 to 70 per cent of the pre-war number.

The roadbeds are reported in very bad condition, and if large repairs are not made in the next few months considerable sections will have to be closed to traffic. According to the latest estimate at least 25,000,000 ties must be replaced and the present program calls for only 5,000,000 replacements. A considerable mileage of branch lines has been removed and used for repair material.

The fuel situation is very serious. Cessation in production of coal by 80 per cent and the deterioration of the mines has forced the railways to depend much more upon wood. Such wood must come from the forests of northern Russia, and the haul is too long for supply to southern Russian railways. An effort has been made to change the locomotives on the southern railways into oil burners, but the gradual decline of oil production has limited this transformation.

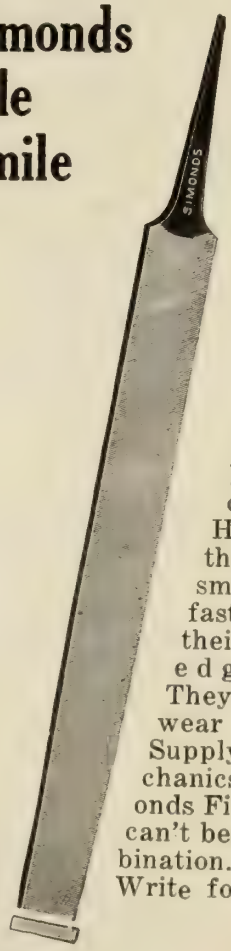
In the course of construction there were 88 auxiliary railroad lines for the forest work, including 38 of narrow gauge and 50 of broad gauge. There were at the beginning of the year in course of construction 626 miles of railroads, 250 miles narrow gauge, and broad gauge 366 miles. About 70 per cent of the roadbed was completed and rails were laid to a length of 142 miles. The construction of these auxiliary railroads are handicapped by the shortage of workmen, as they were constantly leaving, and the work often temporarily abandoned.

ANNEALING STEEL

To anneal high-speed steel thoroughly, the Consolidated Steel Corporation's instructions state it should be packed with granulated charcoal in an iron box or pipe sealed with about half an inch of charcoal between the steel to be annealed and the walls of the pipe or box. The whole should be heated slowly and uniformly, until heat has penetrated to the centre to a temperature of about 1500° to 1550° F. (a light cherry red), and held there for several hours, allowing it to cool off slowly, preferably with the furnace, or, if desired, the box or pipe may be removed from the furnace and buried in dry ashes or slaked lime. Under no circumstances, however, must the steel during the annealing process come into contact with the air.



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A good mechanic is pleased when he has Simonds Files. He knows that they cut smooth and fast and hold their cutting edge longer. They will outwear other files. Supply your mechanics with Simonds Files and you can't beat the combination.
Write for prices.

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Limited
Montreal, Que.
St. John, N.B. Vancouver, B.C.

Classified Opportunities

MACHINERY WANTED

WANTED 4 old lathes and a planer; will be used for special machines so condition does not matter. Price must be low. Box 792 Canadian Machinery. (c16m)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H Sumbling Machinery Co., Toronto. (etfm)

POSITIONS WANTED

OPEN FOR ENGAGEMENT AS GENERAL Manager, Factory Manager or General Superintendent. Have had a good engineering education and 17 years' experience in executive positions in mechanical lines on interchangeable manufacture of typecasting machines, firearms, electrical work, experience on drop forging, heat-treating and testing of steel tool design and making. Box 793. Canadian Machinery. (c16m)

MECHANICAL ENGINEER, COLLEGE GRAduate with seven years' experience as Mechanical executive and in the design, operation and largest of Power Plants and Factories, accustomed to responsibility, desires position, best of references Box 791, Canadian Machinery. (c16m)

MECHANICAL ENGINEER — (GRADUATE School of Technology, Gloucester, Eng.)—12 years' experience, design and production of high-class automobile and aircraft engines with leading British manufacturers. During the war attached to Air Department, British Admiralty, as supervisor of the construction of aircraft engines, including Rolls-Royce, is open for engagement. Just completed installation of industrial plant in Canada. Box No. 794, Canadian Machinery.

SALESMAN WANTED

ADVERTISER WOULD LIKE TO HEAR FROM a man who first of all is a real salesman; who has vision and a capacity for putting across big things. He should possess a knowledge of the Canadian trade, and of machine tools, and up-to-date engineering practice. State age, experience, and sufficient information to enable us to determine whether you are the man we want. The salary we are prepared to pay is big enough to attract a big man. If desired, information regarding identity of advertiser may be secured from Canadian Machinery before sending application. Apply Box 794N, Canadian Machinery.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
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Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

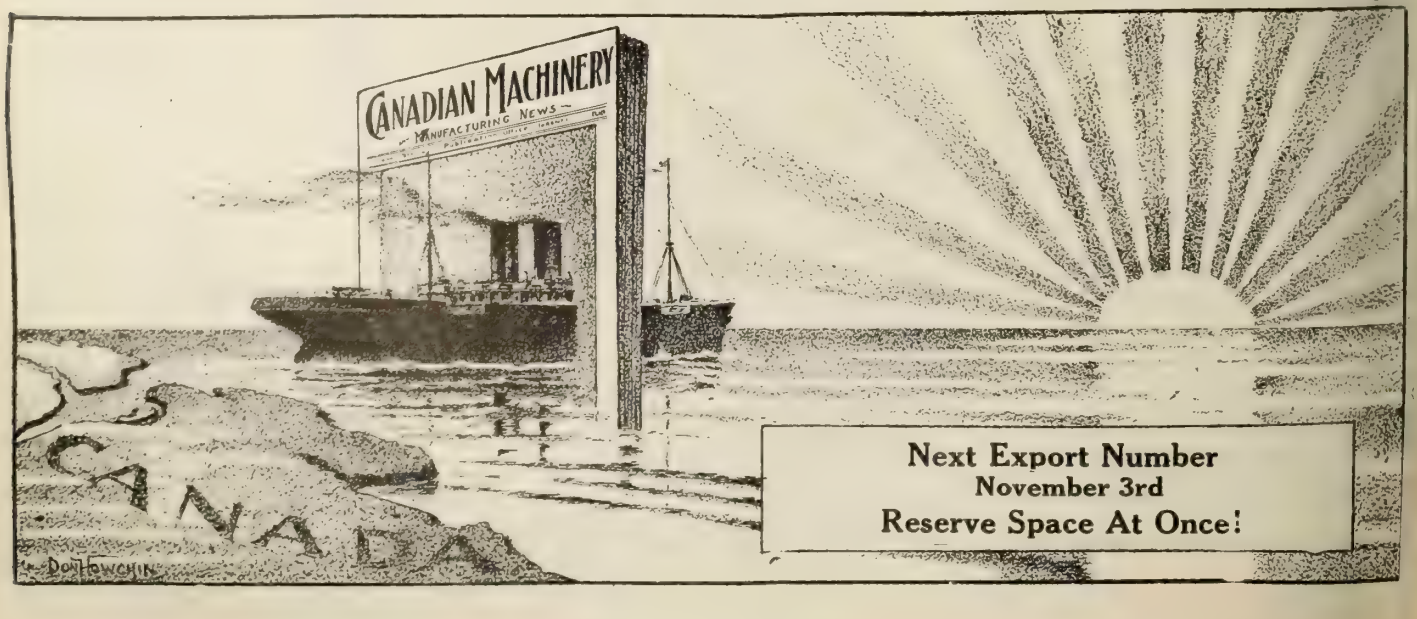
FOR SALE

FOR SALE — COMPLETE PATTERN EQUIPment for the manufacture of a line of goods sold to Wholesale Hardware and Machinery Jobbing Houses. Good future before it and very little Canadian competition. Investment of about $2000 00 only, required. Must be sold quickly. Very suitable as additional line to Foundry and Machine Shop business. Apply Box No. 790, Canadian Machinery. (c16m.)

LARGE QUANTITY OF VALVES—ALL SIZES, surplus stock of a Canadian shipbuilding company. Write for list, prices, etc. Box 789 N, Canadian Machinery.

ACETYLENE GAS CYLINDERS FOR TRANSFER 18 Type W. K. Acetylene Gas Cylinders for Disposal. If you are contemplating leasing one or more get in touch with us at once. Present factory price of lease for these cylinders, $80.00; Our price of lease for these cylinders, $60.00. Apply Box 787 Canadian Machinery. (c17m)

FOR SALE — ONE "NEW BRITAIN" SIXspindle automatic screw machine, 1-5/8" capacity, new. Located in Ontario, duty paid. Low price for quick sale. New Britain Machine Co., New Britain, U. S. A. (c19m)



Surplus Machinery

Tool Room, Manufacturing Machines and Miscellaneous Equipment, for sale

Lathes.

2—12″ x 4′ Mulliner Tool Room, Taper.
1—14″ x 6′ Reed, Q. C. G., Taper and Relieving, oil pan, and collets.
1—14″ x 6′ Lodge & Shipley, Q.C.G., Taper, collets and oil pan.
1—16″ x 6′ Cisco, Q.C.G., Taper.
1—16″ x 6′ Hendey, Taper, collets and oil pan.
1—16″ x 6′ Hendey, Taper.
1—16″ x 6′ Pratt & Whitney, Taper, and collets.
1—16″ x 8′ Hendey, Taper.
1—16″ x 8′ American, Q.C.G.
1—16″ x 8′ Prentice, Taper, collets and oil pan.
1—16″ x 8′ Pratt & Whitney, Q.C.G., and taper.
1—18″ x 8′ American, Q.C.G., and Taper.
1—18″ x 8′ Hamilton, D.B.G., Q.C.G.
1—18″ x 8′ Walcott, D.B.G., Q.C.G.
1—21″ x 8′ Le Blonde, Heavy Duty, D.B.G. Q. C. G.
2—24″ x 10′ Lodge & Shipley, D.B.G., 2 C.G.
1—24″ x 10′ Can. Mchy. Corp. D. B. G. QCG
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2—26 x 12′ Can. Mchy. Corp., D. B. G., Q. C. G.
1—26″ x 14′ Nile Bemont Pond, D. B. G., Q. C. G.
1—30″ x 14′ Niles Bemont Pond, D. B. G., 2. C. G.

Hand Screw Machines

30—No. 1 1/2 Star G.F.H., 1 1-2″ Cap., Power Feed Turret, oil pan and pump.
6—No. 3 Superior, Plain Head, 1 1-4″ Cap., oil pan and pump.
1—No. 4 Warner & Swasey, G.F.H., 1 1-2″ cap., Power Feed Turret oil pan and pump.
6—No. 4 Smurr & Kamer, G.F.H., 1 5-8″ cap., Power Feed Turret, oil pan and pump.
2—No. 4 Millholland, G.F.H., 1 1-2″ cap., Power Feed Turret, oil pan and pump.
11—No. 2 Smurr & Kamer, Plain Head, 1 1-16″ cap., oil pan and pump.
8—No. 2—Warner & Swasey, Plain Head, 1″ cap., oil pan and pump.
4—1 3-4″ x 7″ Gridley Multiple Spindle Automatics.
7—2 1/4 x 7″ Gridley Multiple Spindle Automatics.
8—3 1-4″ Gridley Single Spindle Automatics.
7—No. 55 Acme Automatic, Multiple Spindle.
12—No. 56 Acme Automatics, Multiple Spindle.

Shapers.

2—20″ Smith & Mills, B. G., Crank Shapers.
1—20″ Gould & Eberhardt Crank Shapers.

Milling Machines.

1—No. 3 Ford Smith Universal.
1—No. 2 Kempsmith Universal.
2—No. 3 Cincinnati Plain.
1—No. 2 Ford Smith Plain.
9—No. 1 Burke Bench Millers.

Drilling Machines.

2—Alfred Herbert 7″ overhang, ball bearing.
3—No. 1-2 Avey, Pedestal.
2—No. 1-2 Avey, Bench.
1—Leland Gifford, 6″ overhang, ball bearing, pedestal type.
1—Sipp, ball bearing, pedestal type, swing 16″.
4—Leland Gifford, 6″ overhang, ball bearing, bench type.
6—1-4 Rickert & Shafer, vertical tappers on pedestal.
1—5/8″ Rickert & Shafer, horizontal tappers on pedestal.
1—No. 1 1-2 Cincinnati.

Tool & Cutter Grinders.

1—No. 1 Norton.
1—Greenfield.
6—Stevens.
1—No. 2 Brown & Sharpe Surface Grinder.

Miscellaneous.

1—14 x 9 x 12 Can. Ingersoll Rand Belt Driven Air Compressor with receiver.
2—75 H.P. Crocker-Wheeler Motors, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
1—75 H.P. Can. Westinghouse, 25 cycle, 3 phase, 550 volt, 750 R.P.M.
3—Gas Furnaces.
2—High Speed Hack Saws.
1—No. 2 Standard Double Acting Press.
1—2,500 Ampere Plating Dynamo.
1—No. 9 Buffalo Conoidal Fan.
1—No. 5 Sheldon Exhauster, Motor Drive.
1—No. 2 Garvin Screw Slotter.
1—No. 1 Garvin Screw Slotter.
1—No. 2 American Oil Separator.
1—14 x 24 C.H.V.W. Mechanical Plater.
6—No. 2 Garvin Screw Shaving Machines.
8—B. & S. Polishing and Finishing Machines.
Pulley, Shafting, Couplings, Hangers and miscellaneous small tools.

The above equipment open for inspection at our plant, corner of DUFFERIN and KING STREETS, TORONTO

RUSSELL MOTOR CAR CO., LIMITED

Machinery Sales Dept. **Address communication** **Phone Parkdale 6744**

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Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., E., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia, Pa.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Bearings, Roller
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.

Bolts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Machine and Carriage
Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., E., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mill, Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.

Bronze
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machs.)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati

Bulldozers
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto.

Calipers
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

For list of Dealers see the last page of This Buyers' Directory

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons. Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Semi-Steel
Bull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Booth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Berlin Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Weight Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Weight Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Parts
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springf

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Stridinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis,

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Lt Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Lt Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp Galt Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
National Electro Products Ltd., Torreal, Que.
Prest-O-Lite Co. of Can., Toronto Ont.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co. D E., New London, Conn

Gear Testing Machines
Brown & Sharpe Mfg Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardiner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia,

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
National Electro Products Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co,, Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont
Williams Machinery & Supply Co., A R Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy Co., Toronto, Ont
Greenfield Machine Co., Greenfield, Mass
Herbert Ltd., Alfred, Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy Co., Toronto, Ont
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Index Centers
Dickow, Fred C., Machinery Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co. Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford,

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oils
Canadian Oil Companies, Ltd., Toronto, Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Imperial Oil Ltd., Toronto, Ont.
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont
National Electro Products Ltd., Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.

BUYERS' DIRECTORY

Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Ferry & Co., John C., Birmingham, Eng.

Presses, Forcing
Atlas Press Co., Kalamazoo, Mich.
Stewart & Co., Duncan, Glasgow, Scot.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. B., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Ltd., Montreal Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rohuster Co., P. B., New Haven, Conn.

Rolling Mill Equipment
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto,
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Taber Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal, Q

Screens
Can. Wire & Iron Goods Co., Hamilton

BUYERS' DIRECTORY

Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extracters
Cleveland Twist Drill Co., Cleveland, O

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton Ont.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Alkenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Rocleson Machine & Tool Co., Toronto, Ont
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stewart & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets,
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.

Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg Co., Providence R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Andrew Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Alkenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, nt
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glasseo, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

ubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Stemle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres,
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
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Kempsmith Mfg. Co., Milwaukee, Wis.
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Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
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R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

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The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
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A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q
Dunlop Tire & Rubber Goods Co., Ltd. Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont

Welding, Electric
Goodyear Tire & Rubber Co. of Can. Ltd Toronto Ont
Lincoln Electric Co., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co of Canada, Ltd., Hamilton, Ont
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Apparatus.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Toronto, Ont.
L' Air Liquide Society, Toronto, Ont.
Lincoln Electric Co. Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Walker & Sons Metal Products, Ltd. Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Garlock-Walker Mchy. Co., Toronto, Ont
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R. Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

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Consult this Buyers' Directory when you want the names of reliable makers of machine tools, parts, steel, in fact any equipment you may need.

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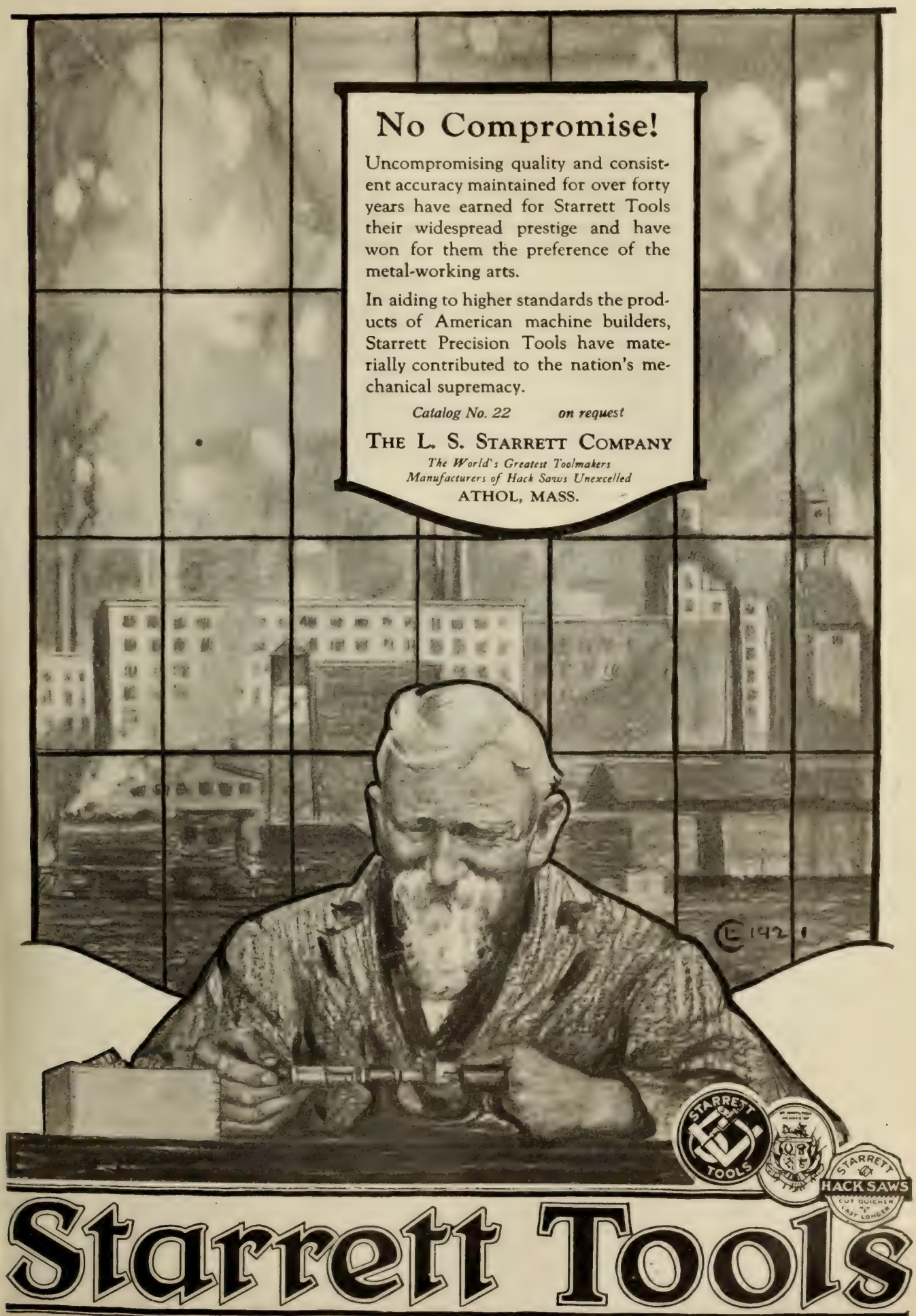
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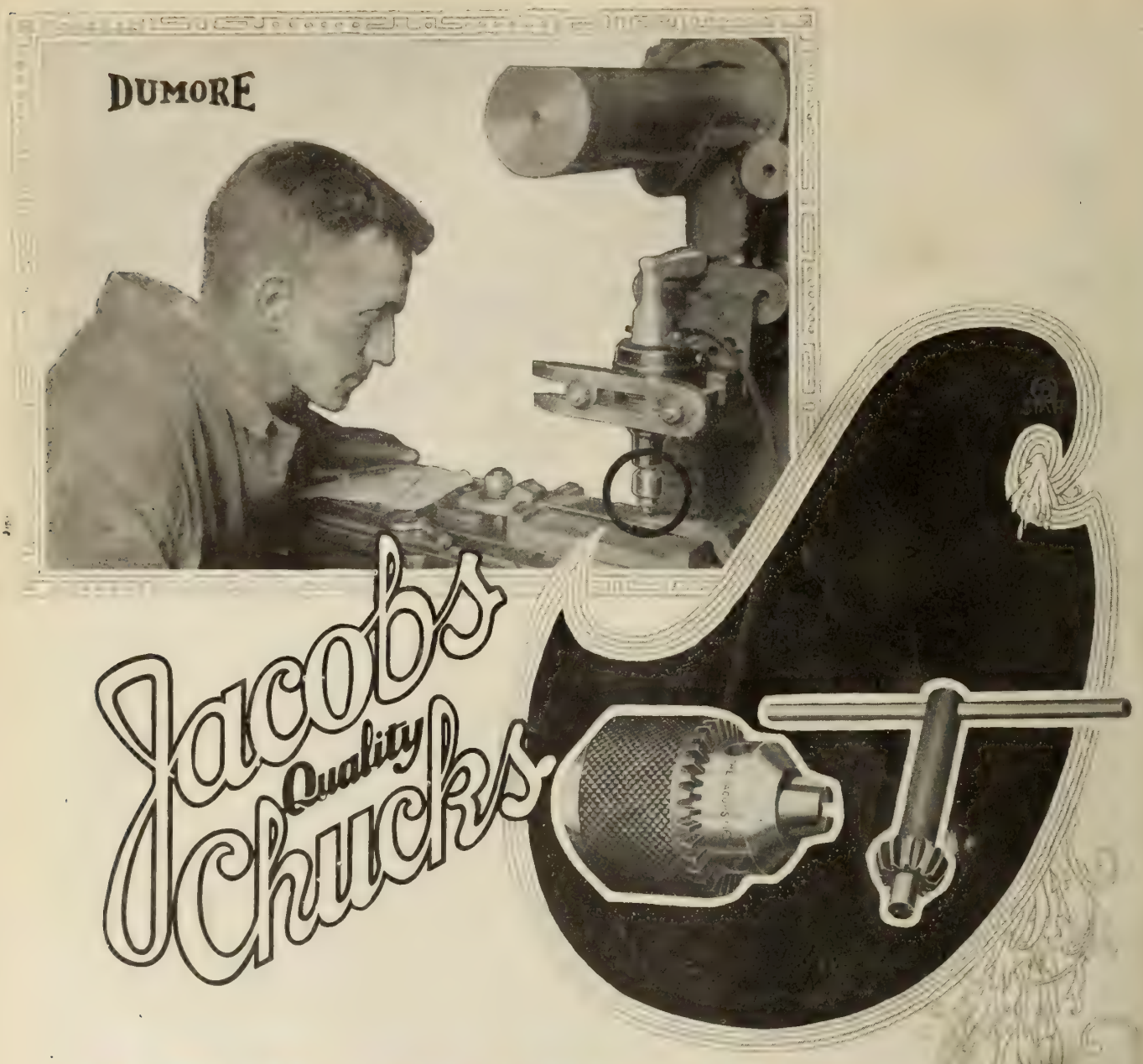
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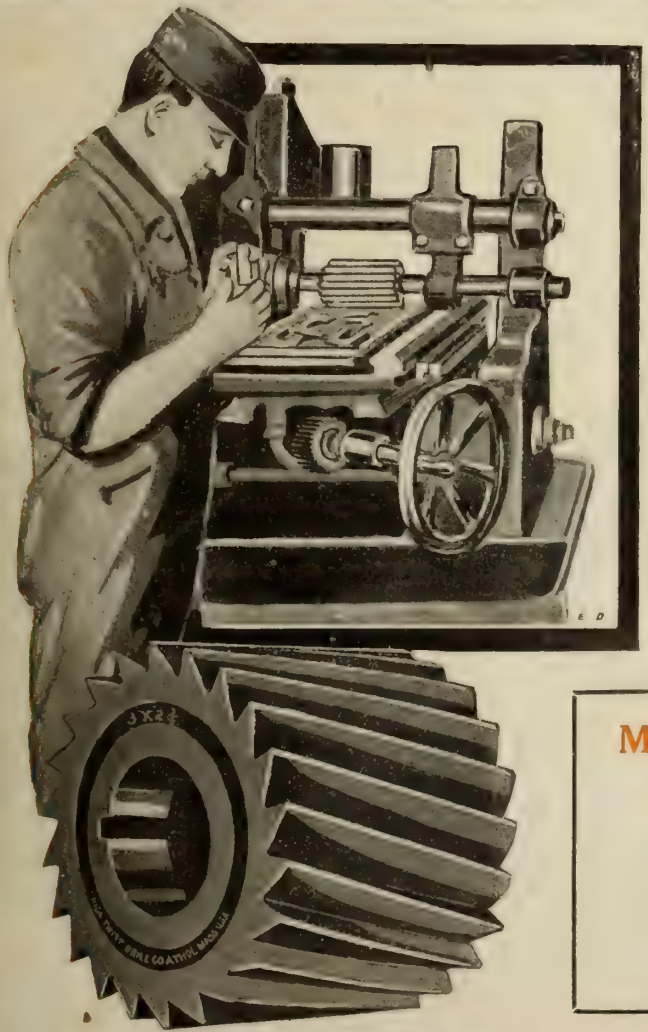
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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

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The BERTRAM Page

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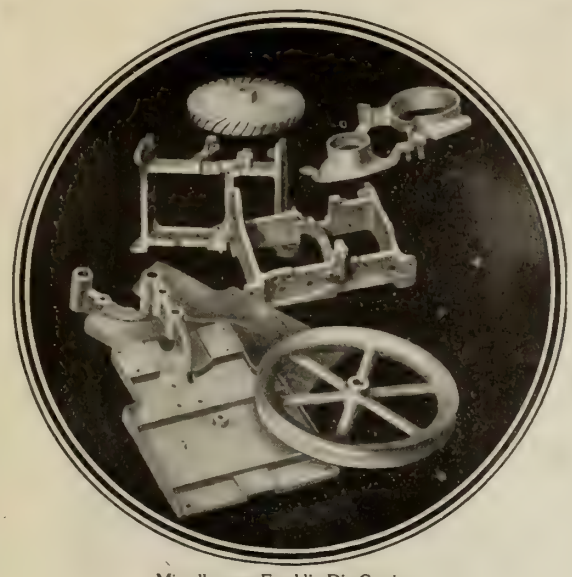
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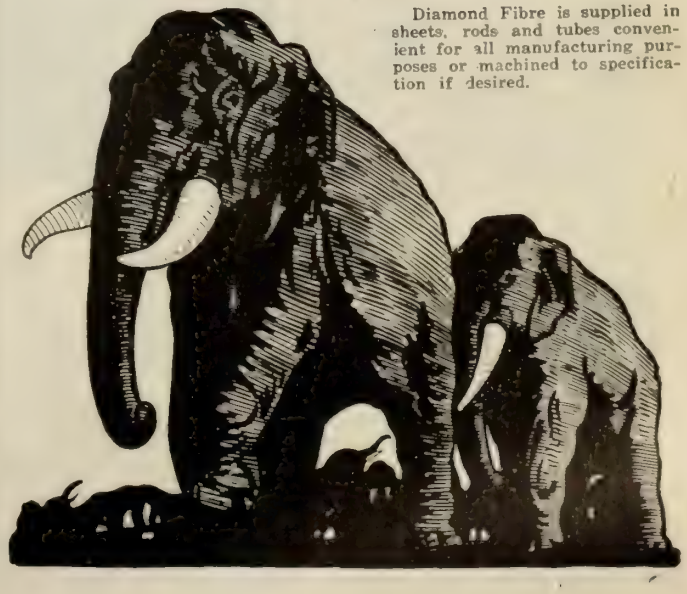
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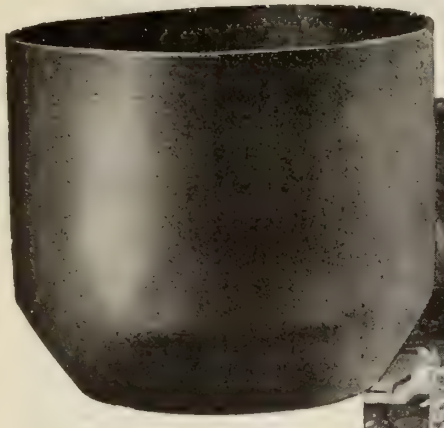
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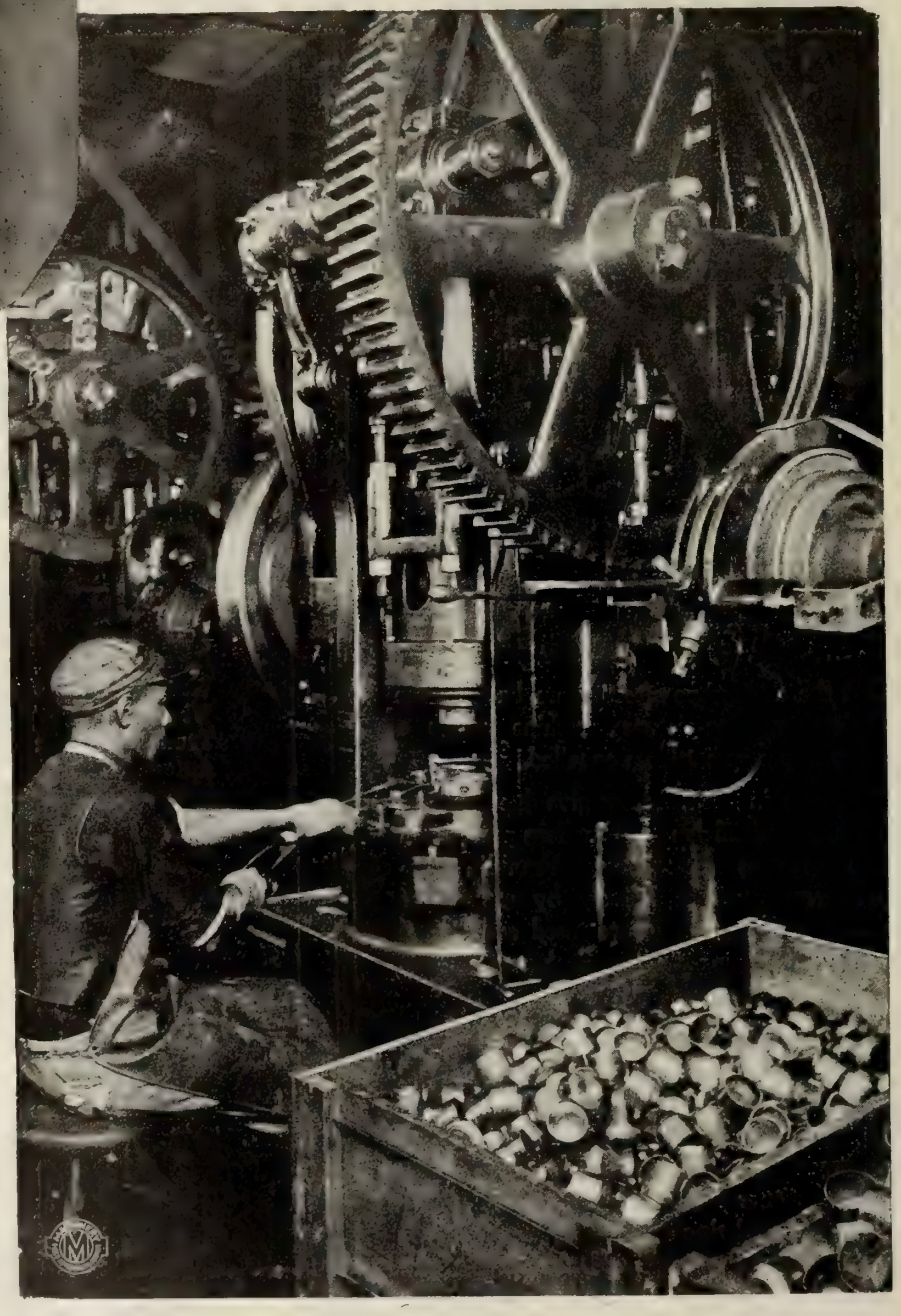


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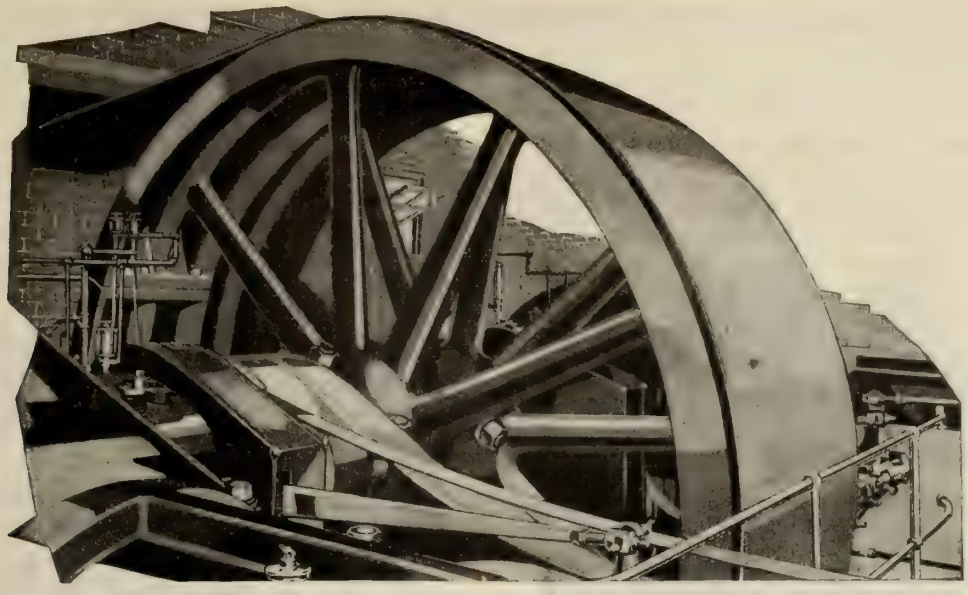
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Elevator: "Dominion," "Rockproof."

Agricultural: "Dominion," "Star."

Grain Elevator: "Metcalf Standard," "Grain King."

Hose

Air: "Kushion Kover," "4810 Airtite," "Star."

Steam: "Indestructible," "Rockproof," "Para."

Water: "Indestructible," "Para," "Kushion Kover," "Star."

Suction: "Para," "Star," "Trade."

Garden: "Canadian," "Dominion."

Packing

Sheet: "Join-Tite," "Star," "Importers."

Rod: "Cabestos," "Valve-Bestos," "Canadian."

Valves: "Montreal," "Commercial" "Canadian."

Miscellaneous

Mats, Matting and Flooring.

Moulded Goods.

Plumbers' Specialties.

Hard Rubber Goods, Tubing.

Rubber Covered Rolls, Deckle Straps.

Friction Tape, Splicing Compound.

DOMINION RUBBER SYSTEM AND ASSOCIATED COMPANIES

TRAFFIC —
a science in itself

Only the institution operating on a major scale can maintain that type of fully-manned, thoroughly-experienced Traffic Department which best guards a buyer from shipping delays, needless freight charges and interruption of production-schedules. It is more than a man-sized responsibility—it is an organization-sized job for a specialized staff such as M. A. Hanna & Co. maintain at all times.

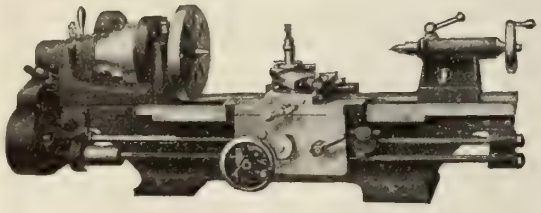
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Cleveland Toronto Cincinnati
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"DALTON SIX"

Type B-6



"The Small Lathe for the Big Job"

Actual Swing - - -	8¼ inches
Between Centers - -	18½ inches
Collet Capacity - - -	¾ inch

Send for Bulletin BC-651

Also Manufacturers of Type B-4 Lathes

Dalton Manufacturing Corporation
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Cable Address - "Aledal - Stamford"

GISHOLT
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work

AUTOMATIC TURRET LATHES
For Chucking Work

VERTICAL BORING and TURNING MILLS

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REAMERS, "SOLID ADJUSTABLE"
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BORING BARS
With Adjustable Cutters

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Separate Catalogs on each Product

Send for the ones you want

GISHOLT MACHINE CO.
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SKINNER DRILL CHUCKS
GIVE BETTER SERVICE

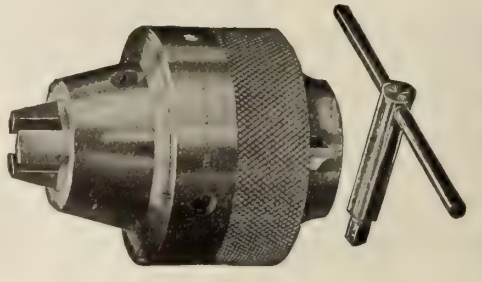
Trade Mark

Skinner Drill Chucks eliminate most of the trouble of accurate drilling operations, only because they are built right to hold the drill or tap accurately and run true or center. The hardened jaws are ground true.

They are easy to handle too, as there are no exposed gears to pinch the fingers.

The long life of Skinner Drill Chucks is due to the great care with which they are built. Made of the best materials available for the purpose. All working parts hardened to resist wear, and of sufficient strength to rigidly hold the tool to the work.

These Drill Chucks are all described in our catalogue, which will be sent to you with prices upon request.



THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN. U. S. A.
ESTABLISHED 1887

New York Office: 94 Reade Street
San Francisco Office: Rialto Building
Chicago Office: 552 West Washington Boulevard
London Office: 139 Queen Victoria St., E. C. 4

DESMOND REMOVABLE JAW DRESSER

A Huntington Dresser with Removable Holder.



Manufacturers of a complete line of dressers.

Overcomes Wear on the "Nose"

When the specially hardened jaws become worn, a new set is adjusted in the V-shaped sides of the handle, and held in place with a jaw nut placed over the counter sunk nut, thus renewing the dresser.

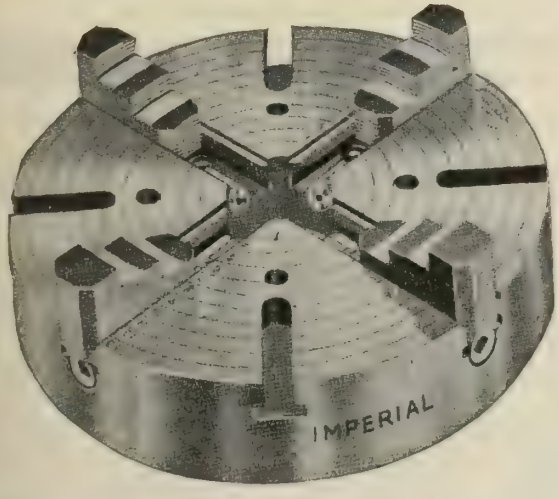
The Canadian Desmond-Stephan Mfg. Co., Ltd.
HAMILTON ONTARIO

IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.

Specify them in your next order.

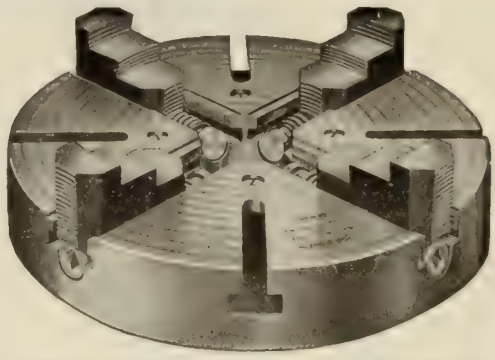


Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company
New Britain, Conn.
New York Office: 26 Cortlandt Street
Makers of a complete line of chucks

THE MORSE CHAIN CO.

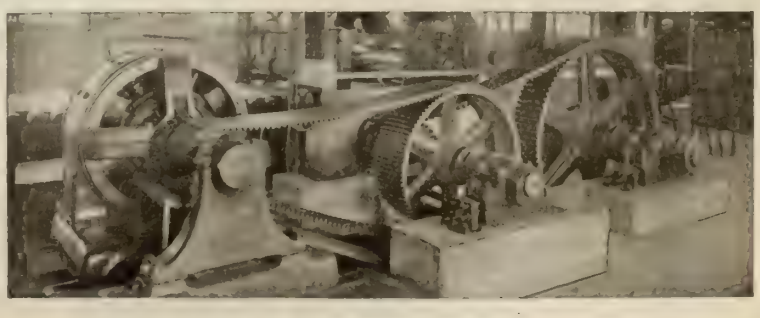
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

Why?

Morse Chain possesses the exclusive
Rocker Joint

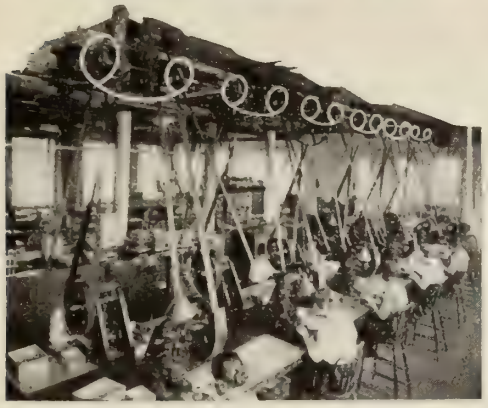
Frictionless—Requires no Oilbath.

Jones & Glassco (Reg'd.)
Canadian Agents
Montreal - - Toronto



80 H.P. Morse Drive to Rolls, reverses direction every 45 seconds

THE JOHNSON FRICTION CLUTCH



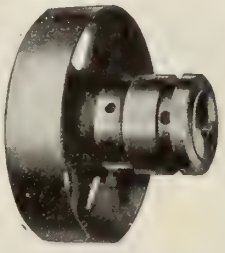
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

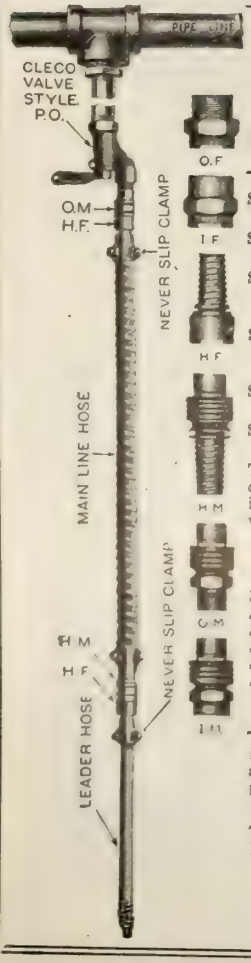
You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building" and our Yellow Catalog.

CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps — Cleco Grooved Hose Nipples and Hose Clamp Tool

STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼ inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

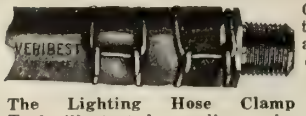
CLECO AIR VALVES.



Style R.A. **Style P.O.** **Style A.**

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style R.A.—Right Angle Valve, made in sizes ¼ in., ⅜ in., ½ in., and ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lighting Hose Clamp Tool illustrated applies wire clamps at a cost of 1* cents each.



In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.

Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 46, 48 and 51. mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. 337 Craig St. W., MONTREAL, QUE.



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

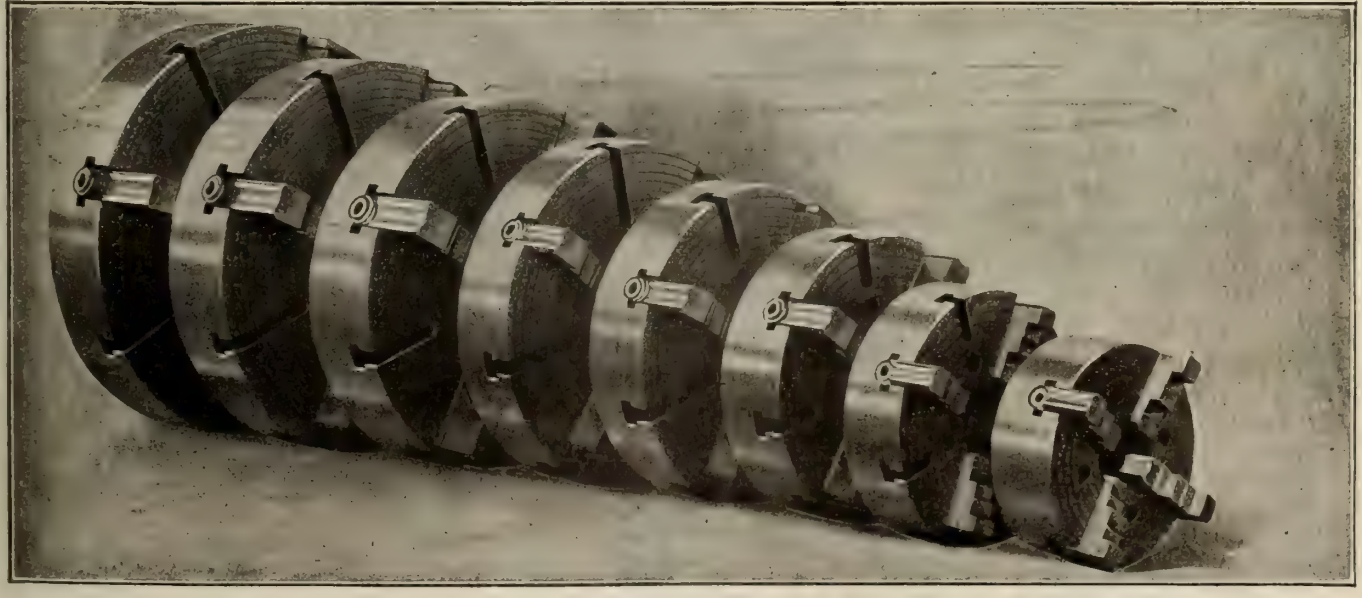
Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

DOMINION CHUCKS

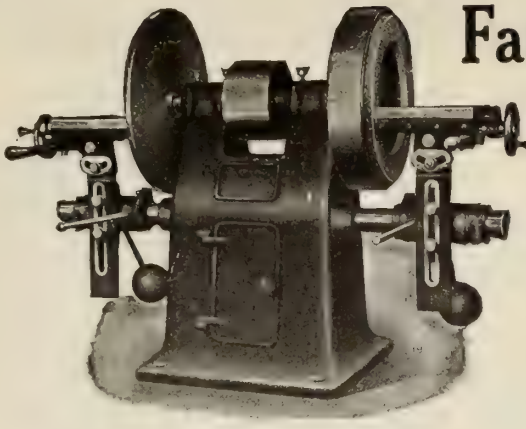


DOMINION CHUCKS, STEEL AND CAST IRON

Built for Long Life and to Stand Severe Service

DOMINION STEEL PRODUCTS CO., LTD.

Engineers and Manufacturers BRANTFORD, Canada



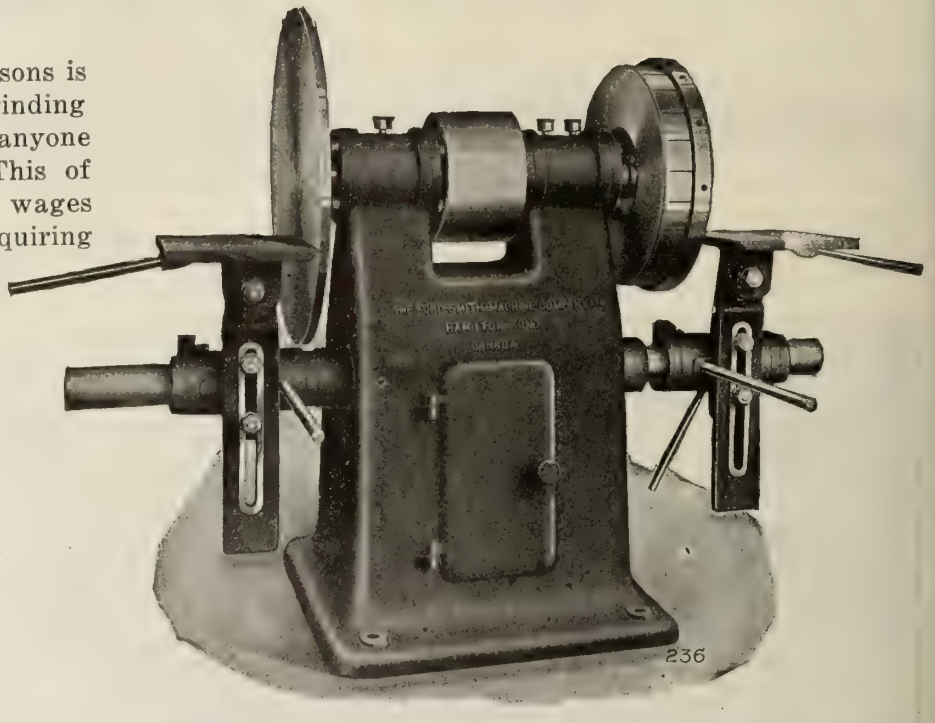
Faster than Shapers or Planers
Cheaper to Operate than Lathes or Special Machines

present day conditions are profitably met with

FORD-SMITH

Grinders

ONE of the many good reasons is that FORD-SMITH Grinding machines can be operated by anyone of average intelligence. This of course means a big saving in wages as compared to machines requiring highly skilled operators. FORD-SMITH Grinders are equipped with work holders and other convenient features that enable the operator to make all his time count. The moderate cost and low upkeep are other features that make Ford-Smith Grinders a worth while investment.



Ford-Smith Grinders are made in essential sizes for every class of work. Before leaving the factory they are thoroughly tested and we can guarantee them satisfactory.

As long established manufacturers of grinders, many problems have come under our notice. If you desire advice it will be freely given.

THE FORD-SMITH MACHINE CO., LTD.
HAMILTON, ONTARIO, CAN.

Foreign Agents:

W. E. Storey, London, Eng. McLeod & Co., Calcutta, India

BROWN-BOGGS

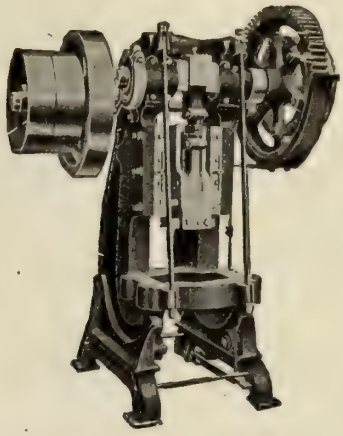
B B

Do You Find Ordering Hard?

We mean ordering a new machine—intended as a labor-saver and production-spreader.

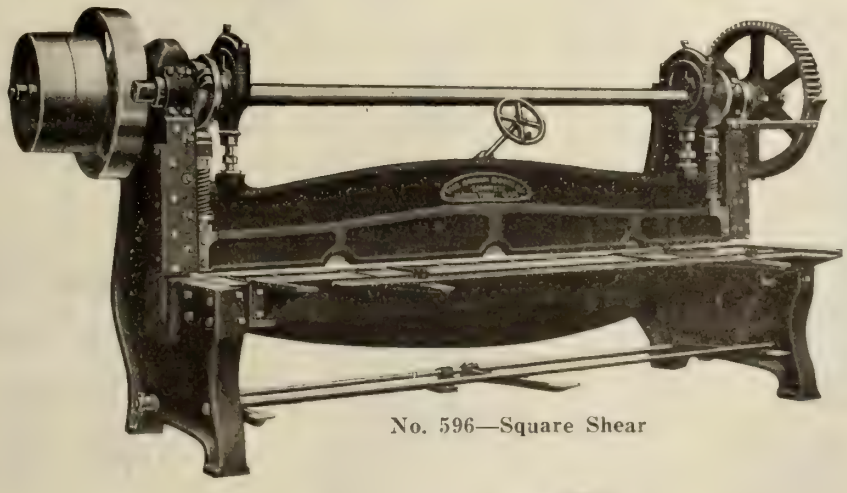
There was a time when it **was** necessary to send for sheafs of catalogues, spend hours of valuable time investigating and end up with a choice which was perhaps 90 per cent. guesswork.

To-day things are different. It's a simple matter to order "B-B" tools. The "B-B" trade mark represents Sheet and Metal Workers' tools of proven worth plus an advisory and consulting service which is always at your command.



No. 215—Power Press

We are always ready to talk over your problems with you. If you wish advice consult us freely.



No. 596—Square Shear

A Complete Line of

Tinsmiths' tools and sheet metal working machines of all kinds, canners' and evaporators' machinery, shears of every description, power presses for punching, forming, embossing, blanking.

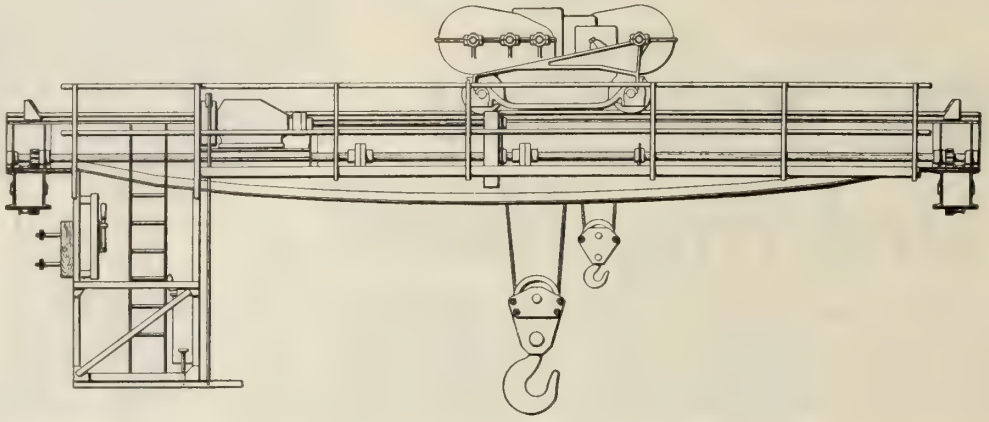
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THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.

CRANES

ELECTRIC AND HAND OPERATED



DOMINION BRIDGE COMPANY LIMITED

HEAD OFFICE & WORKS: MONTREAL BRANCHES:-OTTAWA, TORONTO, WINNIPEG

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of: —

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
ROCHESTER, N.Y.

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery Glass Flint Garnet Corundum Carborundum	Paper and Cloth	In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

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Are Your Casting Requirements Unusual ?
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Then We Can Give You the Service You Need !

We specialize in large and difficult castings of Semi-Steel or Grey Iron, made in Dry Sand, Green Sand or Loam. We can cast pieces as large as 150,-000 lbs. weight, and our metallurgical service insures castings uniform in quality, of proper mixtures for your purpose, and easy to machine.

We are also prepared to do the largest classes of Machine Work, and have an unusually complete equipment of heavy machine tools, including a boring and turning mill to handle work up to and including 35 ft. diameter.

Your inquiries accompanied by blue-prints and specifications will have prompt and complete attention.

Dominion Engineering Works, Limited

Engineers and Manufacturers

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Designers and Builders of Paper and Pulp Mill Machinery, I. P. Morris Turbines and Hydraulic Equipment

1/3 to 1/2 Reduction in Milling Cost

This will be the result of taking small milling jobs from your big millers and putting them up to

The U.S. MILLER

The Miller for Small Work



A small machine takes up less space, requires less power, is easier to operate and is more accurate.

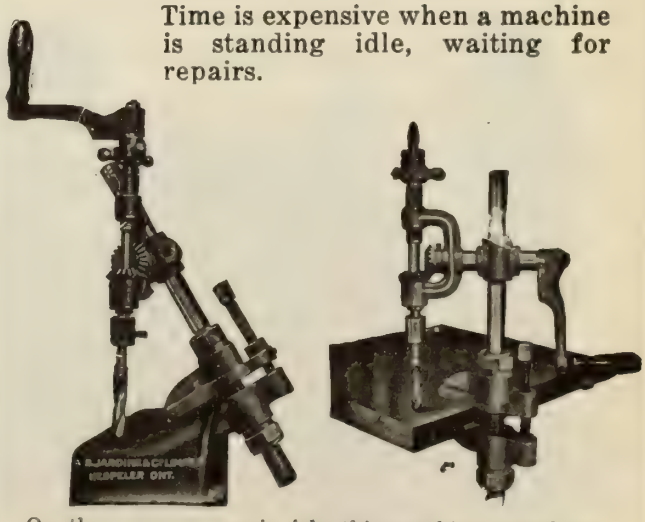
The Paramount Miller of its size. Drop us a line for full details.

United States Machine Tool Company

Cincinnati, Ohio, U.S.A.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.

Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

When Canadian Hall joined with U.S. Williams

A great day for pipe machine users.

IN CANADA when you think of pipe machines, the name Hall immediately comes to mind. In the United States it's the Williams machine that has won the reputation to thread pipe better, quicker and at lower cost. Now the advantages of both are combined in each. They have joined forces and the Hall is now the Williams of Canada.

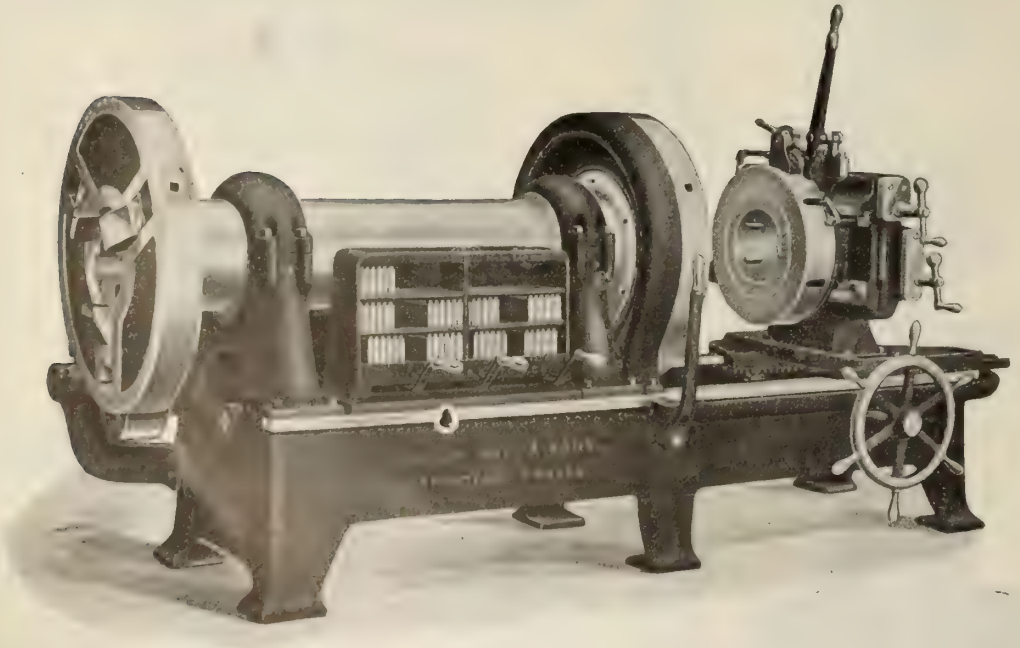
Whether it's 1-8 inch or 16 inch pipe or any of the sizes in between, there's a Williams machine just right for the job. Built in eight sizes and each size especially designed to meet the requirements of the case. And remember, each Williams machine is backed by the combined features, experience and service of Hall of Canada and Williams of the United States, each a firmly established leader in its field.

You who do or should use power pipe machines will do well to write for the details of how and why this merger means greater economy, production and efficiency in pipe threading practice.

Ask for the new Williams' handbook "Don't Let It Happen To You."

Williams Tool Corp. of Canada, Ltd.

U. S. Plant: Erie, Pa.



The illustration is of our No. 8 new improved Duplex Type Standard, capacity 2½" to 8" inclusive.

WILLIAMS PIPE MACHINES



Cutting Commercially Accurate Threads in Monel with GTD *"Gun"* Taps and *"Acorn"* Dies

NO ordinary tap or die can thread Monel metal—a fact which up to now has limited its use in many plants, where its great strength and non-corrosive properties would otherwise strongly recommend it.

The GTD staff, however, recently made a series of tests with Monel and to the great satisfaction of the officials of The International Nickel Company, who produce this popular metal, proved that it can be tapped and threaded to any degree of commercial accuracy required in spite of its toughness and ductility.

Instead of
—cutting over size —clogging
—breaking —dulling
the GTD *"Gun"* Taps did their work as cleanly and with as little difficulty as they would in steel, and when thread after thread had been cut with the chips shooting ahead, in true "Gun" Tap style, the threads were gaged—the first and last in each hole measuring to size without perceptible variation.

With samples of threaded Monel and a report of the tests before them, the International Nickel Company sent in this letter, which we are proud to quote:

> "We have received and examined samples of Monel Metal threaded and tapped with your *"Acorn"* Die and *"Gun"* Tap. The fact that there are no indications of torn surfaces or of split threads is evidence of the efficiency of your tools.
>
> "You are to be congratulated that so successful a piece of work could be done using your stock tools, and by operators unfamiliar with threading Monel Metal."

If you have a threading problem which involves Monel or any other metal, which has previously been difficult to thread, try the *"Gun"* Tap and *"Acorn"* Die—specially designed exclusive GTD products. Or if you wish the experimenting done for you, write us stating kind of metal used, or sending sample—and our engineering department will demonstrate quickly and thoroughly how the *"Gun"* Tap and *"Acorn"* Die work. We will be pleased to send you circulars descriptive of the *"Gun"* Tap and *"Acorn"* Die. Just fill out and mail the attached coupon.

GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO

Successors to Wells Bros. Co. of Canada, Ltd., Galt, Ont.

GTD Screw Plates, Taps, Dies, Reamers, Gages, Pipe Wrenches

GTD
Corporation of Canada, Ltd
Galt, Ontario.

Send me circulars describing the *"Gun"* Tap and *"Acorn"* Die.

Name metals to be threaded

Name Position

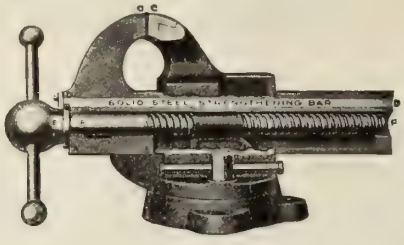
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Leaders Ever Since

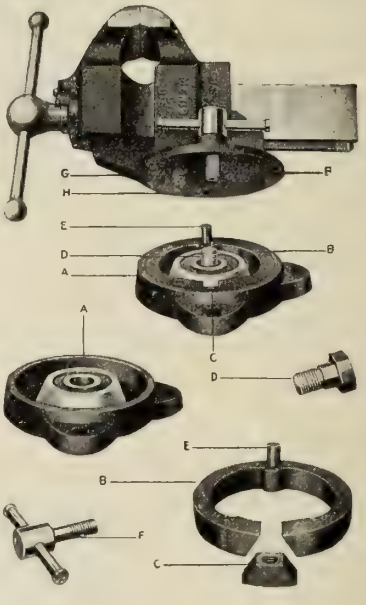
Reasons why:

Method of attaching steel jaws



1. Semi-Steel Casting made in our own foundries.
2. Patented swivel base.
3. Solid Steel-Bar Slide Strengthener. (DD)
4. Renewable, milled and fitted tool steel jaws. (CC)
5. Saddle, taking up lost motion and allowing screw to be easily removed for lubrication. Also gives solid underportion (AB)
6. Set screw and spring tension in handle holding same in position. (E)
7. Extra strong screw and nut. (FF)

Patented swivel base



BACKED BY 79 YEARS OF SATISFACTORY SERVICE

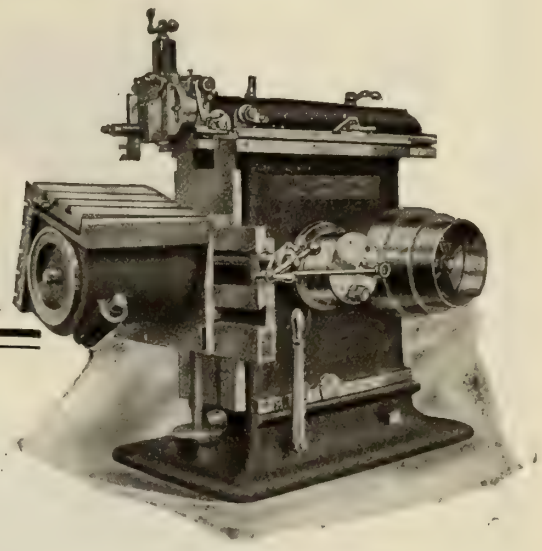
Can you Afford to Be Without Them?

THE CHARLES PARKER CO.

Master Vise Makers

Meriden, Conn. **U. S. A.**

UNIVERSAL
SHAPING MACHINES

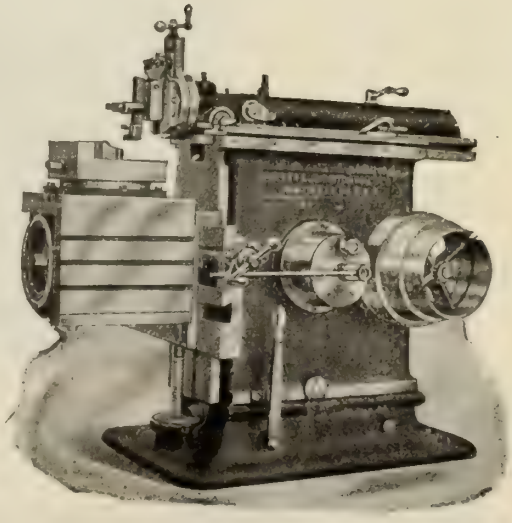


No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to—

Die Work
Tool Making and
General Manufacturing.

Machines regularly furnished with—
Swivelling Graduated Table
Auxiliary Tilting Side for Compound Angles
Power Down Feed on any angle, with any variation of feed
Automatic Feed Stop
Graduated Collars on Tool Head Feed Screw and Table Feed Screw
Swivel Vise and Graduated Base
Table raised and lowered by power on 24-in. size.

We carry large stocks of our 15-inch and 24-inch shapers in our Toronto show rooms—all ready for immediate shipment.

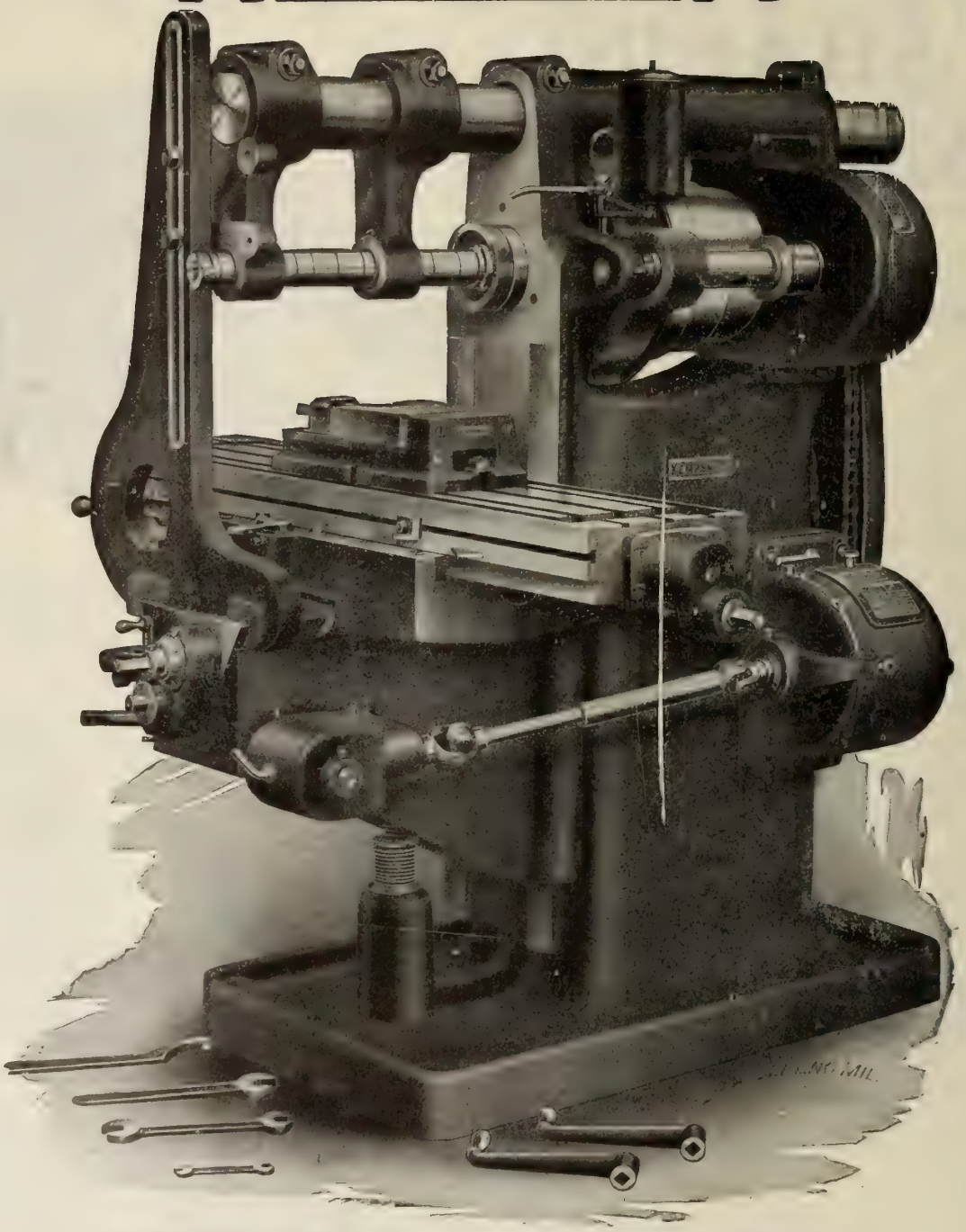


Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office and Show Rooms:
11 Wellington Street East - TORONTO, CANADA

KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy today.

THE KEMPSMITH MANUFACTURING CO.

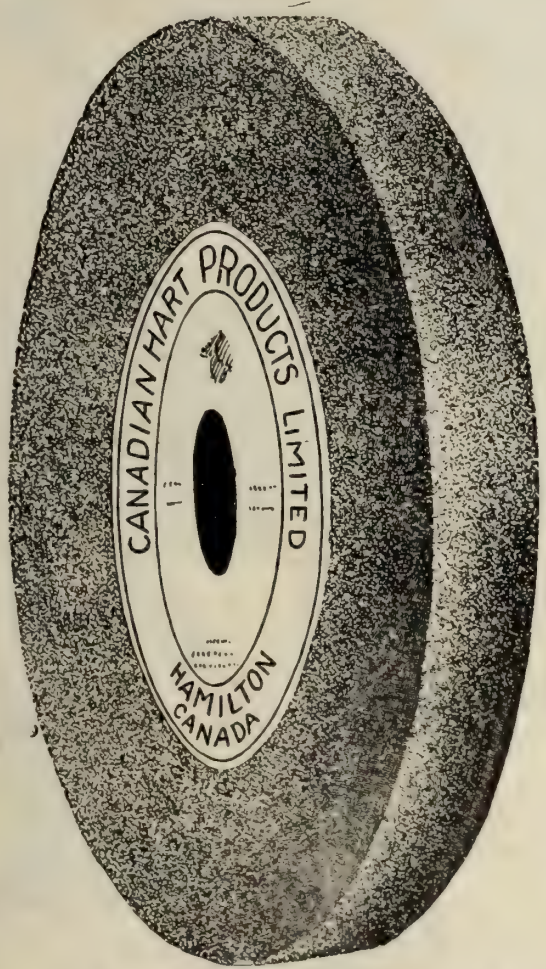
MILWAUKEE, WIS., U. S. A.

FOREIGN DEALERS:—American Trading Co., 25 Broad Street, New York, N. Y. (Japan): Barandiaran & Co., 3-Alameda, San Sebastion, Spain; Bevan & Edwards Pty., Ltd., 117 King Street, Melbourne, Australia; Blair, Reed & Company, Nathan's Bldg., Wellington, N.Z.; Bloxham, Edgar, 12 Rue Du Delta, Paris, France; 245 W. 12th St., New York City; L. S. Devos, Grand Central Palace, New York City; Herbert, Alfred, 54 Dey Street, New York City; Neilsen & Winther, Blegdamsvej 60, Copenhagen, Denmark; 24 Stone Street, New York City, Park & Lacy Co., 60 Clarence Street, Sidney, N.S.W., Aust.; Selson Engr. Company, 85 Queen Victoria St., London, E. C., England; Corso Vittorio Emmanuele, 11, No. 9, Turin; 5 Piazzo Castella, Milan, Italy; 24 Stone Street, New York City; Pascual Teja, La Capuchinas, No. 65 Mexico, D.F.; Spliethoff, Beeuwkes & Co., Leuvehaven, W.Z. 159, Rotterdam Holland; Turner, Hoare & Co., Ltd., Lansdowne Road, Post Box No. 195, Bombay, India; Charter & Gardiner, 55 Calle Echaque Santa Cruz, P. O. Box 1201, Manila, Phillipine Is.; Societe Anonyme Belge Alfred Herbert, Rue de Lacken, 35a & 35th, Brussels, Belgium.

CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

CANADIAN HART WHEELS

Vitrified — Silicate — Shellac



Canadian Hart Vitrified Wheels—recommended for the majority of grinding jobs. May be used wet or dry; give better all-around satisfaction and have a longer life.

Canadian Hart Silicate Wheels—can be made in twenty-four hours and are often substituted when it is inconvenient to wait the required length of time for Vitrified Wheels.

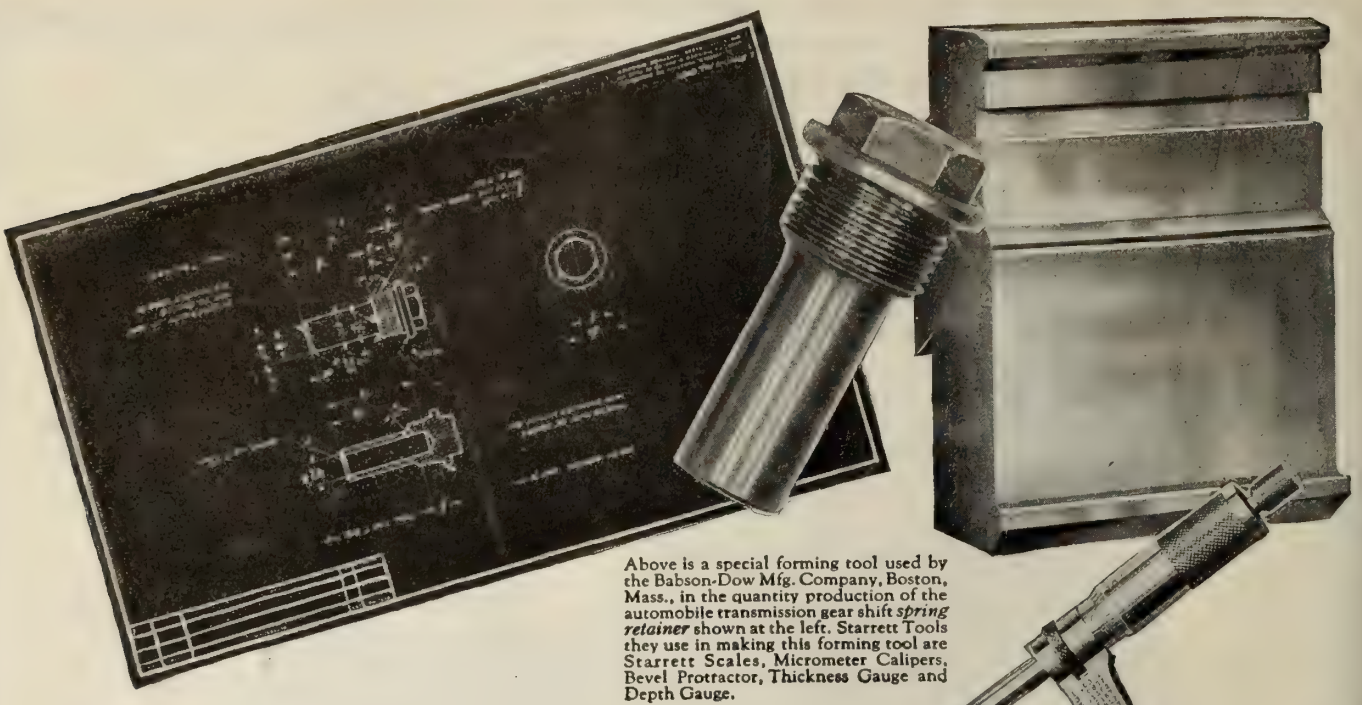
Canadian Hart Shellac or Elastic Wheels—indispensable for slotting work where a thin wheel is required, or for work requiring a special finish. Can be operated wet or dry.

Tell us what you want to grind and we will tell you the wheel to use for the best results.



Canadian Hart Products
LIMITED
Hamilton - Ontario

Made in Canada



Above is a special forming tool used by the Babson-Dow Mfg. Company, Boston, Mass., in the quantity production of the automobile transmission gear shift *spring retainer* shown at the left. Starrett Tools they use in making this forming tool are Starrett Scales, Micrometer Calipers, Bevel Protractor, Thickness Gauge and Depth Gauge.

"Where the highest degree of Accuracy is required-"

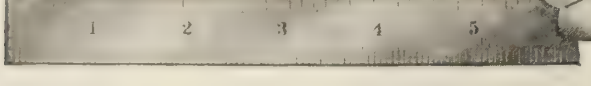
"To produce accurate and interchangeable parts on Automatic Screw Machines"—says the Babson-Dow Mfg. Company, specialists on quantity production of screw machine products—"it is necessary that the special tools required be made with the highest degree of accuracy.

"The entire line of The L. S. Starrett Co. comes into use in a well organized and developed tool department producing tools and gauges for Screw Machine Products."

For more than forty years Starrett Tools have held the preference of the metal-working trades, wherever the highest degree of accuracy is required. Get Catalog No. 22

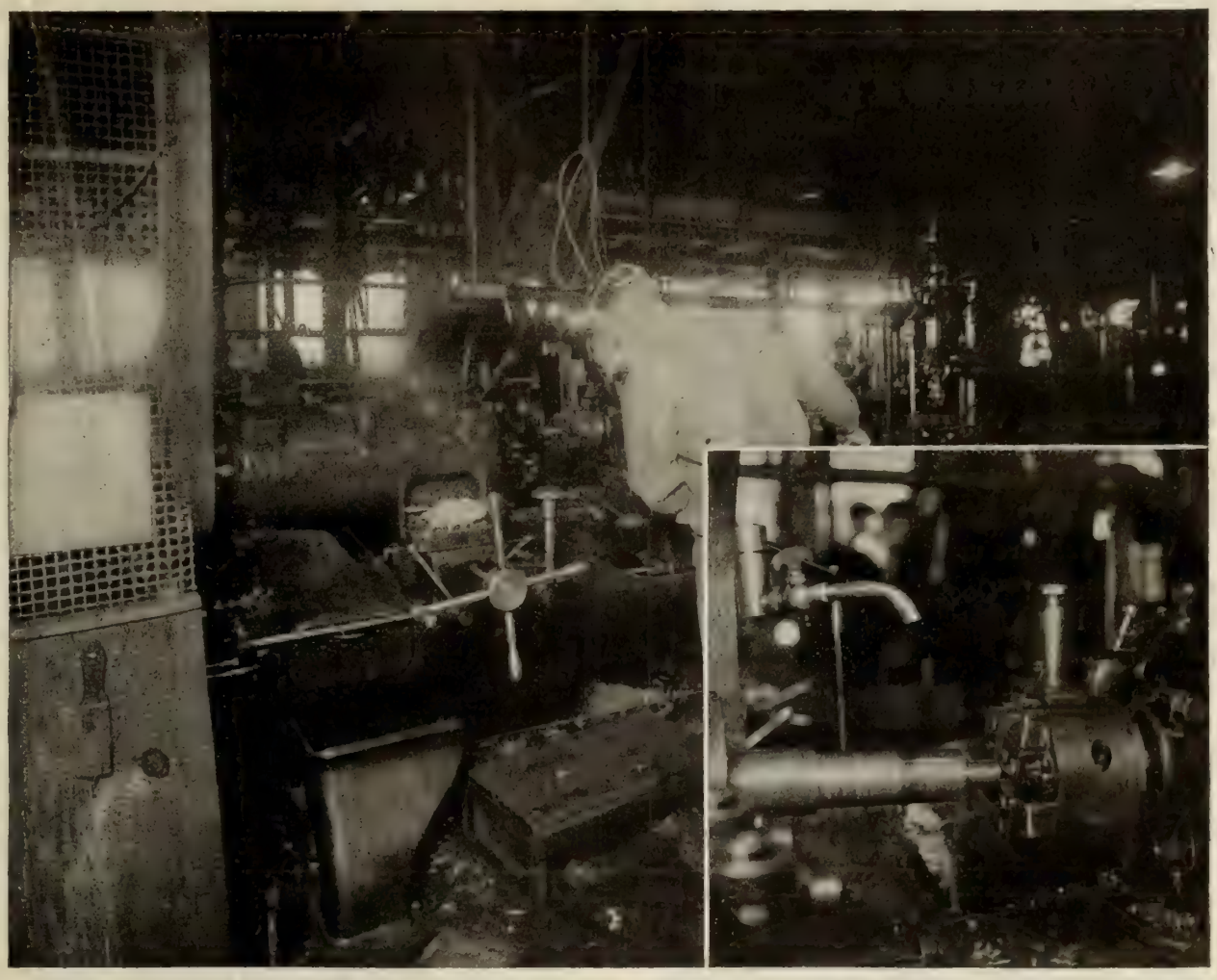
THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.





Use Starrett Tools



THE NEW LANDIS AUTOMATIC DIE HEAD THREADING INTERMEDIATE GEAR STUDS

The New Landis Automatic Die Head has set up a new record in the Plant of an Eastern Manufacturer. It is shown threading intermediate gear studs, 1 inch diameter, 8 threads per inch, U. S. Standard form, length of thread 1 1-4 inches, actual threading time **20 seconds.**

This head embodies in its design many features which made the Landis Rotary Head a success. Furthermore, it employs the Landis long life chaser, which insures efficient and economical threading.

The foreman of the department in which this head is used is all smiles when talking about it. He says, "It is simple to operate, cuts accurate threads and with it I have set us a new time record for threading these studs."

Investigate this head. Send your specifications and we will gladly tell you just what the installation will mean for you.—Write today.

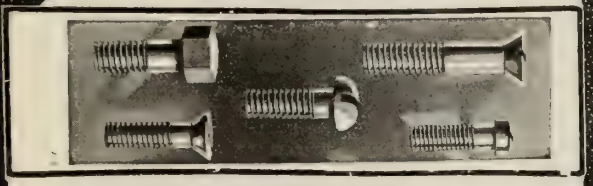
LANDIS MACHINE CO.

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Exclusive Canadian Agents: Canadian Fairbanks Morse Co., Ltd.

Wood Screw Making Machinery

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Series



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

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HENDEY SHAPERS

Boss the Job!

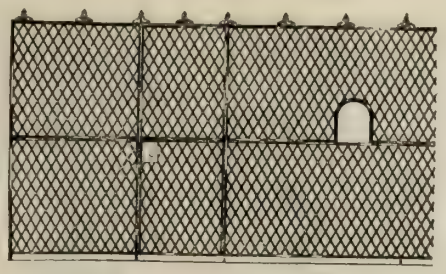
A machine which is not the easy boss of every job which it is required to handle, is not worth the floor space it occupies. Far better sell it and invest the money in a really efficient machine.

Hendey Shapers are proving daily to shops throughout the entire continent that a good versatile shaper can be successfully adapted to a large variety of work—and prove itself the "boss of them all."

The Hendey Machine Co.
Torrington, Conn., U.S.A.

CANADIAN AGENTS:
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LATHES—SHAPERS—MILLERS AND CENTERING MACHINES



Wirework for Every Factory Need

Wire stock room enclosures, elevator enclosures, window guards, machinery guards, etc., are made at our plant in standard sizes.
We are also prepared to make upon shortest notice, wirework in special sizes for individual needs.
Dennis wirework is giving satisfaction everywhere. We attend promptly to orders and make early shipments.

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Steel Lockers, Steel Cabinets, Steel Shelves, Steel Lavatory Compartments, etc.
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THE COPPER COATED CAKE

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Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

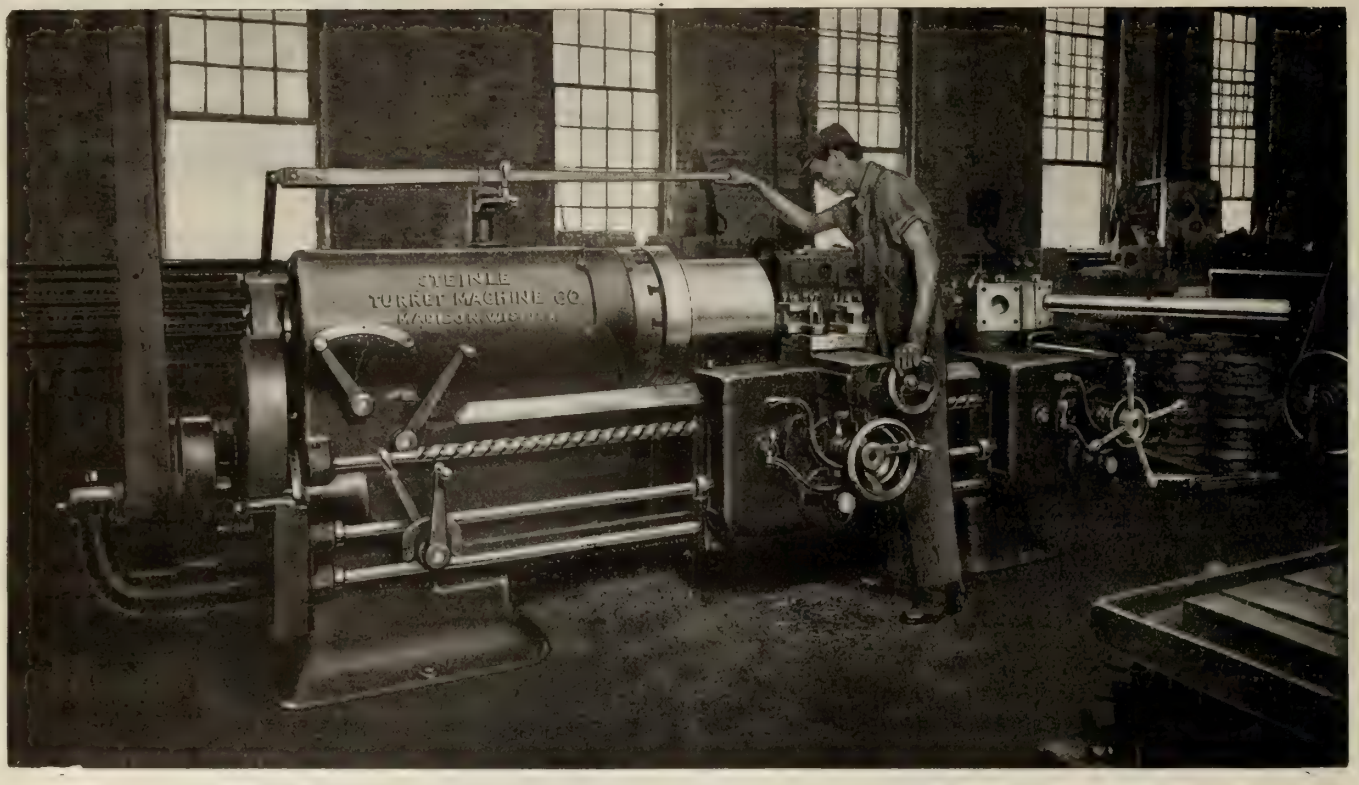
Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products



Finishing a 16 Inch Pulley in 60 MINUTES

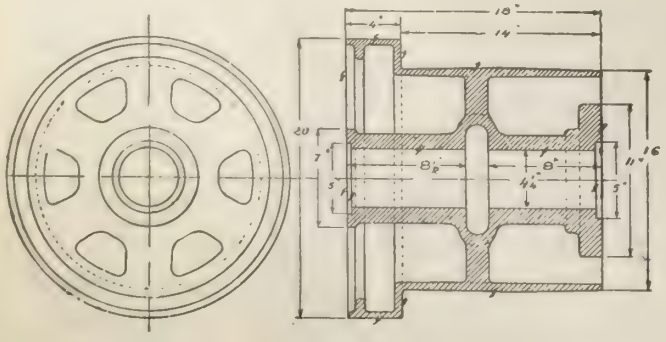
Speaks Well For "STEINLE" Design and Construction

It is a demonstration of the ability of the Steinle Heavy Duty High Power Turret Lathe to pull maximum cuts at as high cutting speeds as the best tool steel will stand.

Especially is this made apparent when it is realized that the surface machined on each pulley is 1,446 square inches, the surfaces machined including turning the 16-in diameter, turning and facing the 20-in. diameter flange, boring the hub, and counterboring and facing one end of hub. All surfaces received a roughing and finishing cut.

Steinle lathes are built and equipped to handle with equal facility large or small castings or forgings or bar work up to 6¾ in.

Why not send us your blueprints so that we may show what "Steinle Saving" means as applied to your work?

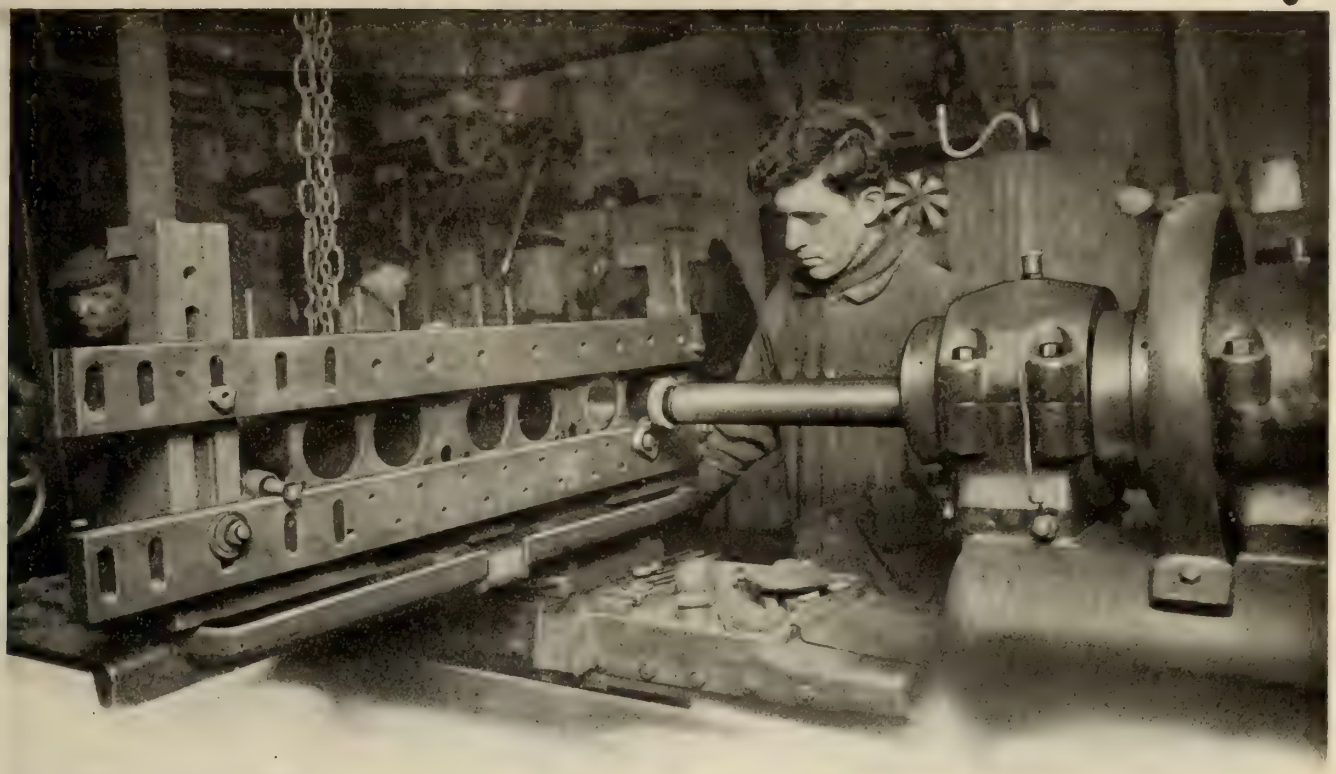


STEINLE TURRET MACHINE COMPANY

Originator of the Full Swing Side Carriage Turret Lathe

Madison, Wis., U. S. A.

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California. FOREIGN—Leo. C. Steinle, 53 Victoria Street, London, England.



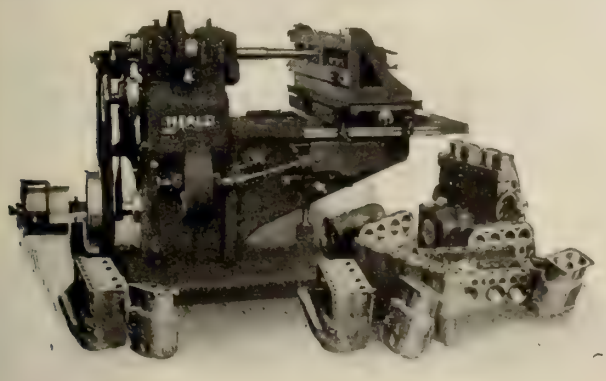
Grinding the 500th Hole for the Month

This could just as well have happened in your shop if—

instead of cursing your luck, or hard times, you had just taken count of stock to see if your equipment would not fit in where you could get some of that 65 per cent. business that the rating houses tell us is being done this year.

We know where part of this comes from, that is—cylinder regrinding. Further, that only a very small percentage of the possibilities in this line can be handled by the equipment and shops now in the field.

It is not a charity proposition just to keep your men working, but there will be real mazuma left in the cash drawer each month instead of cobwebs.



Heald will handle all styles and sizes of cylinders.

Having already sold the Vulcan Brazing & Machine Company, Philadelphia, where the above photograph was taken, three Heald Machines, we do not expect compliments will land another for us, but here's a live wire crew that took Old Man Time by the forelock and are now leading him around gathering in the profit on a 500-hole monthly average from each machine.

What do I need to do this work, you may ask.

What have you got?

If it is a machine shop, auto repair shop or welding outfit you are collecting rust on, you have practically all the equipment needed except a Heald Cylinder Grinder and a stock of pistons and rings.

We will be glad to give you full information about the first, and tell you where you can get the second.

In fact we have a booklet we would like to mail you that tells you all about the possibilities, profits and equipment required.

What are YOU going to do about it?

The Heald Machine Co.

51 New Bond St. **Worcester, Mass.**

Branches at New York, Philadelphia, Cleveland, Buffalo, Detroit, Chicago, Cincinnati

CANADIAN AGENTS: H. W. Petrie, Ltd., Toronto, Ont.; Geo. F. Foss Machinery and Supply Co., Ltd., Montreal

STEEL CASTINGS

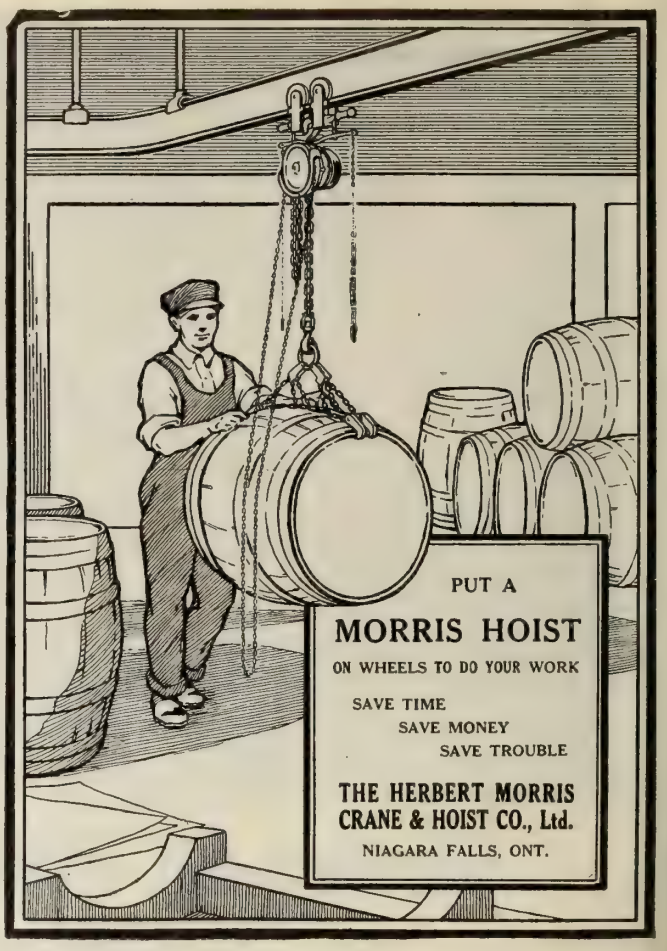
QUICK DELIVERIES

High Carbon Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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OWEN SOUND, ONTARIO
ESTABLISHED 1860



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National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

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Our entire organization—technical and sales—is always at your service.

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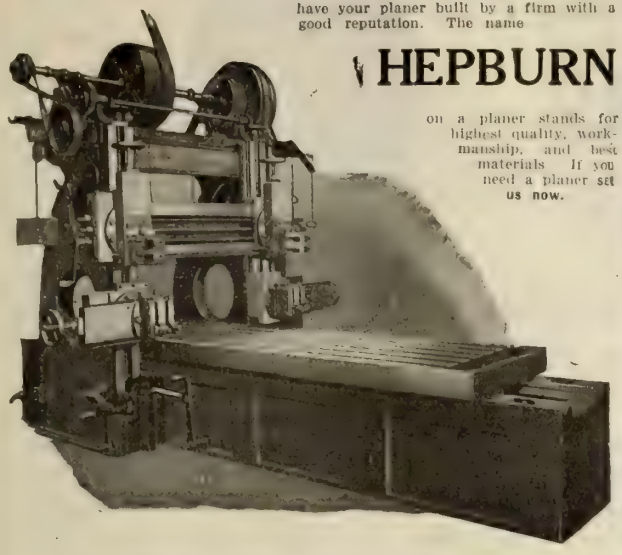
TORONTO SALES OFFICE	MONTREAL SALES OFFICE AND FACTORY	TORONTO FACTORY
80 Adelaide Street East	149 Moreau Street	295 Dufferin Street
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For Maximum Service

have your planer built by a firm with a good reputation. The name

HEPBURN

on a planer stands for highest quality, workmanship, and best materials. If you need a planer set us now.



Standard Size 92''x92''x10'0''

Two or four heads supplied as required. The rack is of cast steel and the pinions are made solid with the shafts. We also make Power Presses, Cranes, Pumps, Engines, Special Machinery, Iron Castings and Forgings.

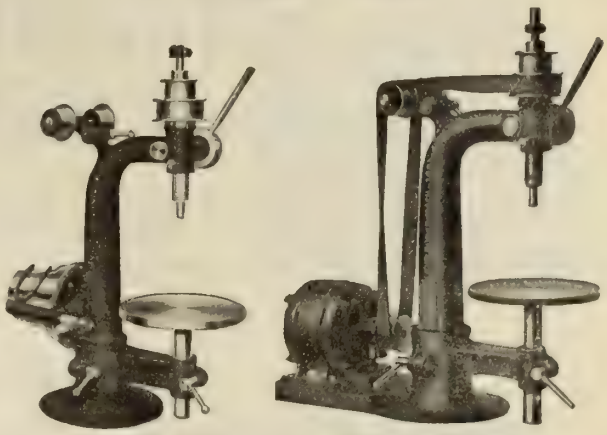
JOHN T. HEPBURN LIMITED

Engineers and Iron Founders

18-60 VAN HORNE ST., TORONTO

IT'S A BURKE

The Most Used Bench Drill Press In the World



THERE'S A REASON

Burke Drill Presses are well made machines. The double flanged top cone is mounted on large bearing through which spindle runs. There is no pressure on the spindle from the driving belt. Thrust of spindle is taken on ball thrust bearing. This construction makes a very sensitive machine. Surface of table is ground for accuracy. Spindle and quill ground to size. All parts interchangeable. An accurate machine, guaranteed in every respect and at a price of only $26 for the belt driven and $55 to $60 for the motor driven machines.

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Write for the name of the dealer located in your city.

CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes

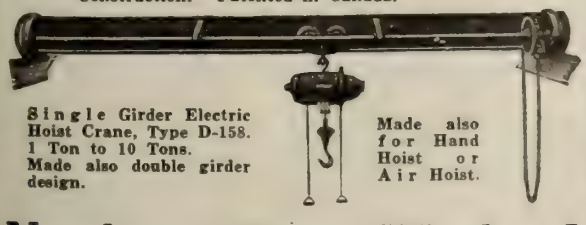


Type E—3-Motor Electric Traveling Crane, 2 Tons to 100 Tons.



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



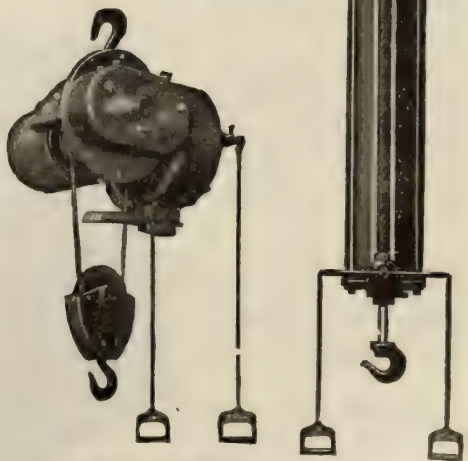
Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.



Type D Electric Hoists—½ to 10 Tons.

Air Hoists, Trolleys and Tracks



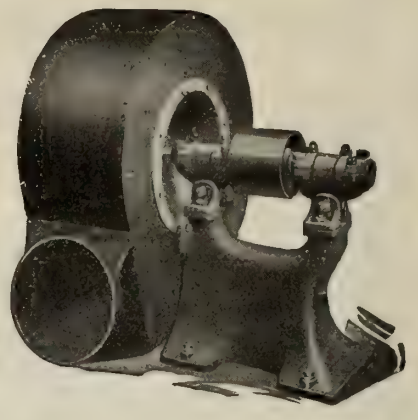
Type No. 20 Air Hoists.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently---sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.



They are adjustable to any angle of discharge instantly---have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77---gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.
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STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

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Steel Ingots
by the
HARMET
Liquid Process

Heat Under Accurate Control

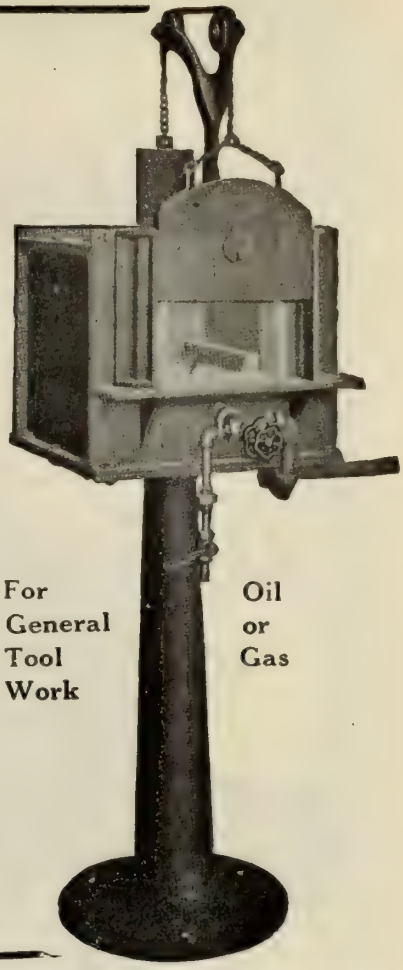
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, is a feature that distinguishes

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems



For General Tool Work — Oil or Gas

Bellevue Industrial Furnace Company

Julius C. Hinz, President

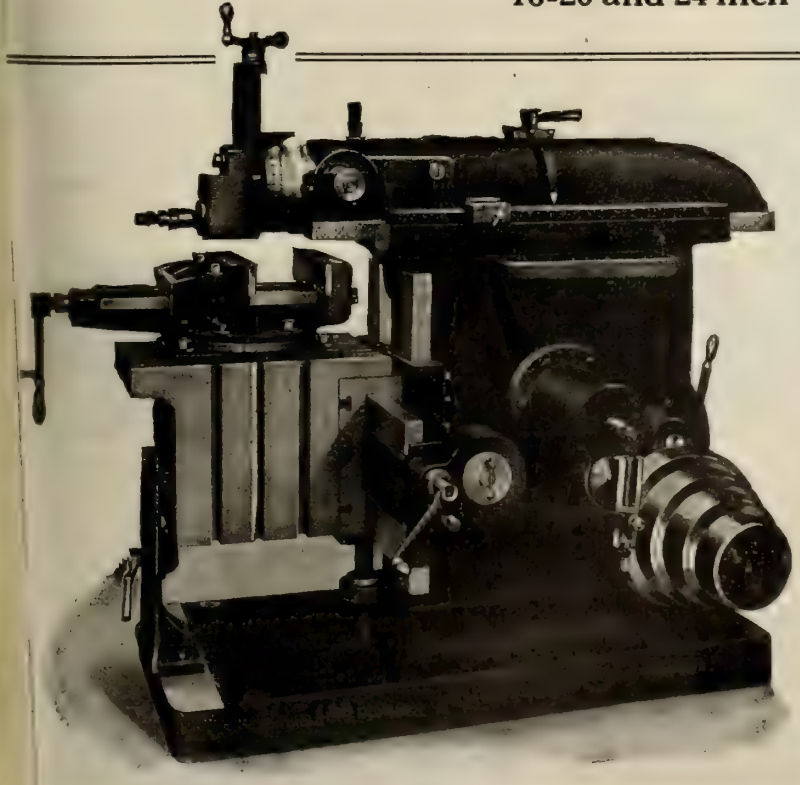
703 Bellevue Ave. - Detroit, Mich.

Representative in Canada: H. W. PETRIE, LIMITED, Toronto, Canada

McDougall Crank Shapers

16-20 and 24 inch

ARE-MAC-DEE IS A GUARANTEE



A Bigger Day's Work

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

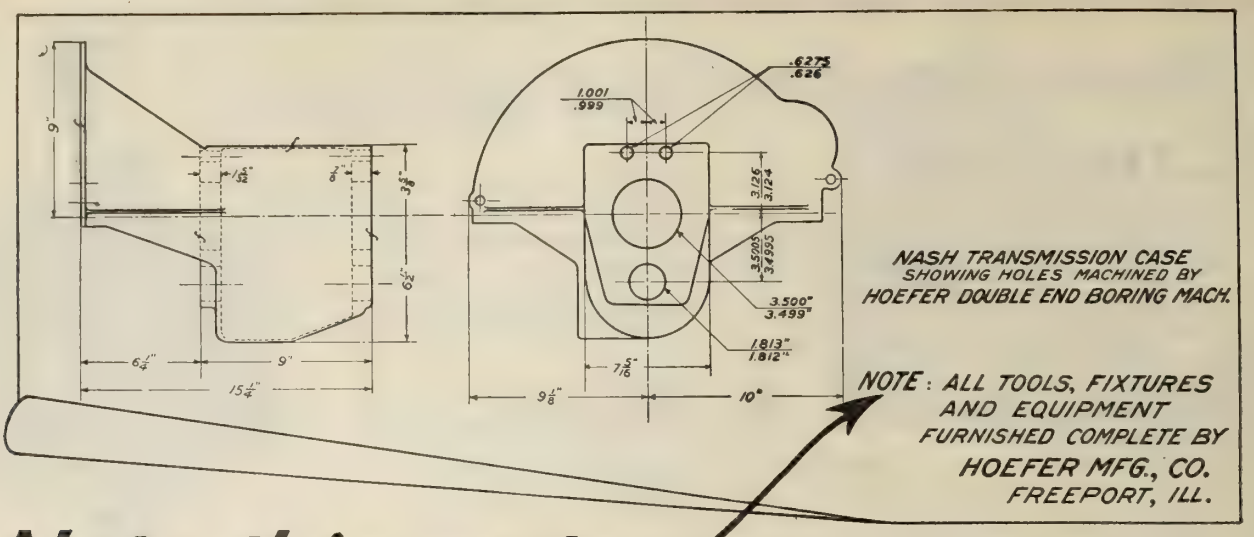
Slides are square, accurately fitted and with broad bearing surfaces.

Have us explain the other salient points of this finely constructed machine. Full details on request.

The R. McDougall Company Limited

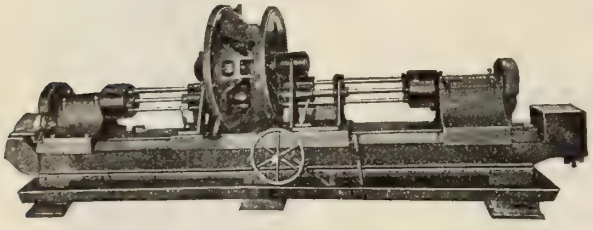
Galt, Ont., Can.

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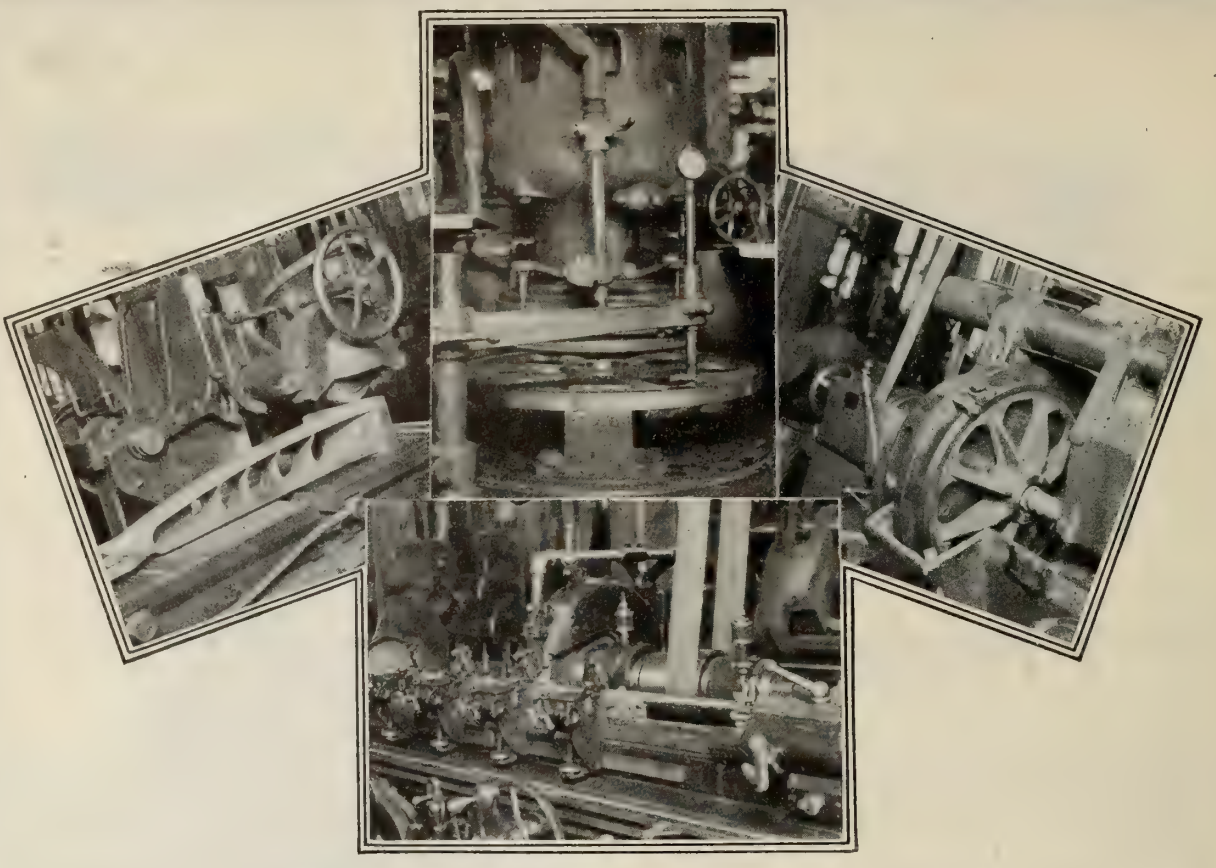
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CANADIAN MACHINERY
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MANUFACTURING NEWS

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Some Uses of Portable Tools in the Machine Shop

Pneumatic Tools as Confined to Machine Shop Use Only—Drills —Scaling Hammers—Grinders, etc.—Electrically Driven Tools— Portable Boring Bar—Heavy Portable Planer—Boring Mill

*By J. H. MOORE

TO fully cover the subject of "Portable Tools, and their uses in the Machine Shop" would take a complete issue in itself, therefore we shall have to content ourselves with a few scattered uses, together with explanatory matter. The term portable tools is a very broad one and embraces many varied lines. Our best plan therefore would be to follow out a clearly defined plan, taking one type of tool at a time. We shall start with pneumatic tools.

Pneumatic Tools

There is a considerable difference between the small repair shop and the large manufacturing plant, but in both cases pneumatic tools are used extensively. There is usually a certain amount of repair or assembly work that is much easier handled by portable tools, than by taking the piece to the stationary machine.

Nowadays it is a poorly equipped plant that cannot boast of at least a few, if not all, the portable tools listed below:—

One or two pneumatic drills; some chipping hammers; and a pneumatic grinder. Of course if we were considering the foundry, boiler shop, etc., we could elaborate still further, but in this present article we will confine ourselves to the uses in the machine shop. Without touching upon the design of such tools in any way, let us consider why they are in such popular use?

Lightness; ease of handling by unskilled labor; ease of repair; ruggedness; low maintenance and operating cost. All these features appeal to manufacturer and worker alike. Their uses are so varied as to almost baffle description, for such tools are used for drilling, reaming, counterboring, tapping, grinding, clipping, cleaning tubes, boring, etc., etc.

Forgetting for the moment all the various uses to which such tools can be put in the foundry, such as cleaning castings and so on, look at Fig. 1. Here we see a scaling hammer trimming the gasket of a pump which has just been assembled. This illustration shows only one of hundreds of uses in the machine shop. Rough edges which have been missed by the foundry are soon leveled down; flanges that are somewhat larger that they should be owing to loose rapping when casting was made are soon brought down to size, and so it goes right down the line, from the first operation, to the time the machine, pump or whatever the product may be, reaches the shipping platform.

Then there is the portable drill, which bores, taps, reams, etc., Apart from the fact that many holes are better drilled at the assembly stage, it is surprising how often holes intended to be drilled on the machine are forgotten. This of course is not so evident when jigs are used at the drilling machine, but every product does not warrant the expenditure of jigs. The time which would be wasted in disassembly, not to speak of the time transporting the part to and from the drilling machine, would be a serious item, but all this is avoided by using the portable drill. In a very short time the error is remedied and with practically no inconvenience.

The same condition holds good in grinding. In many cases the portable grinder puts the finishing touch on an assembled machine, where such an operation would be impracticable, and often impossible, with a stationary grinder.

The air hoist should also be considered as a portable tool because it is one of the means of speeding up production. Where air hoists are installed, men experience less fatigue, and auto-

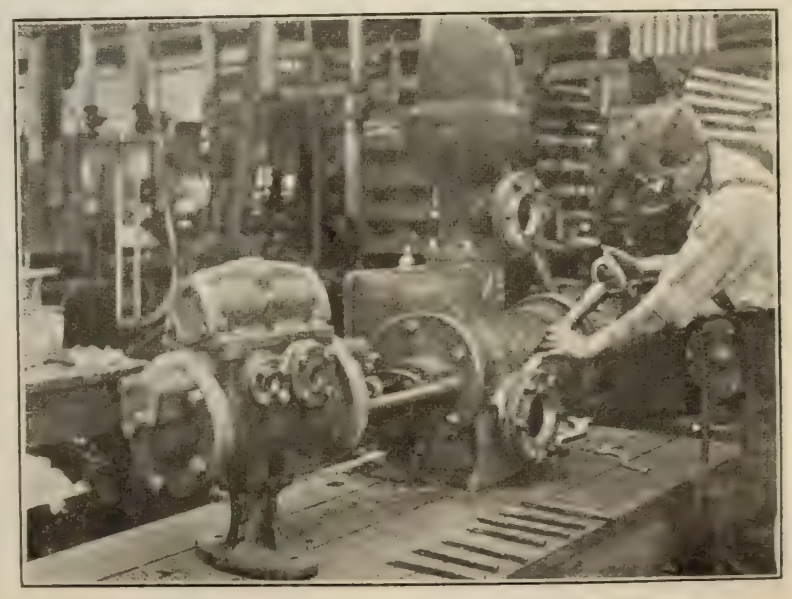


Fig. 1.—Trimming a pump gasket by means of a scaling hammer.

We are indebted to the Canadian Ingersoll Rand Co., Sherbrooke, Que., for the use of Fig. 1; to the H. B. Underwood Co., New York, for Fig. 2; and to the Morton Mfg. Co., Muskegon Heights, Mich., for Fig. 3.

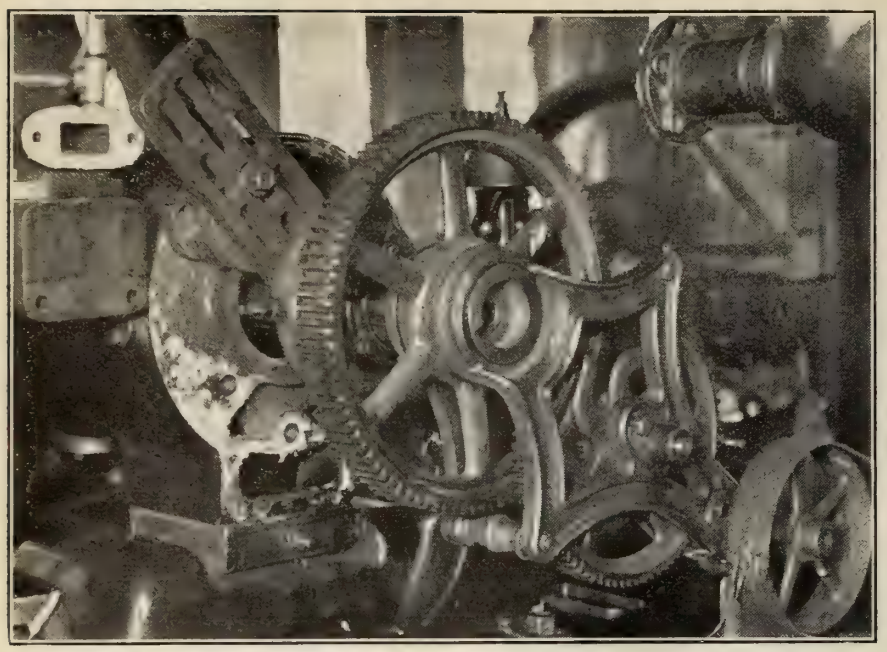


Fig. 2.—A portable cylinder boring bar at work.

matically their productive capabilities increase. An ideal arrangement, especially if the work is of rather heavy nature, is to install an air hoist directly over each machine. When the production does not warrant such a procedure, one hoist of the travelling type can be arranged to serve several machines.

Another useful tool is the blow gun, this being used for such work as blowing dirt and dust from the inaccessible parts of electric motors; cleaning chips and dirt from machine tools, shafting, patterns, work benches, etc., etc. In other words a gun, or nozzle, which, aided by compressed air, reaches spots which are almost inaccessible, and in a rapid and thorough manner.

Then there is the riveting machine. This type of portable tool is very useful in many cases, especially in assembly work, although as a general rule, its use is greatest in construction work, shipbuilding, and boiler manufacture. However there are cases in the machine shop where such a tool is of great value. One could discuss the use of pneumatic tools almost indefinitely, but as we do not wish this article to be of undue length we will pass on to another type of portable tool in use.

Electric Tools

Electrically driven portable tools are much in use and favor throughout machine shops and manufacturing plants. These include such tools as electric drills, grinders, etc. The drills also perform tapping and reaming operations, and accomplish practically the same work as pneumatic drills using electricity as the driving medium. The electric grinder is found to be very useful in the tool room for the grinding of dies, also on the floor for grinding of castings. In fact the uses of these tools are so closely interwoven with that of the pneumatic type, that no further mention need be made. In the one case compressed air is the driving medium, while in the other, electricity supplies the power. Some manufacturers stand firm for the one type, while others swear by the latter mentioned. As we are not out to make comparisons or comments we shall pass to another type of portable tool.

Portable Boring Bar

At Fig. 2 is shown a portable cylinder boring bar busily engaged in boring out the cylinder of an engine right in the plant, without dismantling or disturbing any connections or piping. This type of portable tool is designed for reboring all sizes of steam engine cylinders, pumps, steam hammers, air compressors, large wheels, etc., and is so arranged that it will bore with one or both cylinder heads off. In boring out a cylinder of an engine all that is necessary is the removal of cylinder head and piston. This saves the breaking of steam joints, and so on.

In action, the cutter heads are fed by a steel screw which is let in on one side of the bar. Adjustment of cutting tool is arranged for, and two changes of feed are obtainable. The bar is driven by a train of gears and can be operated either by hand or belt power. In the illustration shown the belt is used as the power medium. However, where power is not available the hand method is quite satisfactory.

Other Portable Tools

While the average shop man's idea of a portable tool is something which he can pick up and carry around, this impression is hardly correct, when one considers the term in a broad sense. For example, we have the portable key at

(Continued on page 66)

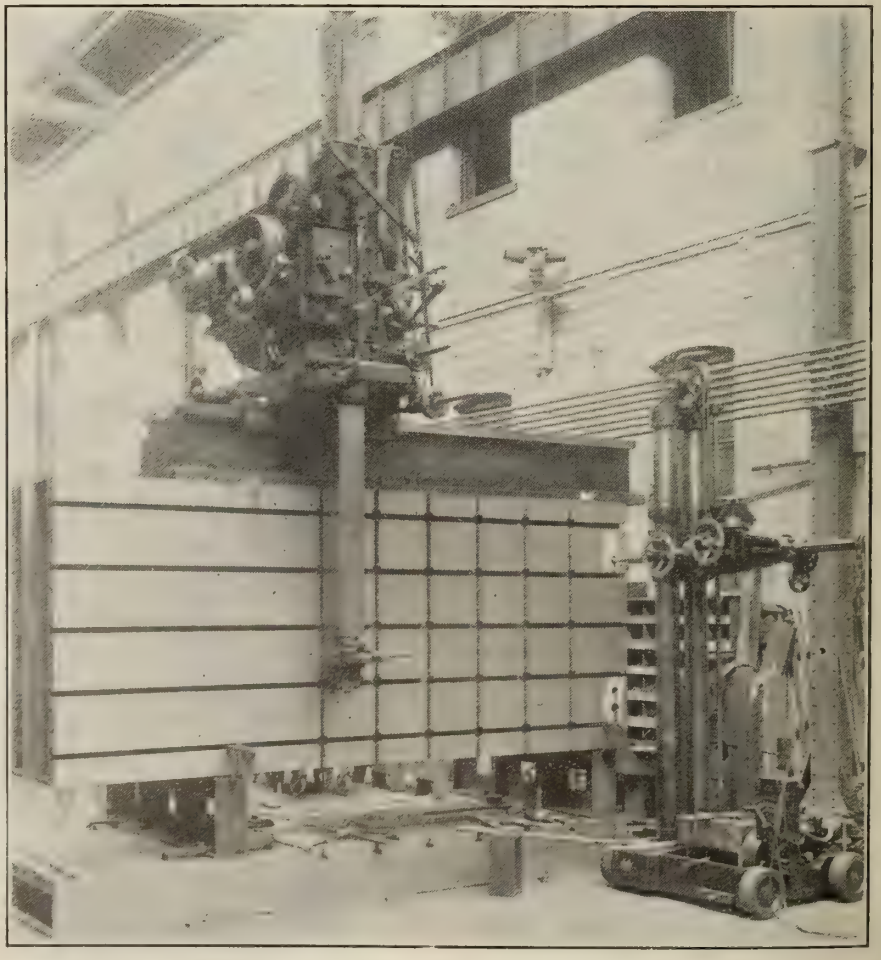


Fig. 3.—A portable planer and boring mill working on a large floor plate section.

Elements of Machine Design—Lesson No. 2

Continuation of Lesson Contained in October 20th Issue—Moment of Inertia—Moment of Inertia of a Compound Section—Section Modulus—Various Examples and Solutions

By L. T. RUTLEDGE

CONTINUING our lesson on beams, from the Oct. 20, issue, we find that for equilibrium as stated previously, the moment of resistance of the fibres of the beam must be equal to the bending moment of the external forces acting upon it. When a beam is loaded transversely, it bends about the neutral axis (N. A.) which lies in the centre of gravity of the section. The fibres on one side of the (N. A.) are compressed and on the other side they are stretched. The fibres which are farthest away from the neutral axis are stressed the most, and if the maximum stress does not exceed the elastic limit stress, then the intermediate fibres are stressed in direct proportion to their distance from the neutral axis.

If these stresses are represented graphically by straight lines, the extremities of the lines would be on one straight line, and the stress diagram on either side of the (N. A.) is a triangle with its vertex on the (N. A.) and its base parallel with the outside fibre under stress. Now it is apparent that the total moment of resistance of the beam is equal to the sum of the moments of all the individual fibre stresses about the neutral axis. The number of individual fibre stresses is so large as to be immeasurable and accordingly the work entailed in adding up this large number of separate moments at first sight may appear to be almost an impossibility, nevertheless it has been done and is quite easy when one knows how. We shall now proceed to do what seems so difficult. Let a beam of rectangular cross-section be used for illustrative purposes as is shown in Fig.11.

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

Let M = the total resisting moment of the beam.
b = the width of the beam.
h = the height of the beam.
c = the distance from the N.A. to the extreme fibre under stress.
s = the stress in the fibre at the distance equal to c.

The variation in stress is represented graphically by the triangle ADO. Consider a very narrow strip on this stress diagram distant z from the N. A. and lying parallel to the N.A. and let it represent the stress on a very narrow strip of the cross-section of the beam which may be represented by

$$\delta A$$

the symbol

$$\delta$$

denoting nothing but that the area is infinitely small.

Now the unit stress at distance c = s (lbs. per sq. in.)

Then the stress at unity distance

$$= \frac{s}{c}$$

The stress at distance z will be

$$= \frac{s}{c} z$$

The total stress on the area

$$\delta A$$

will be

$$\frac{s}{c} \cdot z \cdot \delta A$$

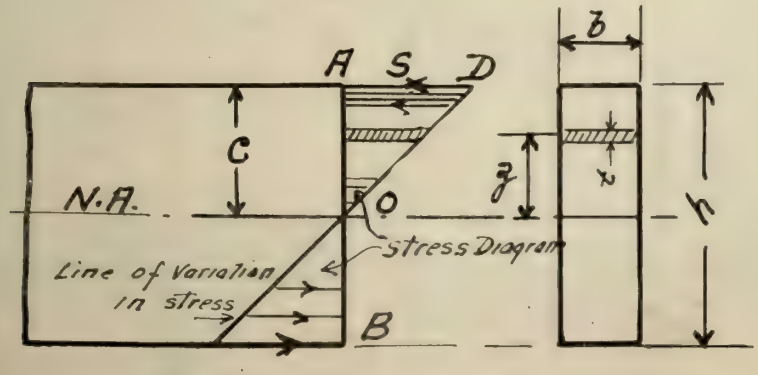


Fig. 11.

The moment of this stress about the N.A.

$$\frac{s}{c} \cdot z \cdot \delta A \cdot z$$

or

$$\frac{s}{c} z^2 \delta A$$

Up to this point we have only considered an infinitely small section of the beam and have found for it the value of the resisting moment. For the entire beam, the moment will be the summation of an infinite number of quantities.

This summation is represented by a symbol

$$\sum$$

put ahead of the formula, so that the entire resisting moment is given by the expression

$$\sum \frac{s}{c} z^2 \delta A \qquad (12)$$

$\frac{s}{c}$ is a constant quantity and can therefore pass through the summation sign. It is not affected no matter what values are assigned to the "z" factor.

So that

$$\frac{s}{c} \sum z^2 \cdot \delta A$$

The quantity

$$\sum z^2 \delta A$$

is an abstract quantity of the fourth dimension since z^2 is a second dimension and area is also a second dimension. It is impossible to visualize this quantity. It is quite easy for the mathematician since he is accustomed to think in symbols. This quantity is called the moment of inertia. The usual symbol employed to designate it is a capital I. So that we have

$$I = \sum z^2 \delta A$$

By substituting in formula (13) the symbol for the moment of inertia we

have the formula written in a simpler form as follows:

$$M = \frac{S}{C} I$$

$$\text{or } \frac{S}{C} = \frac{M}{I}$$

In the above we have the most important formula in machine or structural design, one that is used all the time in design and one that should be remembered. It is the all-important formula used in the design of a skyscraper or in the design of the simplest beam in a common machine.

Moment of Inertia

In the previous paragraph it was shown that the abstract but mathematical quantity known as the moment of inertia and represented by the symbol "I", is a factor of the moment of resistance and is equal to the sum of the products of each elementary area of the cross-section multiplied by the square of its distance from the neutral axis which passes through the centre of gravity of the entire section.

To obtain the moment of inertia of a rectangle of width b and height h about the neutral axis, it will be necessary to divide the section into very narrow strips as is illustrated in Fig. 12. Let "t" represent the thickness of each strip. Its area then is bt. If, as before, z is the distance from the N.A. to the centre of gravity of this elementary strip, then the moment of inertia of the strip is z^2 bt. A value for each strip in the entire section will have to be obtained and then all these values added together. A very little thought on the question will convince one that it will be necessary in order to have an absolutely correct answer to have an infinite number of these tiny strips. If we assume there are an infinite number of these strips then to get the correct sum we should have to employ the mathematics known as calculus. Calculus is a very exact science and by its use we can get the absolutely correct answer. However, by taking a goodly number of strips of measureable width we can get an answer that is very nearly correct, as is illustrated below. The calculus gives the correct answer for the moment of inertia to be 3

$$I = \frac{bh^3}{12} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (16)$$

It is well to note that the dimension that is cubed is always the one that is perpendicular to the axis about which the moment of inertia is taken.

Example: What is the moment of inertia of a rectangle 2"x12" about the neutral axis parallel to the shorter dimension?

Using formula (16) we have

$$I = \frac{bh^3}{12} = \frac{1}{12} \text{x} 2 \text{x} 12^3 = 288 \text{ inches}^4.$$

It is an excellent exercise to apply the approximate method of solution and see how closely the approximate result approaches the answer obtained by the use of the calculus. Let us do this. Divide the section into 24 equal strips parallel to the shorter dimension. The width of each is one-half an inch and its area is one sq. inch. It is now necessary to determine the "z" value for each of the strips, that is, we must know the distance from the N.A. to the centre of gravity of each elementary strip of the whole 24 of them. It must not be overlooked that there are two strips situated the same, one on each side of the N. A. But one would say that one distance is positive and the other is negative. This is true, but then the z is squared and squaring a negative quantity makes it positive. Thus we see that we have to find the moment of inertia for half the sections and at last multiply by 2. The z's for the 12 upper sections are beginning at the centre: .25, .75, 1.25, 1.75, 2.25, 2.75, 3.25, 3.75, 4.75, 5.25 and 5.75.

Now:—then $I = (.25^2 - .75^2 - 1.25^2 - \text{etc.} \ldots.) 1\text{x}2 = 287.5 \text{ ins.}^4$.

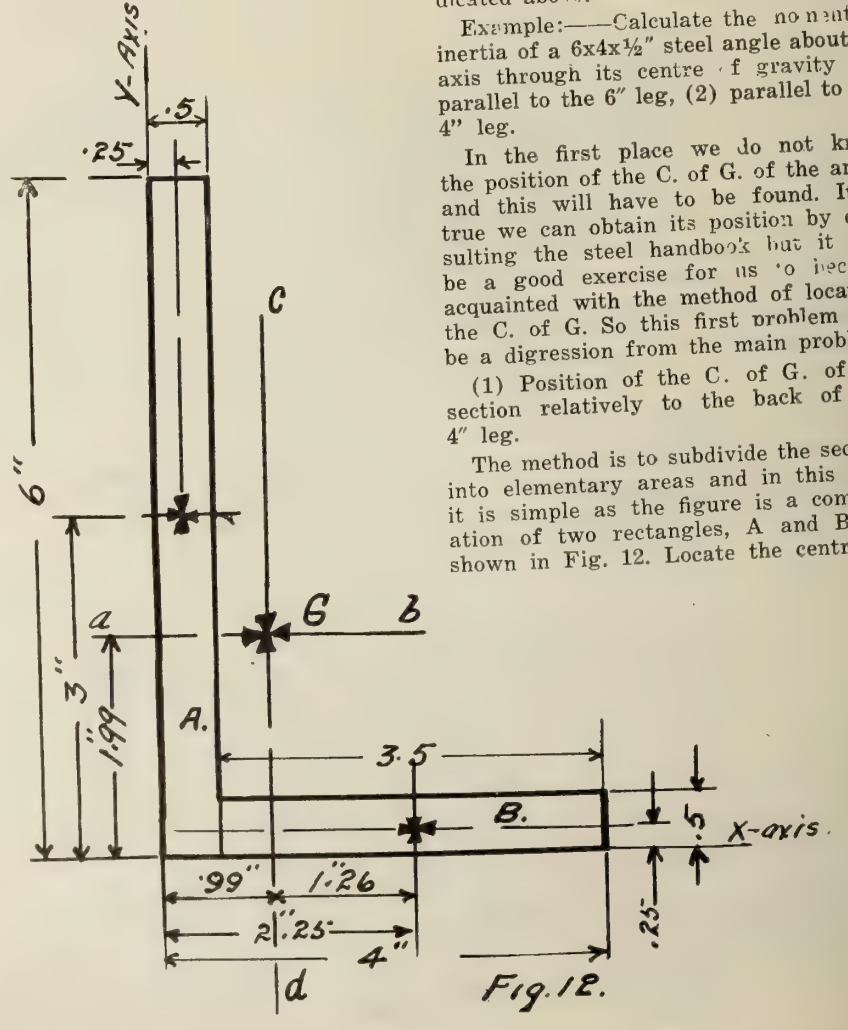


Fig. 12.

The above shows that the approximate result is very close to the correct result, 288.

The employment of similar methods will give the moment of inertia of a triangle and a circle. The values are as follows:

The I for a triangle about its N.A. parallel to the base b

$$= \frac{bh^3}{36} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (17)$$

The I for a circle about an axis through its centre and of

$$\text{diameter } d, = \frac{\Pi}{64} d^4 \quad \ldots\ldots\ldots\ldots \quad (18)$$

Moment of Inertia of a Compound Section

The moment of inertia of a compound section about an axis through its centre of gravity is equal to the sum of the moments of inertia of the component parts about axis through their own centres of gravity plus the areas of the component parts multiplied by the squares of the distances of their individual centres of gravity from the N.A. Then the moment of inertia of any section, no matter how complex, can be found by dividing the compound section into elementary rectangles, triangles, etc., and the total I can be found as indicated above.

Example:——Calculate the moment of inertia of a 6x4x½" steel angle about an axis through its centre of gravity (1) parallel to the 6" leg, (2) parallel to the 4" leg.

In the first place we do not know the position of the C. of G. of the angle and this will have to be found. It is true we can obtain its position by consulting the steel handbook but it will be a good exercise for us to become acquainted with the method of locating the C. of G. So this first problem will be a digression from the main problem.

(1) Position of the C. of G. of the section relatively to the back of the 4" leg.

The method is to subdivide the section into elementary areas and in this case it is simple as the figure is a combination of two rectangles, A and B, as shown in Fig. 12. Locate the centre of

gravity of each of the rectangles. It is at the intersection of the diagonals.

Consider each rectangle as a weight and apply the principle of moments.

Take moments about an arbitrarily selected axis, say, the axis of X. The moment of one of these weights is the product of the measure of it, that is, the area of the rectangle, into the distance of its centre of gravity from the axis of X. Also we know that the moment of the compound section is the sum of the moment of the individual parts.

Let y be the distance from the X-axis to the desired C. of G.

The total area of the section is

$(6x½) + (3.5x½) = 4.75$ sq. ins.

Then we have

$$4.75xy\ (6x.5)x3+(3.5x.5)x.25$$

$$\text{therefore } y=\frac{9.4375}{4.75}=1.99 \text{ ins.}$$

Similarly the distance X which is the distance of G from the Y-axis may be found.

$$4.75xX= (6x.5)\ x.25+ (3.5x.5)\ x2.25$$

or $X=.99$ ins.

Thus the centre of gravity of the section is fixed and we can proceed with the second part of the problem.

(2) The moment of inertia of the compound section about an axis through its C. of G. and parallel to the back of the longer leg, that is parallel to the axis cd.

For rectangle (a)

I about an axis through its own C. of G. and parallel to axis cd

$$\text{is } \frac{b\ h\ 1}{12\ \ 12}=\frac{}{}x.5^3x6=.06 \text{ ins.}^4$$

Area of this rectangle into square of distance of its C. of G. from the axis cd $=3.0x.74^2=1.64$ ins^4.

For rectangle (b)

Its I about an axis through its own C. of G. and parallel to axis cd is

$$\frac{1}{12}x.5x3.5^3=1.79 \text{ ins.}^4$$

Area of the rectangle into square of the distance of its C. of G. from the axis cd $=1.75x1.26^2=2.78$ ins.^{4}

The total moment of inertia equals the sum of the above four quantities that go to constitute the whole

$.06+1.64+1.79+2.78=6.27$ ins.^{4}

By a similar method of calculation the moment of inertia of the section about the axis ab can be found and when so worked out the answer will be found to be 17.4 ins.^{4}.

The difference in these two values of the moment of inertia is a criterion as to which way the angle should be placed to carry the greater load. If it is placed so that the axis ab is horizontal and the quantity 17.4 then becomes a factor of the resisting moment, then the resistance is greater than if the other "I" had been used. Accordingly a greater B.M. can be applied to the angle and that means a greater load.

Section Modulus

In the theory of the beam there is one more abstract quantity that we must become acquainted with before we begin working difficult practical problems.

The usual way of expressing the beam fixture formula is

$S/C=M/I$. Now let us change it around to read

$M/S=1/C$.

The quantity I/C which is the moment of inertia divided by the distance from the neutral axis to outside fibre which is the one stressed equal to S is called the section modulus. The symbol capital Z is used to designate it. It is a handy quantity to have in design and saves dividing the I by C. The section modulus for all the standard structural shapes is given in the handbooks. It is a good idea to have a table of section moduli for all the ordinary sizes of beams made in wood. One has to make this table up himself.

Using the section modulus, the flexure formula becomes

$M/S=Z$ or $M=SZ$ or $S=M/Z$ (19)

Example:—Find the section modulus of a 2" x 12" wooden beam, considering the axis as being parallel to the shorter dimension.

The section modulus for a rectangle $=I/C=\frac{bh^3}{12}$

divided by C which is h/2. Therefore the section modulus is eual to 1/6 of bh^3.

In this problem then the section modulus $=Z=1/6 \times 2 \times 12^2=48$ ins.^{3}

Example:—Why is it better design to load a 2" x 12" pine beam with the 12" dimension the vertical one with the 2" one vertical.

With the governing axis parallel to the 2" side we have

Modulus $=Z=1/6 \times 12^2=48$ ins^3.

With the governing axis parallel to the 12" side, we have

$Z=1/6 \times 12 \times 2^2=8$ ins.^{3}

The above calculations show that the beam is 6 times as strong when placed with the longer side vertical, it being inferred that the load would be so placed that its action would be vertical. Everyone of us will have noticed that the joists are so placed to sustain a floor of the building.

Exercise 4;—A rectangular pine beam resting on two supports 10 ft. centre to centre is loaded with a concentrated load at the centre of the span of 4000 pounds. What section of beam is required in order that the working stress may not exceed 800 lbs. per sq. inch.

For equilibrium the resisting moment has to be equal to the bending moment. The B.M. for a beam centrally loaded with concentrated load is

$\frac{WL}{4}$

according to formula (11).

Then for equilibrium,

$$M=\frac{WL}{4}=\frac{4000 \times 120}{4}=120000 \text{ inch-lbs.}$$

the length being 10 ft., which is 120 inches. Since the stress is given in bounds per sq. in., we have to use inches throughout.

Now using the flexure formula (19)

$$Z=M/S=\frac{120000}{800}=150 \text{ ins.}^3$$

For a rectangular beam $Z=1/6 \times bh^2$.

If $bh^2—6 =150$ then $bh^2=900$.

Now both b and h are unknown, then we must assume one of them to find the other as we have only one equation and one equation will solve for one unknown only. As a first trial assume b equal to 4 the h^2 will equal 225 and extracting the square root to find h we get $h=15$. As a second trial assume $b=6$, then $h^2=150$ and $h=12.5$ about. Either a beam 4" x 15" or one 6 x 12.5" will be strong enough but it will be observed that it will be more economical to use the 4" x 15" beam since there is a smaller number of board feet in it.

The following are typical problems employing the principles laid down in the above theory on the beam. It is recommended that the student try them.

1. Determine the centre of gravity of 5 x 3" angle.

2. Determine the location of the centre of gravity of a chord section composed of

Two 16" channels at 33lbs. weight 19.80 lbs.

One 24" x ½" cover plate weight 12.00 lbs.

the channels being placed back to back and 17" apart inside.

Answer:—The centre of gravity is located on the vertical centre line 4.83 inches from the top of the cover plate

3. Determine for the section given in problem 2 the moments of inertia about an axis through the C. of G. parallel to the cover plate and about an axis through the C. of G. parallel to the back of the channels.

Answer: For the first part 1642.46 ins.^{4}

Answer: For the second part 3249.17 in.

4. A cantilever beam projecting 8 ft. from a wall is required to carry in addition to its own weight a uniform load of 900 lbs. per linear foot. Assuming the beam to weigh 50 lbs. per lin. ft. determine the necessary steel 1-beam. The allowable working stress used with steel beams is 16000 lbs. per sq. in.

Answer: A 10" 1-beam at 25 lbs. will be strong enough.

5. A forging weighing 15 tons is to be carried temporarily on three steel beams resting on supports 8 ft. c. to c. Assuming a uniformly distributed loading, design the temporary structure.

Method of Recooling Oil From Quenching Tanks

Proper Speed of Cooling is Determining Factor in Degree of Hardness Obtained—Temperature Should be Decided Upon—Then Quenching Medium Should be Maintained At that Point

*By S. E. DERBY

IF STEEL is heated through its critical range, the internal structure or molecular arrangement of the steel is transformed into the hardening condition. If thereupon the steel is quenched or quickly cooled in a suitable manner, this hardness is partially or wholly retained. Obviously a large piece of steel, even though at the same initial temperature as a small piece, will take longer to cool to room temperature because a greater time is required for the heat from the interior to flow to the surface where it is removed. The rate of cooling thus depends upon the size of the metal. It also depends upon the composition of the steel, and to a greater degree upon the rapidity with which the cooling or quenching medium removes the heat. This rapidity is determined by the nature of the medium, its fluidity or viscosity, specific heat, and temperature.

The quenching mediums generally used are water, brine and oil. In order to obtain the best hardening results with either of these, a low bath temperature is desirable. An excessively high temperature brings about the formation of vapor bubbles or pockets and these bubbles adhere to the hot steel and prevent uniform cooling and therefore the attainment of a uniform degree of hardness. Furthermore under these conditions the time of cooling is materially lengthened. In the case of mineral oils of low fire point, if the temperature is relatively high, the oil breaks up into various distillation products leaving a residue or precipitate that causes the oil to thicken, corresponding to a greater viscosity and therefore a diminished ability to dissipate heat by convection. The formation of residue in the oil tends to make the oil heat up quickly and for this reason its efficiency as a quenching medium is impaired. Now and then the thickening of the oil and the accompanying sluggishness with which the heat is dissipated frequently result in fire.

The particular temperature that will give the best hardening results should be ascertained first and then this temperature maintained by means of a suitable cooling system. G. W. Pressell of E. F. Houghton & Co., found that by heating in an electric furnace up to 1,200 F. a test piece of low carbon chrome vanadium steel of special construction, and thereupon quickly immersing it to a constant depth in 25 gallons of quenching liquid, and measuring the time required for the steel to cool from 1,200 to 600 deg. F., the quenching speed varied considerably with the initial temperature of the bath.

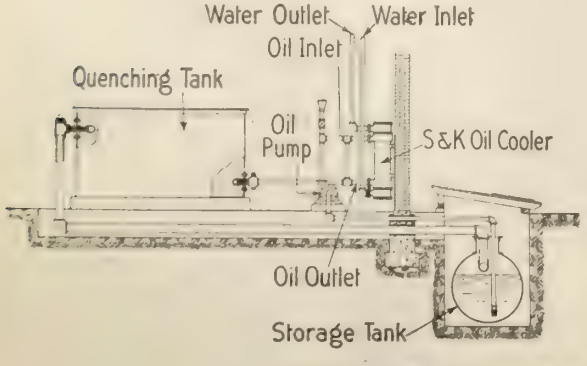
The results obtained for the various oils used are abstracted in the accompanying table.

The reader will note the wide variation in the case of some of the oils used. For this reason it is necessary that the temperature at which the best hardening results are obtained be first determined by test and then provisions made for maintaining this temperature constant throughout the quenching bath. For this purpose some sort of oil recooling system is used. Although several methods of recooling the quenching oil are in use, nevertheless modern practice favors circulating the oil in a closed circuit and recooling the oil in a separate cooler, as for example the typical arrangement shown in Fig. 1.

The heated oil is removed from the top of the quenching bath and passed through a suitable strainer to a storage tank. From here it is forced by means of an oil pump to the cooler, wherein the oil is cooled and thereupon returned to the quenching tank. The oil cooler, see Figs. 2 and 3 for typical arrangements, frequently consists of a smooth bore cylindrical cast iron shell, to the ends of which are attached cast iron headers. Within the shell is a bundle of straight brass or copper tubes through which cold water passes from one header to the other. The headers are separated from the cylinder by the tube sheets.

The hot oil flows into the shell at the top, as shown by Fig. 3, passes transversely across the tubes and around the annular baffles, and leaves the shell at the bottom. During its travel through the shell, the oil strikes the tubes approximately at right angles, thereby splitting into many fine streams. The water flows through the tubes in an opposite or counter-current direction to the oil. The tube sheets are built of a composition metal into which the tube ends are cast. Thus it is possible to choose

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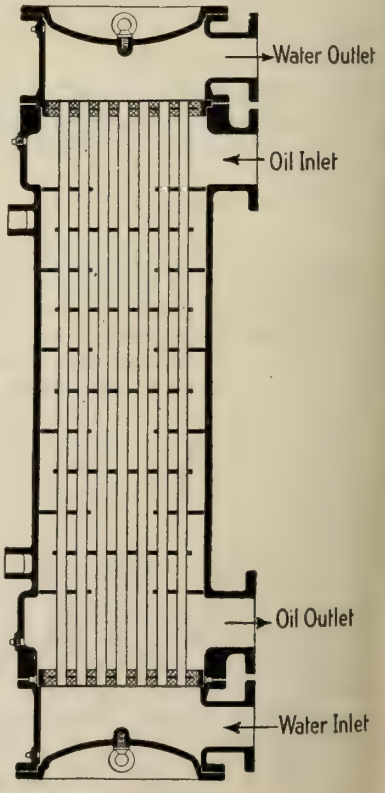


Fig. 1. A system for recooling the oil from quenching tanks. Fig. 2. A typical oil cooler. Fig. 3. Sectional elevation of a typical oil cooler.

the number, shape, size and spacing of the tubes so that a large cooling effect is obtained. The upper tube sheet is rigidly secured to the shell; the lower one forms a floating head construction, thus making provision for the expansion and contraction of the tubes. Each tube experiences the same expansion, and for this reason there is no tendency for the tubes to become loosened, or for the tube sheets to be strained. The composition material of the tube sheets is exceedingly dense, and its melting point is around 550 deg. F. It does not disintegrate at the temperature met in practice.

The packing between the headers and the shell consists of two rings of rubber separated by one of brass and practically prevents any mixing of the oil and water. Since all joints on the cooler are external, leakage is quickly detected. The entire tube bundle is readily removed from the shell without breaking any of the oil connections, thereby facilitating inspection and cleaning. (See Fig. 4.)

It will be noted that the oil pipe enters the quenching tank at the bottom, whereas the overflow pipe leaves the tank at the opposite side and at the top. This arrangement makes for a thorough diffusion of the oil through the tank, and for a maximum cooling during quenching. The evident advantages derived from the use of an oil-cooler are the maintenance of a uniform temperature throughout the quenching bath, uniform hardening results, saving in time, saving in oil and elimination of fire risk

When the quenching oil is continuously circulated and recooled, the temperature of the bath can be closely controlled and kept sufficiently low, thereby preventing the formation of vapor bubbles and soft spots on the surface of the hot steel. It is not necessary to discontinue quenching periodically, in order to prevent the oil from overheating. Adequate cooling is insured at all times and time is saved because the cooling operation becomes a continuous one. A smaller quantity of oil can be used and large capacity quenching tanks are unnecessary. Evaporation losses and the formation of oil sludge at the bottom of the tank are reduced to a minimum. Since the temperature of the bath is always kept comparatively low, and oil having a low flash point can be used. The danger of oil igniting, as in a poorly ventilated hardening room, is eliminated.

In a large steel plant near Philadelphia, the following results were obtainer with the type of cooler shown in Fig. 2.

A No. 3 Gould pump, driven by a 5 H. P. G. E. motor, was installed for pumping the oil to the quenching tank and for forcing it through the cooler and thence back into the tank, thus com-

(Continued on Page 45)

Quenching Speeds of Oils at Different Initial Temperatures

Kind of Oil Variation of Quenching Bath Temperatures		Variation In Time Required For The Steel To Cool fom 1200 to 600°.
Fish Oil Lot No. 1	88 to 255	97 to 120
Fish Oil Lot No. 2	71 to 251	78 to 93
Linseed Oil	84 to 261	94 to 107
Cottonseed Oil	100 to 230	104 to 119
Heavy Viscous Drawing Oil	75 to 229	154 to 181
Houghtons No. 2 Soluble Quenching Oil	82 to 249	97 to 102

Furnace Temperature	1500 to 1550°F.
Pump, R. P. M.	152
Suction of pump, vacuum	2 in.
Discharge of pump, gage pressure	32 lbs.
Gallons of oil circulated through cooler per hour	3,000
Oil inlet temperature	118°F.
Oil outlet temperature	96°F.
Drop in oil temperature through cooler	22° F.
Gallons of water circulated per hr, through cooler	774
Water inlet temperature	35°F.
Water outlet temperature	75°F.
Rise in water temperature through cooler	40°F.



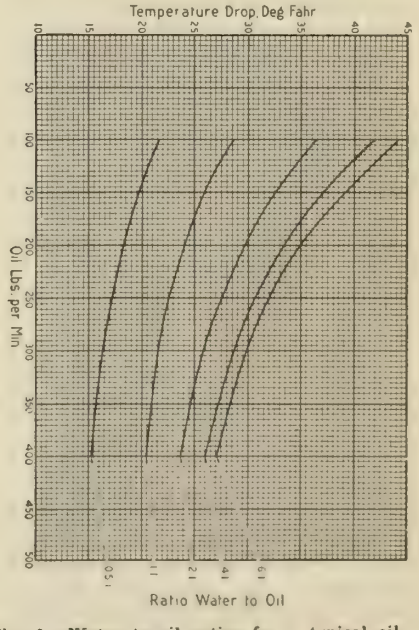
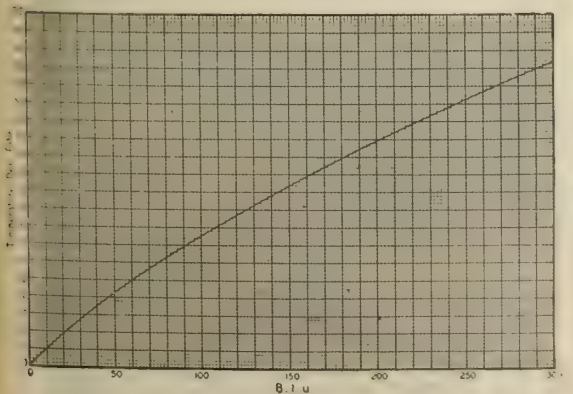


Fig. 6.—Water to oil ratios for a typical oil cooler.



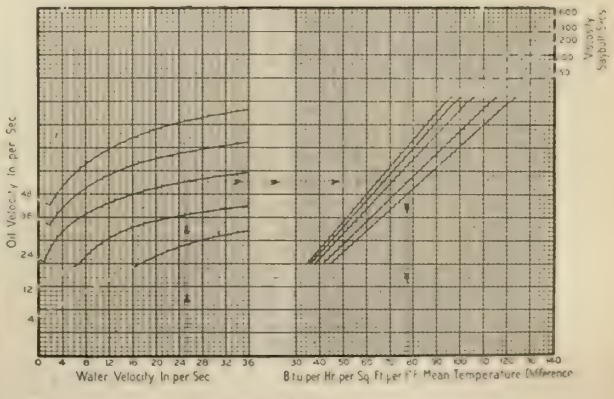


Fig. 4. A typical oil cooler showing tube bundle removed. Fig. 5. Total heat of steel. Fig. 7. Heat transfer rate with viscosity corrections for oil coolers.



WELDING AND CUTTING



Learning To Weld—Some Points for Beginners

Possibilities of Brazing—Use of Welding Rods—Why Fluxes are Used—Sheet Aluminum Welding—Composition of Fluxes—The Question of Eye Protection—Progress in Welding

By FRED E. ROGERS

IN THE Oct. 20 issue of Canadian Machinery we spoke on the subjects of preheating, when to preheat, protecting the weld, penetration, proper size of tip and flames, welding speeds and method of testing welds. In the present materials we will consider some further points of interest. Let us start with brazing.

Brazing.

The welder should not disregard the possibility of brazing with the oxy-acetylene torch. Brazing is a valuable process which should be used in some cases instead of welding, and the welder should exercise judgment to determine whether brazing or welding is the preferable method. It is true that the oxy-acetylene flame may be used for welding all metals but in those cases where the high temperature might seriously distort or deteriorate the metal or adjacent parts of an apparatus it may be advisable to resort to brazing, especially in the case of brass or malleable iron. A brazed joint well done is very strong, and it is a question whether it is not preferable in most cases to braze brass rather than to weld it. In the case of malleable iron, brazing with bronze welding rod is recommended for general repairs because malleable iron loses its malleable characteristics when molten and welded whereas when brazed its malleable quality is not seriously affected, and the brazed joint will be nearly as strong as the parent metal.

When using the torch for brazing, the flame should be made slightly carbonizing, and it should be held away from the metal to avoid concentrating the heat and to raise the temperature only to the point required to fuse the spelter. The parts should be cleaned and fitted together as closely as possible, and clamped to hold them firmly while being brazed. The welder need have no fear of clamping parts too closely as the molten spelter will penetrate the most closely-fitted joint when properly fused and fluxed. As a matter of fact, the closer the joint the stronger the job when brazed.

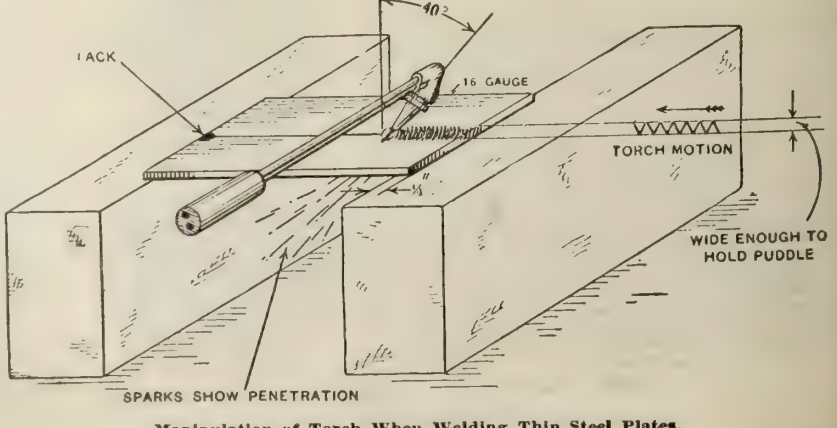
Never attempt to weld a previously brazed joint without cutting away all of the brazed metal. Spelter will seriously weaken a weld, and all traces must be carefully cut away before starting to weld. This rule should be scrupulously observed. Brazing is a form of soldering, in fact it is called hard soldering, whereas welding requires fusion of the metal itself, and it is essential for sound work to incorporate only weld metal of the same physical characteristics as the metal to be welded.

Welding Rods.

Adding material, welding rod or filler is necessary to fill the joint and build up the level of the weld flush with or slightly above the margins. Pure wrought iron or low carbon steel wire is used in steel welding; cast iron sticks, for cast iron; aluminum wire, for sheet aluminum; aluminum sticks, for cast aluminum; bronze wire, for bronze; monel wire for monel; and so on. The rule is to use rods of the same metal as the metal to be welded and of the same physical structure. Rolled or drawn welding rods should be used for rolled metals and cast rods for castings.

Ordinary commercial steel wire or cast iron sticks cannot be used successfully for welding, however, because of impurities present that seriously affect the strength when fused in a weld. Sulphur, phosphorous and carbon in excess of certain percentages make weak castings. Commercial wire is strong because of the method of manufacture, the bad effects of high sulphur and phosphorous being offset by the refining process of drawing. But when the metal is molten and cast as it is in a welded joint it is likely to be brittle and weak. The same condition holds with cast iron. Foundry iron used for machine castings is unsuitable for cast iron welding sticks. It is too low in silicon to work freely and is likely to harden or make hard spots in welds that ruin cutting tools when machined.

Swedish wrought iron welding rod was used and recommended exclusively for all steel oxy-acetylene welding in the early days of the industry, and there are still some welders who advocate it to the exclusioon of other material. In general, however, welders have discovered that pure wrought iron welding rod is not necessary or even desirable for the general run of welding. The reason is substantially this: The first welders did not fully understand the theory of torch and welding rod manipulation and usually melted the rod with the direct heat of the torch, whereas up-to-date welders know that the heat of



Manipulation of Torch When Welding Thin Steel Plates.

the puddle should fuse the welding rod —not the direct flame of the torch. The fusing temerature of pure wrought iron rod is approximately 2780 degrees F. while the fusing temperature of 0.10 carbon steel welding rod is about 2,600 degrees F., and hence the difference in temperature of the two carbon steels is approximately 100 degrees, which is ample for welding purposes. Too great a difference is undesirable in any welding combination. It means that if the correct process of welding is carried on that the parent metal must be overheated in order to fuse the adding material. The tendency then is to melt the rod directly with the heat of the flame and thereby injure the quality of the weld.

The welder should avoid the use of any but welding rods furnished by reputable concerns that specialize in these supplies. The money saved in buying low-grade welding material will be lost and much more through poor welds and excessive gas consumption.

Fluxes.

The purpose for which fluxes are used is to dissolve oxide and eliminate foreign matter which if left in the weld metal would weaken it. Flux is not required for welding low carbon steel or cast aluminum but should be used on cast iron, brass, bronze, sheet aluminum, etc. But Deebee flux may be used to advantage on cast aluminum and thus render the use of a puddling spoon unnecessary. Whether a flux shall be used will depend on the situation and whether a puddling spoon can be used to better advantage.

Flux is generally applied by thrusting the hot welding rod into the flux box which transfers sufficient amount to ordinary width joints. On heavy cast iron welding it will be necessary to apply flux more liberally, and it should be dusted on by hand, a teaspoonful at a time.

Sheet aluminum welding is more or less a specialty, requiring experience and skill. The difficulty of the work is largely eliminated by using Napolitan flux, a result of many experiments made to produce an aluminum flux that facilitates welding and produces no bad after affects. The latter consideration is highly important. Corrosive action may cause aluminum welded joints to separate in use when unsuitable fluxes have been used for welding. Fluxes should be used sparingly and on the molten metal only where needed. Avoid wasting flux by throwing it carelessly over the metal where not required. Also protect fluxes from the air when not in use, always keeping them in tightly-covered containers.

The composition of the common fluxes is no secret, and many welders have undertaken to compound their own but with unsatisfactory results in the main. Reasons are that flux manufacture is a specialty requiring care in the selection of materials and compounding to secure commercial purity, correct proportions and intimate mixing. A welder rarely has the delicate scales and the mixing machinery required to compound the materials in correct proportions, nor the experience in buying chemicals necessary to secure the quality of goods necessary. The best advice that can be given to a welder in regard to supplies in general is to buy them from concerns that have made a reputation, and to devote his efforts to his own specialty which is welding.

Eye Protection.

Colored glasses in the spectacles and goggles worn by oxy-acetylene welders too often are chosen without due regard to eye comfort and efficiency. Welders sometimes suffer from eye strain because the colored glasses are not fitted to their eyes. The glasses may not shut off the injurious violet rays sufficiently, or they may exclude too much of the light. In one case the welder suffers from glare and in the other he works in semi-darkness. Either condition militates against sound work as the operator is unable to see clearly what he is doing.

A principle to be borne in mind in selecting colored glasses for spectacles or goggles is to get those suited to each individual, which stop off no more of the light rays than absolutely necessary for eye welfare. The welder who can see the puddle and the margins clearly is able to work more surely and with less waste effort than he who sees things indistinctly, and works by feeling rather than by eyesight.

As a rule men of the brunette type having dark eyes require less eye protection than of the blonde type, having gray or blue eyes.

Some Points to be Considered.

When preparing to weld a broken machine member the parts should be lined up and supported so that they will not shift or change their relative positions while the work is in progress. It is usually less tiresome to put small parts on a work bench or other support before which the operator can stand and work with his torch at the waist level than to weld them on the floor.

Never attempt to weld broken parts of a machine in place unless free to change shape. Expansion and subsequent contraction will throw the parts out of line and perhaps break another part of the machine. If machine parts contain bolt holes care should be taken to line the parts up so that when welded the holes will be in the same position as before. It is advisable in such cases to assemble the broken parts and mark off the holes on paper or metal before starting to weld; or a better method is to make a tram and prick-punch the parts while cold to the tram points. When welded and cooled off the tram points should drop into the punch marks as before thus indicating that the overall dimensions have not changed.

Remember that welds should not be made in wrought iron, and steel thicker than ¼ inch without beveling the edges, or in other words, preparing for welding. Beveling may be done mechanically or with the torch by breaking down square corners. If the corners are broken down by the flame the edges should be separated more than when beveled before-hand. Welds in boilers, drums, tanks and all pressure containers should never be undertaken by any but experienced welders, and then only with the consent of the state and local authorities. In all cases it is advisable to consult the engineering department of the Davis-Bournonville Company before undertaking welding of tension parts having a comparatively low safety factor when failure in use might cause loss of life and damage to property.

When cleaning torch tips never use a steel wire which might roughen the sides of the hole. Use a copper or other soft metal wire instead.

Never use the torch head to knock work into position nor use the torch as a lever for any purpose. Gross value like this is the cause of many complaints.

Keep the hose free from kinks and contact with hot metals. Test occasionally while under pressure with soapsuds to discover leaks, or close the needle valves and release the regulator screws. If the working pressure gauge falls off rapidly it betrays a leak. Never continue to use a leaking hose as it is wasteful and dangerous

Always use a sparklighter for igniting the gas in preference to matches or an open flame. Keep tips in a covered container preferably of wood with holes bored for each tip to preserve from injury and dust. Welding rods should be kept in a dry place to protect from rust. A rusty dirty rod is not good for a weld.

Don't throw short pieces of welding rod away. Weld them to a long rod and use up entirely. There is no need of wasting an ounce of any kind of rod.

Progress in Welding.

Welding requires the exercise of physical and mental faculties in a manner and to a degree experienced in few other trades. The mature learner of welding usually acquires considerable ability to manipulate the torch and produce fair welds after four or five days of practice. But later he may find that his skill has deteriorated and that he is not able to do as well as he was at the end of the first week or ten days of training. This is discouraging, and a new operator feels like giving up in disgust. The experience is common, however, to all learners of a new trade; a plotting of an individual's development of skill will almost invariably show a steady rise for the first two weeks and then a sudden dropping off. From the low point the rise in the scale of ability will be gradual but definite, and no recurrence of falling off will be experienced provided the person keeps in practice. Hence the user of the oxy-acetylene welding torch who finds that he cannot do as good work after two weeks of practice as he did in the first week need not feel discouraged.

Grinding and Measuring Involute Gear Tehet

Gear Blank Shape is Important—Advantages of Hardened Gears —Grinding the Teeth — Method of Operation — Centering the Tool — Various Diagrams — Testing the Teeth — Production

* By E. J. LEES

MODERN machines, in which gears are used, are now being equipped with hardened gears. This is especially true of drives that have to carry a large torque load, and of course holds true of the automobile transmission, but it is also true that machine tool makers and other manufacturers of machinery are coming more and more to realize that the present demand in a gear drive is one that will stand up under severe load. Having hard teeth will be more efficient because the hard surfaces of the teeth will transmit power better, and not deform the tooth profile, causing friction, irregular motion and loss of power.

This being the case it is very important that the gear blank be machined very accurately in all the operations, and particularly so when cutting the teeth, because after it is once hardened the outline and size are fixed, and can not then be recut on the gear cutter. And even if the gear has been made correct up to the point of hardening, there is no assurance that the blank will go through this operation and retain the accuracy, because it may swell or shrink, or it may distort from a plane surface, or become oval, or eccentric or cam shaped.

From a paper presented at the annual fall meeting of the Society of Industrial Engineers, Springfield, Mass., Oct. 5-7, 1921. The authors are consulting engineers, Frank B. Gilbreth, Inc., Montclair, N. J.

After the gear is hardened it is necessary to grind the bore and if the gear is distorted it is only possible to chuck it approximately correct, or in other words an average of the errors in the gear and in the pitch circle. And should the machining be correct, and the hardening come out true, or substantially correct, there is still the human judgment operation of rechucking to grind the bore, and this may be incorrectly done. So it is very evident if the teeth on a gear can be ground that this grinding process will eliminate all of the foregoing troubles.

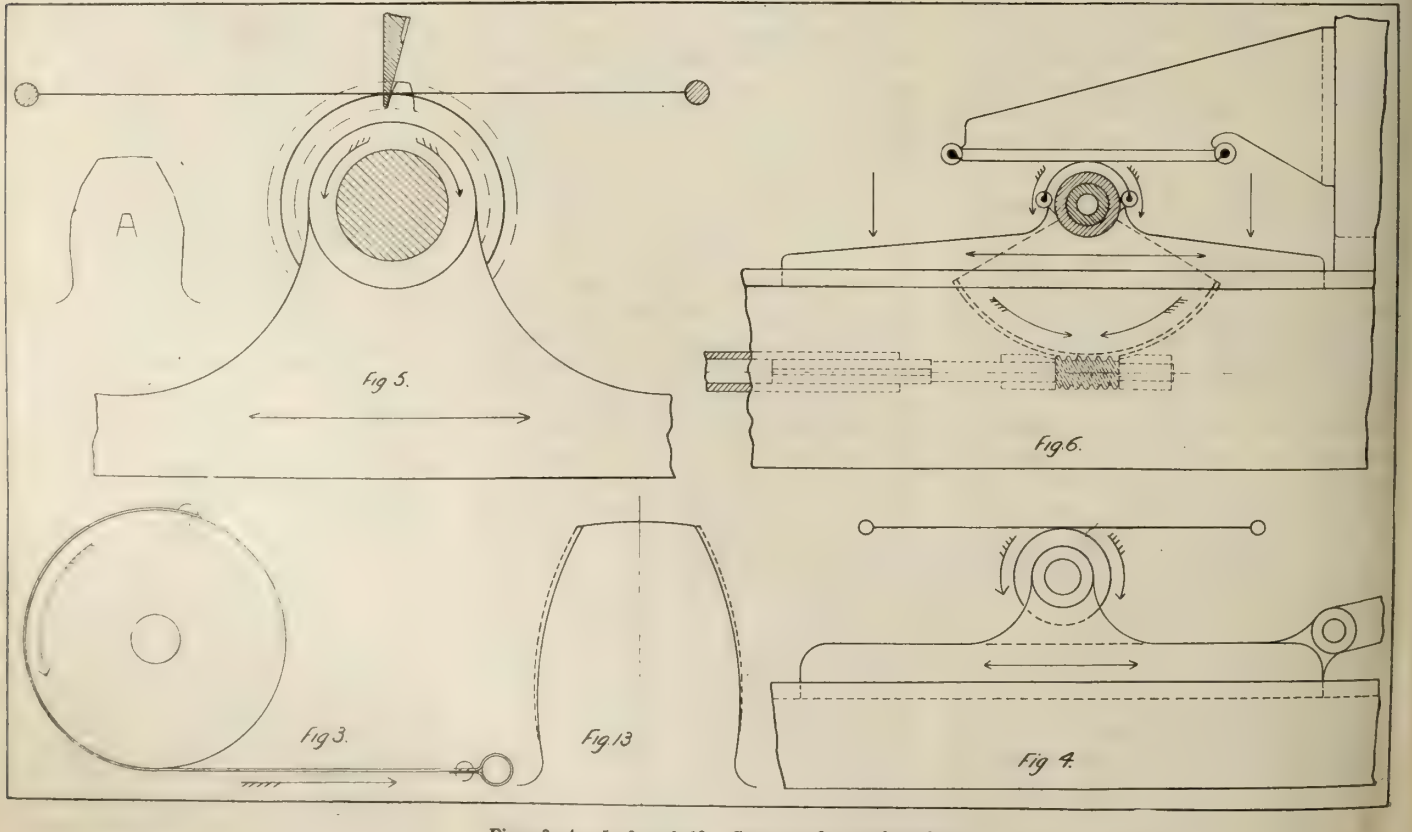
When it is known that the gear is going to be first hardened and then ground, the machining of the teeth is then not important, and only a roughing out is required, also when chucking to grind the hole, great accuracy is not required.

Advantages of Hardened Gears

The advantages of using hardened and ground gears are that no matter how irregular the blank was before, or after hardening, it can be corrected by grinding. That as the bore is the first part of the gear to be ground, all other grinding operations are then controlled from the bore and will be true and concentric with it. That the teeth can be ground very accurately and held to very close limits, as this is the final work on the gear. And last the smoothness and correct action of the teeth result in a gear, that is not only efficient but quiet.

We now come to the real problem, which is to construct a gear grinder that will first grind the face of the teeth smooth; second, grind this face in a true involute, or modification thereof, and third index the gear to insure correct spacing of the teeth, as well as operate rapidly and easily and be capable of ready adjustment. Such a machine is now in actual use in one of our largest automobile plants, and in the matter to follow I shall describe and relate some of the remarkable results obtained by it.

Before going into the details of construction attention is directed to Fig. 1 which shows the machine at an angle from the front. This machine is known as the Lees-Bradner No. 10 gear tooth grinder. Based on the involute system



Figs. 3, 4, 5, 6 and 13. See text for explanation.

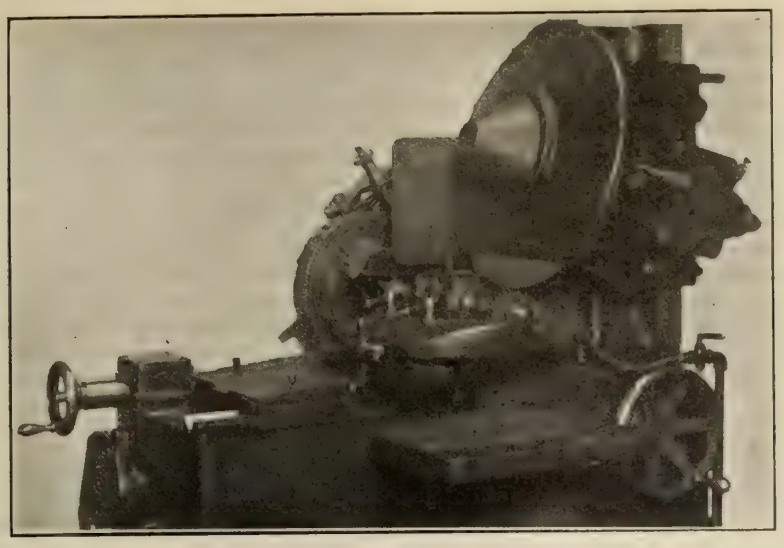


Fig. 1.—General view of machine.

it is possible to grind spur gears from 14½ to 24 degrees angle of pressure; any pitch from 12 to 3 diametral pitch; and from 2″ to 12″ pitch diameter. An emery wheel of 30″ diameter with a planular grinding face is used. The wheel is supported on a stationary column, and the work is travelled past the wheel by a slide having a reciprocating action. The work is given a rotary together with a correct sliding motion, in order to obtain the desired profile action, relative to the plane face of the wheel. A segment equal to the pitch diameter of the gear to be ground is used in conjunction with tapes or bands to obtain this combined sliding and rolling action. These segments can be modified in various ways to obtain any desired change in tooth profile.

A diamond is used to true the face of the emery wheel. This diamond is both lever and screw controlled, and of course travels in a plane line to keep the plane face of the emery wheel true, it is used in conjunction with the emery wheel micrometer feed. The drive to the wheel is by an endless belt, self contained on the machine. This belt is guided by two idler pulleys which are carried in a bracket, with sliding adjustment on the back of the column, to suit any diameter of gear being ground. A single belt is used to drive the machine from a line shaft, but a motor drive may be substituted. The indexing is by means of hardened and ground plates, secured to the work spindle and completely shielded inside a case. The indexing is automatic and takes place at one end of the slide reciprocation.

Setting the wheel at the proper angle is accomplished by means of a worm and segment on the swivel head. There is a pump and connections for supplying the coolant. The work can be held between centres, or supported on a mandrel having a taper shank to fit the spindle and supported at the outer end by the tailstock. To grind an involute tooth profile correctly with the above type of machine, it is necessary that the gear blank and grinding wheel have perfect co-acting motion of generation.

Why is it so difficult to accomplish the perfect generation of a gear tooth on any type of machine? The answer is that ordinary mechanisms do not obtain an absolutely uniform unbroken velocity ratio between the tool and the blank. Any irregularity in this motion generates a broken or incorrect profile. In all machines which generate with a tool that must be centered there is always the chance of error and producing what might be called a ratchet or lopsided gear. Also any tool which has a lapsed intermission in its generating action can not of necessity make a perfectly smooth profile but only an approximate outline composed of small irregularities or waves. So we have three important conditions that are necessary to generate a perfect involute:

1st—the uniform motion between the tool and blank. 2nd—elimination of centering the tool and blank. 3rd—continuity of action between the tool and the gear tooth profile.

Fig. 2 shows two discs in rolling position. We can conceive of their being made so accurate that their rotating motion and velocity would be nearly perfect and much more accurate than gears. Fig. 3 shows one disc and a tape attached for converting sliding motion into rotary motion This, it will readily be seen, is a much smoother and uniform motion than making the conversion by other means such as a rack and gear. Therefore a disc or segment and a tape are probably the most accurate method of obtaining a correct rotating and sliding connection. The use of tapes and segments is old, but they have been used as shown in Fig. 4, where the power is applied to the work slide as reciprocating action and this reciprocating action is transferred into rotary motion of the work spindle by the tapes. Now the weak point in this construction is that under ordinary conditions and care of the average operator, the bearings may not be perfect as to diameter fits, or end thrust tension adjustment, and these conditions coupled with the fact that a tape has more or less flexibility, will result in an error of irregular transmission of motion in a retarded and accelerated form, which will produce a profile having flats or other imperfections on the gear tooth being ground, such as is shown exaggerated in diagram outline to illustrate the result, (see Fig. 5) tooth A. The solution of this problem is as follows:

The power is not applied to the work slide but to a sleeve through which the work spindle rotates when indexing. When the machine is grinding, the sleeve and work spindle rotate together as one unit. The sleeve carries the segment to which one end of each of the tapes is fastened. The other ends are fastened to a bracket on the column, accordingly when the sleeve is rotated first in one direction and then in the reversed direction the tapes will wind on and unwind from the segment and thus through their pulling action on the bracket, cause the work slide to reciprocate. This is shown in Fig. 6, and it is very apparent from this diagram that there is a uniform torque load to the work spindle by a worm and wheel whose primary function is to rotate the sleeve in reversed directions, also that there is uniform load on the tapes due to the fact that the frictional resistance of the work slide on the ways is maintained constant by gravity only, and does not depend on a take up by clamps or gibs which might vary in resistance.

The smoothness of the worm wheel driven sleeve and work spindle, and the accurate travel of the work slide are utilized. It is almost inconceivable how easily and accurately these two elements co-operate while the grinding is in operation.

The problem of centering the tool and blank is done away with by the fact that an emery wheel with a plane surface is used when generating, as illustrated at Fig. 7. This plane face also has continuity of action with the profile of the gear tooth, and must not be confused with a cone shaped wheel which necessitates a compound movement of work and tool in two directions, that is, a generating rolling action, and a cross travel to make the small intersection of wheel and profile cover intermittently the width of the tooth.

Operating Machine

The operation of the machine is as follows: A segment equal to the pitch diameter of the gear to be ground is located on the work spindle. The emery wheel is set at the pressure angle of the tooth to be ground. The head carrying the wheel is raised to the correct height so that the wheel will cover the working depth of the tooth. The wheel is dressed using a micrometer adjustment. The wheel is then moved to the starting position by a micrometer handwheel and there are two positive stop pins located in a circular T slot. These are used in conjunction with a positive stop to locate the wheel in a start and finish position. There is also an intermediate spring stop for the roughing cut. The starting stop is usually set to grind .004″ from the tooth.

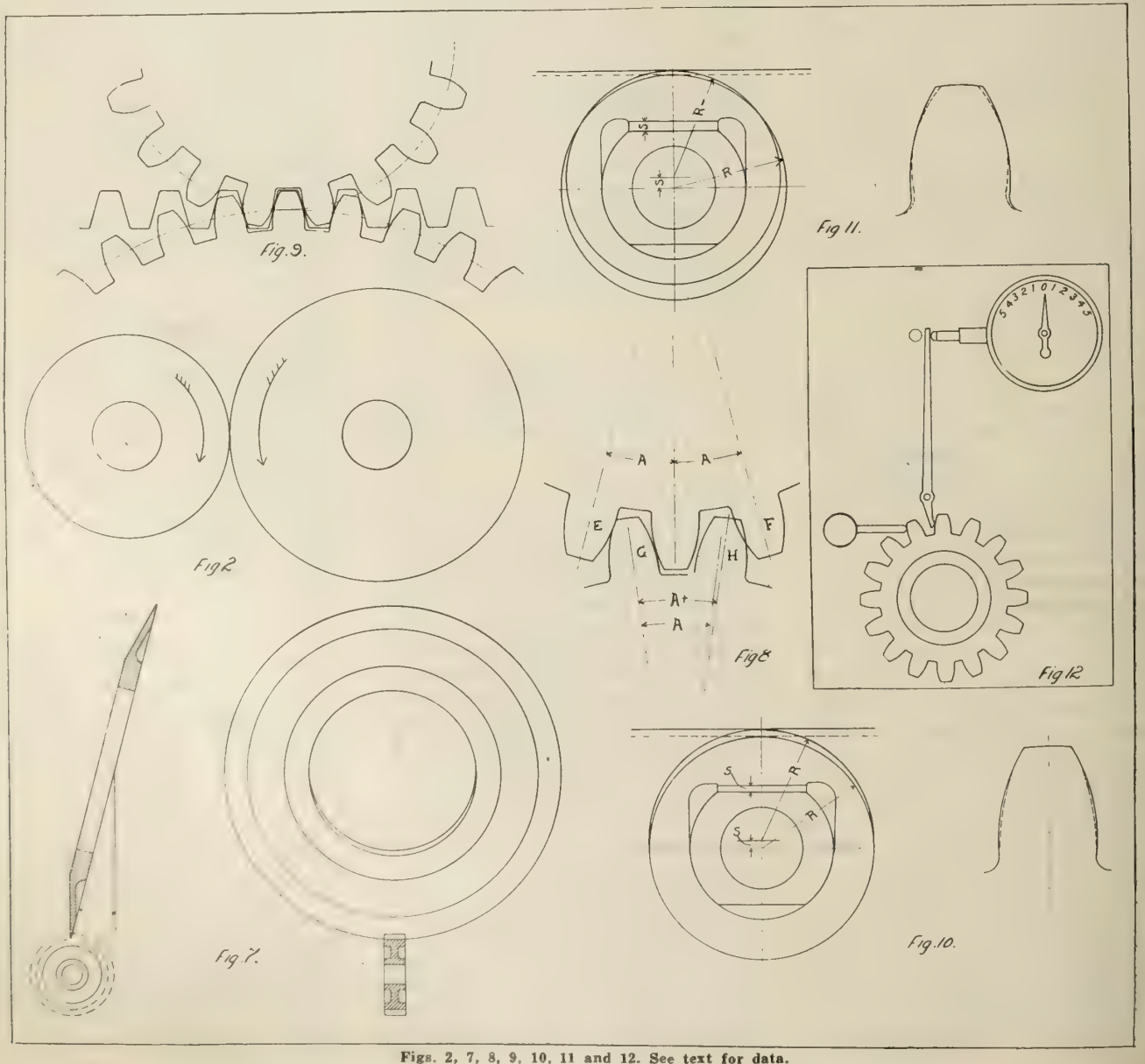
The gear to be ground is then locked on the work arbor with a tooth in contact with the emery wheel face. The machine is started up and the roughing cut is taken, located by a spring stop usually cutting .003″ from the teeth once around, then the micrometer is fed up. .001″ more to the finish stop being the .004″ allowed for grinding. This brings the wheel back again into the generating plane and the same position in which it was dressed. When the wheel needs to be dressed again, which is usually every other gear, then .0004″ is taken off the face. This is accomplished by an independent feed to the micrometer so that the stops for starting and finishing do not have to be disturbed.

There is a notched disc and a lever pawl, releasing this pawl allows the wheel to be fed up 2/10,000 inch for each notch so that usually two notches are used to bring the wheel against the diamond the average cut of 4/10,000 inch. The indexing of a gear is a very important factor in obtaing quiet running gears. The index plates used are hardened and ground and the error is very slight as the masters from which these plates are ground are made by the Warner & Swasey Co., who are said to have the most accurate indexing machine in existence today.

Fig. 8 shows in diagram from how an incorrectly indexed pair of gears can not mesh correctly. It is very apparent that the teeth G and H can not come correctly into mesh with E and F and must at this point crowd the centres apart and cause an eccentric noise. Poor indexing may be mistaken for eccentricity or incorrect tooth profile, for under the ordinary methods of testing gears such as rolling them together or using spring centres the resultant effect seems to be the same and oftentimes is very misleading.

The accuracy obtained from this gear tooth grinder calls for a different procedure in the testing of the teeth both for profile and spacing, and since a perfect involute can be ground not to vary more than 1/10,000″, it becomes only necessary to know whether the gears are perfect or not. To do this, a profile testing machine such as shown in Fig. 9 is used. The principle of this machine is that a point unwound from a base circle which is concentric with the gear will trace the involute profile of the tooth. Another method of testing the profile is by using the basic principle that a rack will mesh with a gear of any number of teeth of the same pitch this is shown in a diagram form in Fig. 9.

So far it has been assumed that perfect profiles were required, but we all know that gears are not always used in perfect machines with perfect alignment and center distance, or have other inaccuracies, and in this case the gears may have to be modified or in other words the profile changed to suit local conditions. It has been proved that the variation of the profile of the teeth will cause the gears to "whine" or "hum" or "growl", etc. or run quiet if the correct outline required is found. As an example a certain gear may require a perfect involute and the mating gear



Figs. 2, 7, 8, 9, 10, 11 and 12. See text for data.

a modification of 1 to 2 ten thousandths and a variation from these profiles of .0004″ will cause noise. This being so the following method of procedure has been followed with good results. When modified gear teeth are found necessary a charted record may be kept and after testing with the machine they are ground accordingly. Another way is to keep a master gear which by actual running test has proved quiet, then when grinding use this master on the tester first and by inspection notice the reading of the curve and grind to suit the same reading.

In automobile transmission with correct center distances and parallel shafts very little modification is needed judging from the tests made up to the present . As stated before the modification of profile is made by changing the segments as follows: If the segment is made the same diameter as the pitch circle of the gear to be ground and is then raised by shims as described, then the tooth profile will be generated as shown in Fig. 10, modified at the pitch line, and dying out at the top and bottom. If a smaller segment than the pitch circle of the gear to be ground is used and raised up by shims then the profile will be generated as shown at Fig. 11, modified both top and bottom and dying out at the pitch line.

Measuring Gear Teeth

The method of measuring the gear teeth for index is shown at Fig. 12. The gear is placed on the stud and a tooth turned against a positive stop in X and the indicator is set at zero. Now the gear is indicated tooth by tooth and if the reading remains at zero each time the gear is perfect. The errors are recorded plus or minus by the indicator for angular error in 1/10,000″. The surface of the profile of gear teeth is very important and should be of such a nature that any small imperfection in this profile will under load tend to disappear.

When machining the teeth in the blank to allow for grinding, the best outline to make is as shown in Fig. 13. This it will be noticed, shows the finished tooth in solid lines and the allowance for grinding in dotted lines, and by cutting the allowance almost down to nothing at the root of the tooth, also cutting the full depth of tooth allows good clearance for the wheel and a minimum of metal to be ground. A gear hobber is ideal for cutting the teeth as outlined above, because the principle of hobbing uses the same basic involute system by using a rack form of cutter teeth, the same principle as the grinder uses with the plane face, and as a single cut through the blank is sufficient there is a saving of the time of the finish cut and this time can be applied to the grinding time. However, if other types of machines are in use to rough the blank they can be used with the above slight change in the cutter outline to give a profile to allow finish for grinding. The production obtained from this machine with a 24 inch wheel is as follows: Actual grinding time on the in and out movement of gear including indexing to next tooth on a 6 pitch 31 tooth gear is 10 seconds per tooth or a little over five minutes around the gear removing .003″ on the rough grind and .001″ on the finish grind. Total 11 minutes, loading and unloading time 2 minutes, averaging 30 gears per day of 9 hours.

The life of a wheel is as follows: This is an actual report of a wheel used from March 29th, 1921, to May 12th, 1921. Wheel was a Norton 6636 combination grade "K". This was used down to 21-½″ diameter, and ground 1641 sixteen tooth gears twice around each gear, also did some other grinding making the number about 2000 gears and it is estimated has enough life left in it to grind 500 to 800 of the 31 tooth gears, so on an average the wheels will probably grind 2500 gears.

RECOOLING OIL

(Continued from page 39)

pleting the circuit. The quantity of heat absorbed by the cooling water is 257,897 B. t. u. per hr. The quantity of heat given up by the oil is 269,914 B. t.u. per hr., and of this total amount, part is absorbed by the water in the cooler, and the remainder, 12,017 b. t. u. is dissipated by radiation from the surface of the cooler, piping and oil tank. In this installation, the cooling water was purchased at a cost of 30 cents per 1,000 cu. ft. The total cost therefore of cooling the quenching oil per day of 10 hrs. was 31 cents. The dimensions of the cooler in this plant are as follows:—

Overall length 64½ in; oil inlet and outlet diameters 3½ in; water inlet and outlet diameters 2½ in; largest diameter of flanges 60¼ in; distance from back of feet to face of flanges 21 ¼ in; diameter of shell 14 in; and weight of cooler 1,000 lbs.

The heat surrendered by 1 lb. of steel during quenching as for example, from 1,550 deg. to 150 deg. F., can readily be determined by means of Fig. 5. Enter the the vertical axis at the left at 1,550, proceed horizontally to the right to this point intersection with the curve, thence vertically downward to the horizontal axis. The point of intersection with this axis is 256 B. t. u. Likewise, entering the vertical axis at 150 deg. F., and proceeding 1,200 F. a test piece of low carbon as above, the point of intersection with the horizontal axis is 16 B. t. u. 256-16=240 B. t. u., or the heat that is surrendered by 1 lb. of steel during cooling from 1,550 deg. to 150 deg. F., and that must be extracted from the oil by the cooling system. General practice is to specify 1 gallon of oil for every pound of steel quenched per hr.

If we assume a specific heat of oil equal to 0.487 b. t. u. per lb. per 1 deg. F. and a density of 7.25 lbs. per gal. which is correct for Houghton's No. 2 soluble quenching oil, the temperature rise produced in 1 gal. of this oil by 1 lb. of steel heated to 1,550 deg. and quenched to 150 deg.=

$$\frac{240}{1 \times 0.487 \times 7.25} = 68 \text{ deg. F.}$$

In other words, if the initial temperature of the 1 gal. of oil is 80 deg. F., it will be increased to about 148 deg. F. during the quenching.

If the 3,000 gal. of oil are to be circulated per hr. through the cooler, the oil circulation per min. is 362.5 lbs. If a water-to oil ratio of unity is chosen, that is, if the same weight of oil is circulated per min. through the cooler as weight of water, we can find, by means of Fig. 6, the temperature drop of the oil circulated through the cooler. To do this, enter the horizontal axis at 362.5, proceed vertically upward to the point of intersection with the 1-to-1 ratio curve, then horizontally to the left to the point of intersection with the vertical temperature drop axis. The temperature drop is seen to be about 20.5 deg. F. For 2 to 1, 4 to 1 and 6 to 1 water ratios, the temperature drops are 24, 26.5, and 27.5 deg. F. respectively. Thus, beyond a certain point, increase in the quantity of circulating water does not produce a proportionate temperature drop in the oil.

Fig. 7 gives the heat transfer rates (in b. t. u. per hr. per sq. ft. of heating surface per 1 deg. F. mean temperature difference between oil and water), corrected for oil viscosities corresponding to different oil and water velocities expressed in inches per second. For example, given a water velocity of 25.5 in. per sec., and an oil velocity of 24 in. per sec., the viscosity of the oil being 100 Saybolt seconds, the correct heat transfer rate is determined as follows: Enter the horizontal axis of left chart at 25.5, preceed vertically to the curve corresponding to an oil velocity of 24 in. per sec., thence horizontally to the right to the curve corresponding to an oil viscosity of 100 Saybolt seconds, thence vertically downward to the point of intersection on the horizontal axis. This gives 77 b. t. u. as the heat transfer rate corrected for viscosity under the given conditions.

BOLTS AND NUTS

A recent investigation into the fit of commercial bolts and nuts, carried out for the British Engineering Standards Association by the National Physical Laboratory, has shown that a considerable proportion of the tolerances allowed on the effective diameters is virtually absorbed by defects of thread form and pitch. With the quality of thread form at present found in commercial screws, nuts and bolts are not by any means interchangeable, although they may be wholly inside their respective tolerances on effective diameter as measured in the usual way.



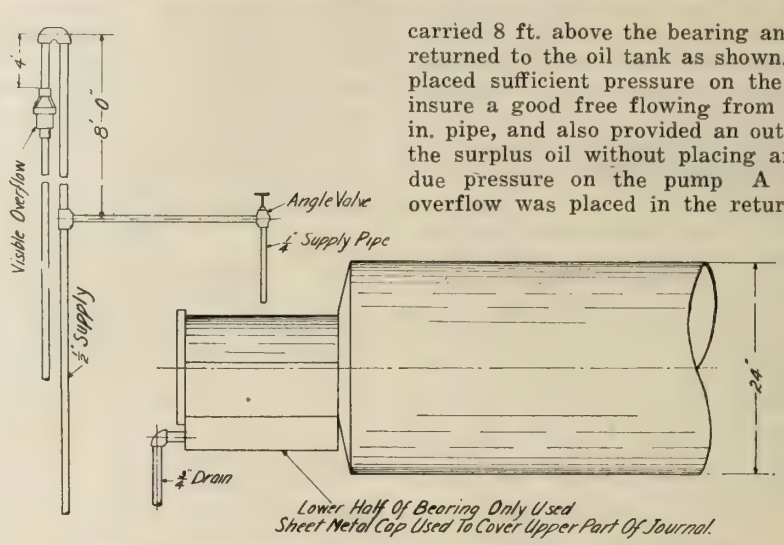
WHAT OUR READERS THINK AND DO



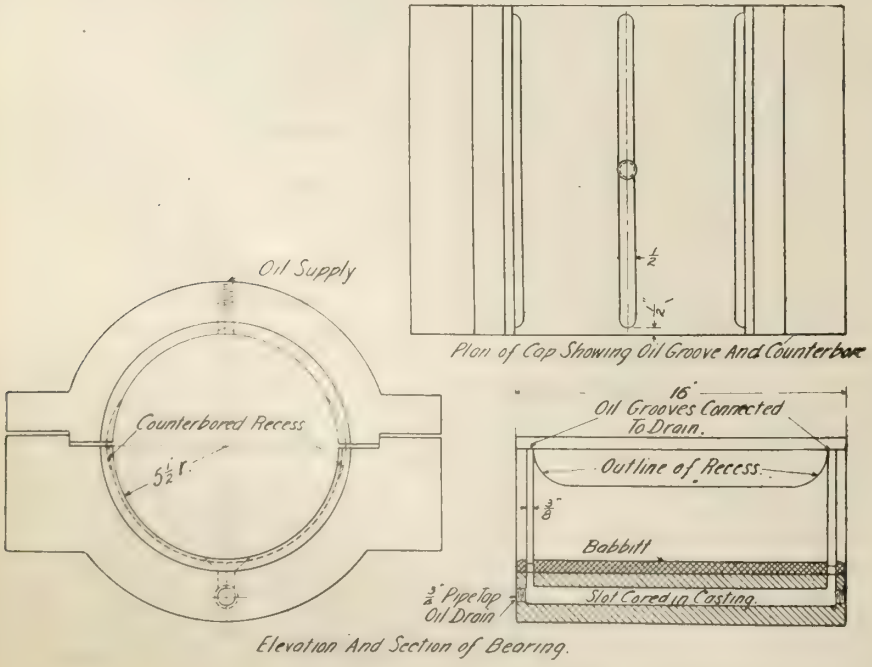
SIMPLE METHOD OF LUBRICATING BEARINGS

After experimenting with various types of bearings, the one which I have shown in the sketches accompanying this article proved most successful. This bearing had to endure a dead load of approximately 150 lbs. per sq. in. projected area and a rubbing velocity of about 6 ft. per min. The bearing was also subjected to considerable heat and had to run hot under the best of conditions. The oil ring type of bearing did not prove at all successful as the oil film was continually breaking down to the slow rubbing speed and the comparative high unit pressure for that speed. The result was a metal to metal contact most of the time as the rings running at such a slow speed could not bring up enough oil to renew the film in the bearing.

A plain babbitted water cooled bearing was next tried and, although giving better results as regards wear on the bearing surfaces, it was very wasteful of oil and required considerable attention. The type of bearing shown in the sketch was then designed and proved very successful. It consisted of a plain babbitted bearing with two oil grooves, and a positive, continuous, adjustable oil supply system. The oil reservoir consisted of a tank of about 30 gallons capacity placed far enough below the bearing to allow the oil to drain back into it from the bearing by gravity. A small rotary pump was placed in the oil tank and driven by a chain from a convenient shaft at about 125 R.P.M. A ½ in. supply pipe was used and reduced to ¼ in. over the bearing. This ¼ in. pipe was equipped with an angle valve so that the flow of oil in the bearing could be regulated. The supply pipe was carried 8 ft. above the bearing and then returned to the oil tank as shown. This placed sufficient pressure on the oil to insure a good free flowing from the ¼ in. pipe, and also provided an outlet for the surplus oil without placing any undue pressure on the pump A visible overflow was placed in the return pipe about 4 in. from the upper extremity. This served as an indicator to see if the oil was flowing freely and prevented the oil being siphoned out of the supply pipe thus leaving the bearing without oil. As the load on the bearing was constant and always in the same direction, the upper part of the box was not used and the exposed journal was covered by a special sheet metal cap to keep dust and grit from the oil and rubbing surfaces. The design of the cap intended to have been used is shown in the detail sketch of the complete bearing. The temperature of the oil used in this system rose to about 40 to 50 degrees above the room temperature and remained fairly constant within these limits. A good quality free flowing light machine oil was used and the temperature rise was not sufficient to cause a break down of the oil film due to decreased viscosity resulting from the increase in temperature.



Sketch is self-explanatory. Shows how bearing is lubricated.



Elevation and section of bearing used.

The oil grooving in the bearing was so designed that the oil would be introduced at a point where the forces acting tend to separate the shaft and the box. At this point a groove was cut in the surface of the box so as to distribute the lubricant evenly over the entire surface of the journal. Having been so introduced it was expected that the oil would adhere to the journal and be carried around to the point where it is pressed against the box with the greatest force, thus forming the lubricating film which separates the rubbing surfaces. As few oil grooves as possible were cut. One at the top of the cap to distribute the oil

over the bearing, and one on each side of the lower half of the box to collect the oil, which would otherwise run out of the ends of the bearing, and cause it to flow by gravity into the lower part of the bearing where the oil grooves are connected to the hole in the box and from which it is conducted by a ¾ in. pipe back to the supply tank where it is strained and used over and over again. In order not to have the oil wiped off the journal before it reached the point for which it was intended, the sharp edges of the box were recessed or counterbored as shown in the sketch.

The upper extremity of this counterbore was connected with the oil grooves at the side so that any surplus of oil would flow into these grooves and back to the tank. The oiling system and bearing just described is simple in construction. The oiling is positive in action and can only fail from the pump breaking down or wearing out and a spare pump should always be kept on hand to meet such an emergency. The bearing has given much better service than those of a more complicated type.

Editor's Note—Who wrote this article? We have by some means or other lost the author's name and address.

CHART FOR PIPING

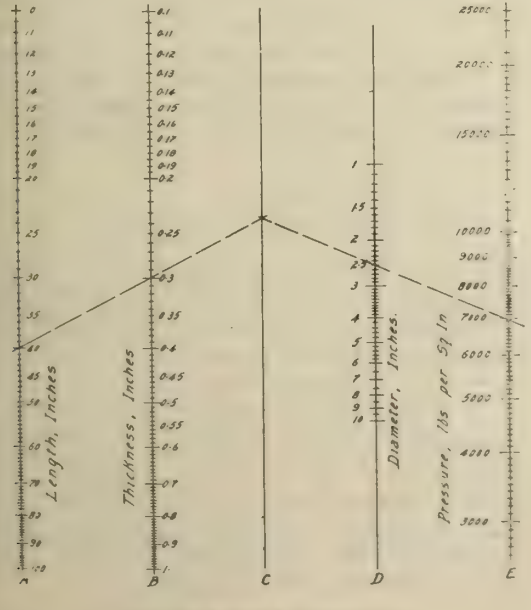
W. F. Schaphorst

The chart shown in the accompany illustration is one which is based on the formula that

$$P = 9{,}600{,}000 \frac{T^{2.18}}{LD}$$

where P=the collapsible pressure in lbs. per sq. in.
T=thickness of metal in inches.
L=length of pipe in inches.
D=outside diameter of pipe in inches.

The chart is intended for solving piping problems without need of calculations, by the simple use of a straight edge as shown by the dotted lines.



This chart should prove useful.

Example — What external pressure will a 2.5 inch pipe safely with stand whose length is 40 inches and the thickness is 0.3 inch?

Run a straight line through 40 (col. A) and the 0.3 (col. B) and locate the intersection on Col. C. From this intersection run a straight line through 2.5 (col. D) and the intersection with col. E gives the result. In this case, 6950 lbs. per sq. in. The chart can be used to obtain any of the other factors by simply reversing the process.

PECULIAR GEAR ARRANGEMENT

In the Oct. 20th issue, we showed an interesting example of gearing, as applied to a "Quilt Stitching Machine." It was not our intention at that time to compare the method of making this gear arrangement, but rather to point out an unusual application.

Mr. Chester B. Hamilton, Jr., of the Hamilton Gear & Machine Co., Toronto, noticed the article and has written us a very interesting letter in which he points out that this work could have been accomplished in a more economical manner by means of a gear cutting machine. As he says, "The gear arrangement is composed of portions of external and internal ring gears, which are connected by tangent racks. The only place where a commercial gear cutting machine would be struck would be on a job involving spiral or progressive curves of changing radius."

This brings up an interesting point, viz, how will further machines of this nature be made? While the present pattern may suffice for a time, the period will come when a decision will have to be made between the cast and machine cut tooth method, and of course there is no question about which would make the most satisfactory job. If gear cutting machine manufacturers care to prove their cost figures, there is no reason why machine methods should not be adopted.

FLOATING REAMER HOLDER

By Harry Moore

The holder shown in sketch will hold four different sizes of reamers with a floating effect which is often so much desired. At the same time it does away with the necessity for drilling the shanks of reamers and driving a pin in each one. Part A is slotted across the face to take the circular holder B, which has four holes drilled in its periphery to take the reamer shanks, and is tapped at the top in the center of each hole for a tightening screw C.

A pin D is driven tight into B, but is a loose fit in the hole A, and, with the width of B, less than the width of slot in A, the reamer is allowed to "float" accommodating itself to any inaccuracy that may be present in the machine. Four shallow holes drilled in line with the tapped holes in B, and a knurled head pin fitting hole in A, serves to keep the holder from flopping about as the turret is turned.

ERRATA

Last week we published an article on "Ball Bearings as Adapted to Grinders." This should have been credited to Gordon Janes, and not Donald A. Hampson. Mr. Janes is manager of the Toronto office of the S. K. F. Ball Bearing Co., and it was through his courtesy that the material was printed.

Several oil manufacturers have contributed samples of their products for experimental material, specimen automobile and tractor motors of different makes and types have been obtained from manufacturers, and the various kinds of oil will be subjected to a practical test in these engines. Before and after the oils are used the chemical engineering department will make various tests to ascertain the physical and chemical qualities, and to determine the relation between the laboratory tests and the actual value of the oil.

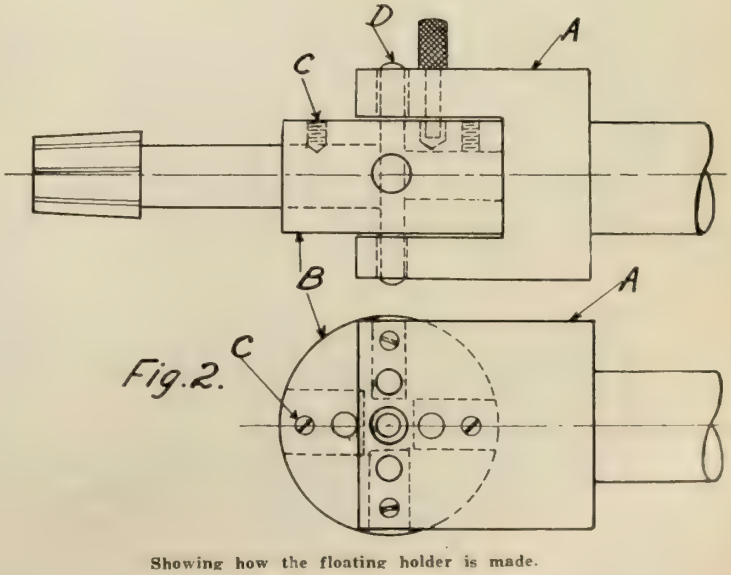


Fig. 2.

Showing how the floating holder is made.



A Novel Departure In Design

A. F. OSTERLIND and F. C. Damn, both of St. Paul, Minn., have replaced the complicated and bulky type-setting machines, which have long been characteristic features of the modern printing plant, with a machine that startles one with its absolute simplicity. We learn, says "Scientific American," that the two inventors had been working along the same general lines for many years, but it only required the meeting of these two minds and the exchanging of their ideas some two years ago to bring about this new conception in type-setting machinery. The new machine is a matrix-setting line-casting device, containing many features not heretofore attained by other machines of like nature, so claim the inventors. The line is assembled the same, but when assembled the operator touches a key and the line automatically passes directly into the jaw, in position for casting. Each line is followed by a master matrix which holds the succeeding line. There is no elevator to wait for, nor are there any return stops or springs, all of these annoying features being discarded entirely, and the line when cast is ejected by means of the liner which is a part of the mold. The length of the line is determined by a dial that can be set in less time than it takes to tell it—varying from 2 ems to 38 ems in length, and from 5 point to 42 point in thickness. The machine especially intended for the large display types of advertising composition, has a range from 42 point to 102 point.

The magazines, of which there are six, are shifted to position simply by operating the small lever up or down, the movement being about one inch for each change. There are no cranks or wheels to turn—each movement is positive and accurate and made instantly.

The metal pot holds 100 pounds of metal. The well is separate from the main pot, though heated by the same flame. The mouthpiece and throat are easily accessible by means of a very ingenious method, making cleaning a matter of minutes rather than hours and no special saws, brushes, drills or tools are necessary. The slugs cast by the machine are solid top and bottom, supported in the center by a solid support. The new machine is claimed to be unequalled in the matter of speed, due to the simplified mechanism. Only one-half as many parts are needed in this design, as compared with the usual type-setting machines.

The True Value of Work

SPEAKING ON "Work" the college paper, "The Varsity," gets away with these choice and true remarks:

After all, why should we work? Why spoil one's College course by going to lectures, and by plugging hour after hour at the writings of men who are dead and gone—we know where we should have sent them—when there are so many othr activities that claim one's attention and interest? What's the use of it, when we know that a kind-hearted Providence has endowed one with brains enough to get over the year's work in the last six weeks and still get a very respectable third, or even a second? How often we reason thus, not so much at this time of year as later in the session. How ready we are to accept the old interpretation of the Genesis story and believe that Work was sent as a punishment for man's sin and that Heaven is a state of rest in which our tasks are all done and done with. It is well that at the outset of our year we should realize the fallacy of this view of Work. The Pauline dictum, "Let this be known among you, that if any man will not work neither shall he eat," is not only sound theology, but is also sound economics. Work is not an imposition, but a duty and a privilege, and the man who does not appreciate the fact that without real work his personality cannot gain full play, is indeed unfortunate. It is all right to work for a degree. It is better to work for the knowledge gained, but above all it is good to work for work's sake. The greatest happiness is the knowledge of a congenial and useful task well done and the prospect of another to be done.

Straightening Malleable Castings

TO STRAIGHTEN a malleable casting with the least risk of breakage, comments "Mechanical World," the necessary force should be applied gradually by means of a screw press or other similar arrangement, and the work should always be done cold. If, however, the casting is too short or rigid, it may be heated; but in no case should it be allowed to get more than "blood red," or the nature of the iron will be completely changed; and if it is allowed to reach a bright heat it will be "red-short." After heating and straightening, the casting should be buried in ashes and left to cool down gradually. Neglect of this latter precaution will lead to subsequent trouble in the machine shops, owing to the exterior of the iron becoming chilled and hardened beyond the reach of anything but the finest high-speed tool steel.

Atmospheric Corrosion

THE Committee on Corrosion of Iron and Steel of the American Society for Testing Materials reports that tests which have been in progress for five years in the Pittsburgh district on uncoated metal sheets are nearing completion and have now reached the point where the committee definitely concludes that "copper-bearing metal shows marked superiority in rust-resisting properties as compared to non-copper-bearing metal of substantially the same general composition from which superiority we may truly anticipate a marked increase in the service life of copper-bearing metals under atmospheric exposure of uncoated sheets." Other corrosion tests are being conducted in different parts of the country, and before very long a final report may be expected in which results of importance will be stated.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Several contestants submitted correct answers this week and as there was nobody correct the previous week, two scales are being given for the Oct. 13th list. Following is the way in which the correct lists were eliminated: F. Kane, Lachine, Quebec; John Strain, London, Ont.; L. T. Churchill, Calgary, Alta.; Nelson Ryder, Hamilton; F. L. Walsh, Sydney, N.S.; M. L. Thompson, Kingston, Ont., and J. McCampbell, Thessalon, Ont. The first two names mentioned receive the scales.

CONTEST FOR NOVEMBER 3rd ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—How to face the bottom of a hole.
2—Something that is oil and grease proof.
3—How to cut and draw at the same time.
4—Something that was originated 29 years ago.
5—How to eliminate certain troubles.
6—Something that overcomes wear.
7—Good advice.
8—Something designed primarily for one purpose, but adaptable to other machines.
9—A product that is completely guarded.
10—Something light, but strong in power.
11—How to get the advantage of 60 years' experience.
12—Something that is properly proportioned.

These are Correct Answers for List from October 13th Issue

1—The Charles Parker Co.
2—The L. S. Starrett Co.
3—Duncan Stewart & Co.
4—Canadian Fairbanks-Morse Co.
5—Crane, Limited.
6—Simonds Canada Saw Co.
7—Nicholson File Co.
8—Northern Electric Co.
9—Oakley Chemical Co.
10—Geometric Tool Co.
11—Bilton Machine Tool Co.
12—Wright Manufacturing Co.

Closing Date for This Contest is Nov. 24th



DEVELOPMENTS IN SHOP EQUIPMENT



STICKING MACHINE

Mr. R. S. Griffith has received the agency for Vickers Limited, London, Eng., and recently opened up a Canadian Sales Office at 371 St. James St., Montreal, and has on exhibition in the warerooms adjoining his office a representative range of book-binding, stitching, and box making machinery, binding machines, cutting, scoring and grooving machines, which save 25 per cent on glue, as well as several small oil engines, and small products of the Vockers plant, such as machine shop small tools, rifles, etc. They have on exhibition the variable feed straight and cross stitching power machine, the fixed feed corner wire stitching machine, and the nailing, stitching, and cleat stitching machine. The variable feed straight and cross stitching machine is provided in two models, one designed exclusively for making up card board boxes, and the other for the printing trade. The former machines use round or flat wire and form stitches parallel to the corner of the box. The mechanism of the machine is mounted in a "T" shaped casting, bolted to the pedestal, one end of the "T" carrying the stitching head and the other the driving gear and pulley. The steel driving shaft is carried in gun metal bearings and transmits the power from the driving gear to the stiching head. A silent one revolution spring clutch is operated between the driving pulley and driving shaft. The pulley runs continuously and is connected to, and disconnected from the driving shaft through the medium of this clutch operated by a foot pedal mounted on the base. This foot pedal is provided with a safety catch to prevent accidental depression and any number of stitches can be taken, that is, one at a time, two at a time, or continuous! Perhaps the point that is the most interesting is the fact that the adjustment for thickness of work is made at a single operation, without the use of a scale or rule or any reference to the thickness of the work in terms of dimensions. Two caliper stops are provided, one fixed on the head casting, and one moving with the top of the anvil. In adjusting the thickness it is only necessary for the operator to place a specimen of the work between these stops and raise or lower the anvil by means of a handscrew until the stop bites the work with an easy grip. The anvil is then clamped in position. With this setting other adjustments are automatically made without thought or action on the part of the operator. The length of wire for the stitch the length of feed for the wire, the length of stroke for the machine, and the timing of the cut-off will all be found correct. Thus, whatever the thickness of the work within the limits of the machine, it will be tightly and securely stitched, the extremities of the wire which go to form the clinch being of constant length for all thicknesses.

No feed wheels are used, the feed being by means of two sliding grippers which ensure a positive feed. The wire is fed around a flat spring guide, which compensates for any slight irregularity in unwinding the spool. The feeding mechanism is operated by a cam movement, the length of stroke being automatically adjusted as mentioned above. Means are provided for throwing the feed mechanism out of gear instantly, so that the machine can be run without wire, to see that all working parts are running correctly. The maximum time is allowed for the feed owing to the fact that the feed for each stitch is taking place while the previous stitch is being driven. Special wire guides are provided to ensure entire reliability in the case of the longer feeds.

All component parts of both stitching and driving mechanisms are made of substantial sections and sizes, to avoid breakdowns. The working surfaces are hardened so that the user of the machine can rely upon long life, and freedom from breakage. The knives and cutting tubes can be repeatedly ground up and easily reset, and thus no part need be discarded until thoroughly worn out. The various operations going to complete the stitch take place in sequence, both in the up and in the down stroke. There is no idle period in the complete cycle. In consequence, the maximum time is given to each function, thereby avoiding harsh and hammerlike action, and also giving a steady and even torque on the driving shaft.

The machine is built to withstand hard work and rough usage, and it is claimed that the chances of breakdown are very slight. All working parts are standardized and numbered, and interchangeable replacements may be obtained from stock by return of post. Though the machine will work smaller sizes than that for which it is built, perfect work cannot be guaranteed if this is done, and owners of machines are therefore recommended to use wire supplied by the manufacturer of the size for which the machine is fitted.

PISTON GRINDING ATTACHMENT

The Norton Company of Worcester. Mass., have just brought out a new universal piston grinding attachment. This is supplied as regular equipment with their autopart regrinding machine, which is a tool designed primarily for automobile regrinding shops. The character of work done by these shops makes it necessary for them to change the set up of their cylindrical grinding machine each time they grind the pistons of a particular make of car. Under these conditions the ordinary fixtures used for quantity production would not be satisfactory. The new device is said to possess the following advantages:-

Universal application.—Can be used on pistons from 2¾" diameter up to the largest tractor pistons 7½" diameter. Set up of fixture for different size pistons can be made in less than two minutes. Ample clearance for the corner of the wheel to travel beyond the end of the piston, without interfering with fixture. Provision for taking up wear, insuring long life. Facilities for proper oiling.

The fixture consists of a dead center upon which revolves a cast iron cone in which have been cut three dove-tail slots. In each of these slots is mounted a hardened tool steel slidable member, the upper surface of which is ground conically. This upper surface is parallel to the bottom of the slot, so that the movement of the jaw is along an element of the cone. In each of these jaws is turned a transverse groove which permits the corner of the wheel to travel beyond the end of the piston, without interference. The jaws are also slotted longitudinally and locked in place by a taper pointed screw

The surface upon which the piston rests being elements of a cone, an accurate setting of the jaws is unnecessary they are merely set by the eye to bring the clearance groove into proper position. The cast iron cone revolves upon the end of a dead center on a conical bearing and is driven by the regular drive pin extending from the face plate of the machine into the cored slot shown. The piston is driven by means of a spline, made of a small piece of sheet steel screwed to the side of one of the jaws. A sha

low slot is filed in the skirt of the piston to engage this spline.

In the case of a DeLuxe piston where the makers do not recommend slotting the skirt, a special driver is furnished, which is adjustable for all sizes of pistons. The bearing of the cast iron cone on the end of the dead center is tapered, wear being taken up by turning a split adjustable threaded collar immediately in back of the cast iron piece. The slidable jaws are of tool steel hardened. Should they become worn they can be dressed by setting the fixture in the adjustable center grinding attachment which comes with the machine. This can be set to the proper angle and the jaws cleaned up. Ample oiling facilities are provided by means of drilled holes leading from the back of the center to the inside of the bearing. The fixture described is known as attachment style No. 509 and is only furnished with Norton autoport regrinding machine.

OPEN SIDE PLANER

The Pollard Mfg. Co., Ltd., of Niagara Falls, Ontario have just brought out a new Open Side Planer of very rugged design. The machine will plane 49" high under the cross rail, and 42" wide with cross rail head set square, and 48" with cross rail head angle. Standard machine will plane 12' 0". The Platen is 40" wide. The final drive to the planer platen is through a steel rack 6" wide bolted to platen, with teeth cut square, (not at an angle) to avoid side thrust on the "V" ways. A quadruple thread spiral gear 8" diameter engages the rack. The spiral gear shaft is driven through bevel gears with a four to one reduction. Driving pulleys are 30" diameter and three inch belts are used. The counter shaft is mounted on the top of the planer frame and operating at 336 r.p.m. gives a cutting speed of 35' 0" diam. The space between platen and post is 8" Power raise and lower for cross rail and side heads. One head on the cross rail and one side head on the post is standard equipment. Two heads can be accommodated on the rail also two side heads if required. The complete machince sits above the floor line, thus no pits are required to set it.

The "V" ways are 4½" wide, 20" centre to centre, provided with oil pockets and automatic oilers. The platen has the attractive feature of being double decked, as it were. All stake holes, either square or round as desired, are in the top plate as also are the four "T" slots which are 10" centre to centre. The bottom plate is solid. Centre cores between the two plates provide for the discharge of chips, none of these chips getting through to the driving mechanism. The post is of rigid construction, securely attached to the machine bed. It is provided with two sets of cross rail ways of generous proportions.

The cross rail is of heavy design. The cross rail heads have automatic feeds in all directions. Side heads have vertical automatic feeds only, hand feed for horizontal motion is over a distance of 12 in. A fast speed friction raise and lower for side heads is provided. A 15 H.P. motor is recommended to drive the machine. The weight of a standard machine to plane 12' 0" long is 28,000 pounds.

WOOD WORKERS VISE

The Oliver Machinery Co., Grand Rapids, Mich., have produced a new type of wood worker's vise with some unusual features. The vise is known as their No. 1 Universal. A pamphlet illustrating the sise shows ten different set ups. Briefly they are, first, the usual conventional vise set up with the jaws horizontal and with horizontal vise screw. It may be here mentioned that the vise screw is in the centre of a pair of rectangular shaped jaws 7¼" wide, 18" long, which will open up to 16". The method of attaching vise to the bench is unique and reflects careful designing. This fixture is of rugged design and lends itself nicely to several universal features contained in this tool. The first set up with jaws horizontal brings the top of the jaws flush with the top of the bench. The second set up shows the vise with vertical jaws extending well above the bench. The third set up shows the jaws horizontal, vise screw vertical, and tilting jaw in place. The lower jaw is the stationary one and is flush with the bench. The position illustrates its adaptability to the use of wedge blocks and clamping angle pieces or other irregular work. The locking bar is flat, not round, and prevents slipping of the vise in any position from 0 degrees to 90 degrees. The fourth, fifth and sixth positions show the versatile features of the vise when taking care of angle pieces. The seventh position shows the main jaws swung around to bring the jaws for holding metal into top position. This is a handy feature for metal patterns. The eighth set up shows method of holding frames and box forms, making use of the tilting feature of the vise. The next set up shows the use of extension dogs in the front and rear jaws holding rectangular work. By using four dogs, two in each jaw, round work can be clamped on top of the jaws. The screw is steel 1-1-8" diameter, with buttress thread. The nut is self centering and detachable, being easily replaced. The beam on bar is so constructed that metal filings or other injurious matter cannot fall from the jaws above, on the screw, and wear the threads unduly.

NEW LINE OF GRINDERS

The Sumbling Machinery Co., Ltd., Toronto, Ont., have placed a new type of grinding machine on the market. The machine is for machine shop use in grinding tools, cold chisels, etc. It is an improvement on the earlier type of grinder head. Two grinding wheels are mounted on the ends of the arbor, and sizes up to 12" diameter can be used. Each grinding wheel is protected by a malleable iron guard held by one bolt and handle. In event of breakage the shock is well distributed over the top of machine. The work rests are attached to guards and are adjustable to all positions, "T" handles holding them firmly. A self contained water reservoir forms part of the tray of machine which is mounted on the top of the pedestal frame. Special patented mounting means are incorporated in the design. Details of design such as large self oiling bearings have been given careful attention.

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B. G. NEWTON, Manager
J. H. MOORE, Editor
T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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A Study In Contrasts

THE FIRST public railway for steam locomotives was opened between Stockton and Darlington, England, by Edward Peese and George Stephenson on September 27th, 1825. This event caused great excitement, and nearly everyone prophesied that the "iron horse," as the engine was called, would be a failure. The train weighed about 90 tons, and consisted of six waggons loaded with coal and flour. Then came a covered coach which held the directors and proprietors, with twenty-one coal waggons fitted up for invited passengers, these numbering nearly 600. Stephenson's engine, which was named the "Locomotion," had a ten foot boiler and weighed not quite 1,500 pounds. As six miles an hour was supposed to be the limit of speed, it was arranged that a man on horseback should ride on the track ahead of the engine, carrying a flag.

The train was started without mishap and many of the spectators attempted to keep up with it on foot, some on horseback galloping across the fields to accompany this new means of transportation. After a few minutes Stephenson got impatient and shouted to the horseman with the flag to get off the track, for, to use his own words, "I am going to let her go." Spectators and passengers were alike afraid, but hung on tight while Stephenson opened up the throttle. Soon he was going at 12 miles an hour, later finishing with a glorious spurt at the rate of 15 miles. Spectators were left far behind, and one newspaper reporting the incident said that the performance had exceeded even the most sanguine expectations.

Compare this first locomotive with the modern type which is capable of eating up distance at the rate of 82 miles per hour. Hundreds of improvements have been made in addition to that in speed until at present we have a carefully prepared and massive piece of mechanism which excites wonder even in the heart of locomotive men themselves. The latest achievement in locomotive history is the "Thinking Engine."

The danger of collision has been ever existent, and unfortunately has been the means of a heavy loss of life. Some weeks ago. A. R. Angus, an Australian, demonstrated in London, England, a new device which he has invented, and which makes the locomotive so safe from collisions that he named the engine the "thinking locomotive." Three tests were made. In the first, two locomotives going head on towards each other at great speed on a single track were automatically stopped on approaching the danger distance without the intervention of the engineer. In the second test a locomotive heading towards another standing still on the same track was similarly stopped, and in the third test a rapidly moving locomotive overtaking one moving slowly was stopped.

On another page we give a brief description of the device. The thought, however, which remains uppermost in our minds is that marvellous inventions are continually being perfected and yet attract practically no attention. Here we have a life saving device which practically eliminates the human element, yet we sit back and take it all for granted. It is to be hoped the invention proves a success and a commercial possibility, so that all engines may be equipped with this added safety measure. The present safety condition of our railroads is excellent, but anything we can do to make them fool-proof, so far as switch operators are concerned, would be well worth while.

IT IS REPORTED by a British investigator, Mr. F. G. Cawston, who has been studying leprosy at Durban, that the administration of colloidal antimony appears to produce good effects. According to the British Medical Journal, he found that lepers in an advanced state of the disease, with all of their fingers and toes suppurating, were helped to such an extent by this treatment that the suppuration entirely ceased.



It's not the public that has stopped buying—It's certain people that have stopped selling.



MARKET DEVELOPMENTS



A Lighter Demand Exists on Market This Week

Demand On Steel Mills Has Tapered Off—Pipe Mills Show Increase—Other Finished Steel Products Light in Demand—Machine Tool Market Not Very Brisk—Small Tool Market Steady

ALL MARKETS report a slight tapering off in business this week. From Pittsburg we hear that the steel mills are not so busy, although existing conditions are still much better than they were in July. Production of steel ingots is around the 40 per cent. mark, against a 20 per cent. rate in July.

The demand upon the pipe mills continues to increase, this being very evident in standard pipe and oil country goods. The latter will hardly hold up, as winter will naturally bring lighter demand. Bars are practically stationary; plates show a very light demand, and sheets are the only finished steel product with any strength. Wire products are rather quiet, but of course this condition is in keeping with the season of the year. Sheet, wire, pipe and tin plate mills are all operating at 50 per cent or better, this being well above the rate of steel production.

It is an open question as to whether finished steel prices are going up or down. Several increases have been made, also a few reductions. Considering the matter from all angles it would look as if there is a trend to go downward rather than upward, as a recent bullish effort was not successful in strengthening the prices of certain products.

The Steel Corporations latest report shows that it is possible to make money in steel production, even with a very light operation and existing high freight charges. This clears up an important point, for it was claimed that such a condition was out of the question.

The machine tool market is not very active. Competition is keen, and prices are being shaded in many cases in order to make sales. The small tool business is steady, and dealers in this line are quite content to wait, for they feel that things are bound to improve in the near future.

The scrap market refuses to come to life. The same inactivity continues, and it is likely to do so for some time. Although all lines show a lull in the number of orders, the dealers in these various markets are by no means downhearted. Many feel that business is simply marking time until after the election on December 6.

PIPE MILLS SHOW INCREASE IN DEMAND—BUT STEEL MILLS EASE UP

PITTSBURGH, November 3rd.—On the whole, demand upon the steel mills has tapered off a trifle in the past week. There is no important decrease in buying but the change is noteworthy in that the continued improvement for three months has ended, though perhaps only for a very short time. The change does not necessitate a decrease in steel production, for while the appearance has been for months past that all the buying was for prompt shipment, the fact is that some of the mills have accumulated a little volume of business for the remainder of the year.

Indeed, the mills as a whole appear to be operating at a slightly better average rate than two or three weeks ago, despite the fact of the market being a trifle less active. The rate of steel ingot production seems to be close to 40 per cent., with the Steel Corporation operating at that rate or a trifle more, and the independents at somewhat below 40 per cent. Production of steel ingots in October was probably at about 35 per cent., against about 32 per cent for September, while at the low point last July production dipped just below a 20 per cent. rate.

Demand by Products

While the steel markets as a whole show slightly lessened activity, demand upon the pipe mills has continued to increase, particularly in standard pipe and oil country goods. In the latter, the increase will hardly be held as winter would naturally bring lighter demand. At long range view demand for structural shapes has been increasing, though it is still light relative to capacity. Bars are practically stationary. Plates show a very light demand, a demand that would appear light even if there had not been such a great increase in productive capacity in the past four years. Sheets show a slight tapering off in tonnage, but still make the best showing of any of the finished steel products. Wire products are rather quiet, in keeping with the season of the year. Tin plate is in lighter demand, also reflecting seasonal conditions.

Sheet, wire, pipe and tin plate mills are all operating at 50 per cent or better, on an average, or well above the rate of steel production. Bar, shape, plate and rail mills are all at less than the general average.

Steel Price Trend

Since the early part of September it has been a conundrum whether finished steel prices as a whole were advancing or declining. There were two advances, September 12th in wire products, and a week or two later in sheets. Meanwhile list prices on tubular goods were reduced, but only by a little more than the shading previously existing. Bars, shapes and plates have been presenting the appearance of trying to advance, but without a great deal of success. Some mills advanced their prices more than a month ago, expecting others to follow, and the others probably themselves expected to follow, but only after they had booked a certain amount of business, as backlog, which business it seems now they were unable to gather together. At any rate it has been found in the past week or two that at least two important producers who had

previously stiffened up their prices are again meeting the competition. This seemed to swing the general weakening rather than strengthening. A trend in the same direction is furnished in sheets, for more than a fortnight ago the majority of independent mills advanced their asking prices a second $5 a ton and this action has not worked out into an actual advance in the market, which is easier in tone than if the attempt had not been made.

Thus a careful scrutiny of actual facts in the market indicates that if there is any trend in steel prices it is downward. Added to this are two theoretical considerations, involving freight rates and the Steel Corporation's earnings statement for the September quarter. Everything is up in the air as to what will occur with freight rates, and a wide variety of guesses is being made, but the steel buying public is likely to count upon rates being reduced at some time, expecting therefore that mills will be able to reduce prices somewhat on account of reduced costs.

Steel Corporation Report

The Steel Corporation's report is very important since it shows that even with a very light operation and existing freight rates and wage rates it is possible to make money in steel production. That is contrary to what was being said in the steel market during the quarter now reported upon. It was claimed that the steel mills generally were losing money, and as to some of them it was claimed that the more tonnage they made the more they would lose. The Steel Corporation report gives the lie to such statements, in general. Various efforts have been made to explain away the showing. Analysis would show that these explanations do not hold water, but it is not worth while to go into details. The Steel Corporation's earnings, after payment of interest on bonds of the subsidiary companies, were: July $5,157,395; August $6,502,976; September, $7,257,687; total $18,918,058. This took care of all charges down to the preferred dividend, paying nine-tenths of that and leaving the other tenth and all the common dividend to be paid from surplus. Shipments, in proportion to capacity, were approximately 25 per cent. in July, 30 per cent. in August and 34 per cent. in September. Prices declined, chiefly in the first half of the quarter, while there was a general wage reduction August 29. September is therefore to be taken for comparative purposes. The earnings in that month were about $15.75 per ton. In 1912 and 1913, which were considered fairly good years for both the Steel Corporation and the independents, the corporation, with an operation of 88 to 90 per cent., instead of 34 per cent., showed earnings averaging slightly under $10 per ton, instead of over $15. With a fair operating rate the cost per ton would be less and the profit per ton greater, producing very good earnings.

Nearly two years ago, when the independents began advancing their prices above the Steel Corporation level, claims were made that the Steel Corporation had "advantages" over the independents, so that the independents could not "afford" to sell at as low prices as the corporation. Talk of this sort still survives. It is on record, however, that the independents had fairly satisfactory earnings in 1912 and 1913, when the Steel Corporation showed earnings of less than $10 a ton, so that the difference could not be great, in dollars per ton.

If the independents cannot make profits at prices that give the Steel Corporation more than $15 a ton something must have gone wrong with the independents since 1913. The Steel Corporation has not particularly changed its manufacturing position. When the independents were getting fancy prices they probably acquired expensive habits which they have not altogether shaken off yet, and they probably failed in some cases to write enough off inventory and make other adjustments in 1920, as the Steel Corporation did. Losses now reported are probably due to these factors, which are of only temporary application. It should be noted the the Bethlehem Steel Company, unlike some independents, showed good profits for the September quarter, enough to pay the dividends. It is plain that with a reasonably fair steel mill operation it will be possible to reduce prices farther and still leave earnings.

POINTS IN WEEK'S MARKETING NOTES

The demand on the steel mills has tapered off somewhat during the past week. The rate of steel ingot production is close to the 40 per cent. mark.

Structural shapes have been showing a slight increase, but are still light when compared to possible capacity. Bars and plates are both very light, and steels show the best of all finished steel products, although even this demand is nothing to brag about.

The movement of prices recently has got one guessing, for some commodities go up, while others again ease off a little, it would indicate that if there is any trend in steel prices, it is downward.

The Steel Corporation's report shows that it is possible, even with a very light operation and present freight rates, to make money in steel production. This, in spite of the fact that such a condition has been said to be out of the question.

Montreal reports much quieter business in all lines. Even with this condition, business is much better than it was in midsummer. Further rail orders are looked for in this field in the near future.

Both Montreal and Toronto markets report a quiet machine tool market. Enquiries are coming in all right, but whether they will actually develop into orders, is another question. The coming election is said to be partly responsible for the existing lull. Everybody is sitting tight until December. 7th, when we will all know how things stand.

The small tool market is the healthy member of the market. Although business is not what could be termed brisk, it is steady, and in fact has been so for the past three or four months. Dealers in this line are quite satisfied and they feel that conditions will improve as time goes on.

LIGHT DEMAND ON TORONTO MARKET

Demand in Various Lines is Light; Elections Seem to Have Exerted Influence In Buying—Small Tools Are Steady—Scrap Market Dull

TORONTO, November 3rd:—There is no question but that the demand on this market has eased off during the past week. Although at isolated points we hear of a "good" month, we know that the reason October was a "good" month, was because the previous month, September was very poor. The first two or three weeks of October were really better than the one just passed, and in many cases, the coming election is being blamed for existing conditions. Lest this may seem to be theory, rather than actual fact, we quote the following story, as one machine tool dealer told it to us.

"We have been chasing up a certain prospect," said this dealer, "and had reached the point where he was convinced we had the only machines which would suit his purpose. The price was right, and everything looked rosy, yet we couldn't close the deal. 'Would you mind telling us why you won't sign the order,' we enquired, and here was his reply. 'The machines are just what we want, but we cannot afford to take a chance on purchasing until after the present election. If protection goes through all right, we buy the machines, but if the free traders get into power, well we will have to turn the key in our shop, and go back where we came from, namely, the United States.' Can you blame us," finished this dealer, "for wishing it was all settled, so that we could get firms to purchase with confidence?" Although this tale concerns the machine tool section of the market, the same condition holds equally true in the other lines.

One good thing about the present lull is this. Dealers are still confident that there is business to be got, and that it is a question of patience until the people of the country have decided which party they want in power at Ottawa. Dealers believe that after that date things will pick up slowly but steadily.

Speaking to one of the foremost scrap metal men this week, we asked this question, "When on earth do you expect things to pick up?" and this was the answer we received, "I wish I knew." This dealer then went on to say that this has been the longest stretch of inactivity that he would care to see again in a decade. "The little spurt we did have didn't last long," remarked this gentleman, "and from present outlook, I cannot hold out any hopes until after the middle of December." It would appear that this market will stay very weak until foundries see enough business ahead to order metal with confidence that prices are going to stay steady.

The Steel Market

Outside of a seasonable demand in sheets, the steel market locally shows no change. In fact the activity in sheets is to be expected, for everybody is anxious to finish up their buildings before the cold weather sets in. Prices are the same as last week, and about the best way to describe this section of the market would be to say that it is fairly steady.

The machine tool market is very erratic. Some dealers report good sales for October, while others again say it has been a very poor month. It's the old story of prospects breaking at different times. One month, a certain class of dealers close with their clients, while the other section is working theirs up to the buying point. One thing however exists of which there can be no doubt, and that is "competition." Every dealer is on his toes and is continually on the lookout for business. For example, three men came to Toronto during the past week on a machine tool shopping tour. Their wants were by no means exceptionally large, yet they were much better than the usual line of business these days. The result was that these gentlemen found themselves in the peculiar position of having all sorts of things to pick and choose from. After considerable deep thought, they picked a tool here and there, with the result that many dealers got a slight nibble at the order. No doubt a sigh of relief went up all around when the deal was completed, for shading of prices was the regular, rather than the occasional thing. As one dealer said recently, "If people only realized, now is the time to buy, for we are willing to talk prices and terms, which it is doubtful if we ever will again."

The small tool market remains very steady. Orders come in regularly, and while not large, if considered singly, they make a nice item when totaled up. If a graph were drawn of this market for the past six months, the quantity of goods sold each month would be found to be very nearly the same.

Although the week's activities show an easing off, there is still plenty of confidence amongst dealers themselves. They feel that things have passed the worst, and once let the election get out of the way, then business will pick up considerably.

QUIETER CONDITION EXISTS ON MARKET—SMALL TOOLS STEADY

MONTREAL, November 3rd: — Analyzing the reports from various quarters of the iron and steel industry, the unmistakable conclusion that business is distinctly quieter, is reached. Throughout September and October there was a distinct improvement in all lines, but evidently this small revival has run its course. Manufacturers and jobbers, in many cases, do not express surprise at such a turn of affairs. Even with the quieter condition, conditions are considerably improved over those existing at midsummer, showing the net result of the whole to be a gain. These temporary periods of activity followed by quieter periods are what we must expect, and as long as the net results are gains, a healthy condition is exhibited. The present time is not ripe for a general wave of prosperity. Artificial inflation of prices has not been entirely eliminated, labor wage scales have not been adjusted to their proper level, and while these and many other unsound economic conditions exist, business along general lines cannot enter upon an extended period of prosperity.

The Steel Market

Prices of steel have not altered since last week. Business has dropped back a little, and the firmness in price in evidence for some time back has not been productive of any results. The rail orders announced last week will keep the mills busy till the end of the year. The C. P. R. rail orders given to the Algoma Steel Corporation enabled that firm to put on a double shift last week, which factor will allow them to produce the steel at a lower cost. It is expected by the local representatives of the steel mills that the National Railways will be in the market for more rails before the end of the year. The amount is estimated to be about 50,000 tons. The steel men are making every effort to get the order booked. At the same time a few inquiries for structural shapes are coming in and this end of the business is receiving considerable attention from steel salesmen. Building, locally, during the past season, has not been so dull as has evidently been reported. Plans for 1922 are such as to lead the steel fraternity to look forward to much better business.

Steel bars are very quiet. The situation surrounding this end of the business has altered but little since midsummer. The sale of a few odd bars here and there, represents about all the trading that exists. There are but few inquiries. The sheet and plate market enjoys a little activity. The improvement in sheets, due to the seasonable autumn demand, has lapsed again. Plates of the lighter varieties are moving fairly well in small lots, while the prices keep firm.

Pig Iron

The volume of business turned for the six weeks following September first was extremely encouraging to producers. For the last two weeks sales have fallen off very appreciably. Dealers report that the conditions in foundries today are rather varying. Some foundries are closed, while others are running from day to day on small orders. Other shops are showing some very resourceful methods in keeping their employees busy. One foundry in this locality had six moulders laying a cement driveway into the plant next door and thus these men were enabled to get a week's employment, during which time the foundry landed a fair sized order which brought them back in the molding shop and caused a car of pig iron to be ordered by wire. This little incident about represents the condition of a large number of small foundries around this locality. The larger firms who usually buy pig in lots of from eight to twelve cars, now order one or two cars only and carry but a small stock in the yard. Prices have not changed and are not likely to until the demand increases considerably.

Machine Tools

It is very hard to accurately sum up the situation locally. A few scattered orders are being received from time to time. Most shops are pretty well equipped with standard types of tools and will not probably be in the market for some time as the present volume of business passing leaves quite a quantity of idle equipment. Secondhand rebuilt tools continue to move fairly well. The machine shop purchasing agent is not greatly interested in machine tools in general but he is keenly alive to any new equipment that promises to show up some labor saving device.

The small volume of traffic on the railways has resulted in a large quantity of idle rolling stock, and during the lull, all this equipment has been placed in first class repair. The result is that today these railway shops are caught up with their work and are not at all interested in new equipment, as, the lessened amount of general wear and tear calling for repairs can be taken care of with a reduced staff of men which results in idle machine shop equipment.

Small Tools and Supplies

Probably the healthiest department of the metal trades is the small tool and supply business. Liquidation, the great evil of the last few years, has gradually disappeared. The manufacturers are stocking up the jobbers, price lists are again a medium through which business is transacted, and the shops are buying in a reasonably acceptable way. True

(Continued on Page 66)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 50
Steel bars, base, Montreal	3 50
Reinforcing bars, base	3 50
Steel hoops	5 00
Tire steel	4 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	4 00
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	35 00	37 00
Spelter	7 25	7 50
Lead	6 50	7 50
Antimony	7 25	8 25
Aluminum	28 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 38	14 71	17 77
½ in.	6 50	8 03	7 95	9 48
.....	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	12 00	14 00
Malleable scrap	12 00	20 00
No. 1 machine cast iron	22 50	25 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus 10	
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 40	4 25
Canada plates, dull, 52 sheets	6 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	8.00	....
Fleur-de-Lis, 28 B. W. G.	7.50	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28	....	....
Premier, No. 28, U. S.	6 75	6 25
Premier, 10¾ oz.	7 25	6 90
Zinc sheets	10 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.	.....	34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21	Atlas	.19
Peerless	.22	X Empire	.15
Grand	.21½	Ideal	.18
Superior	.21½	X Press	.13½
X L C R	.16½		

Colored

Lion	.13½	Popular	.10½
Standard	.12	Keen	.9
No. 1	.14		

Wool Packing

Arrow	.35	Anvil	.22
Axle	.28	Anchor	.17

Washed Wipers

Select White	.17	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

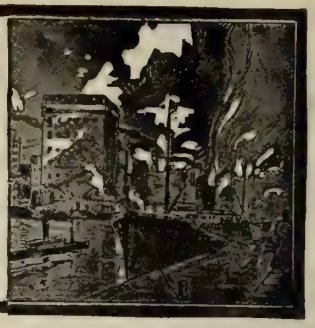
Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.16
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

Machine and Foundries, Ltd., Brockville, are developing a line of hardware specialties, chief among which are hand pumps of different types.

Smiths Falls Malleable Castings, Ltd report considerable improvement in raway demand. They recently found it neccessary to increase their foundry force.

H. George, managing director of The Hans Renold Co., of Canada, left Montreal on October 28th, on the C. P. R. Steamship Minnedosa for England. He will be gone 6 weeks.

The Stirling Trunk Co., of New York, are locating a Canadian factory in Toronto. They have leased space at 510 King St., E. for the present. It is intended to erect a large plant of their own here at a later date.

The Riordon Company announce the re-opening of their sulphide plant at Kipawa. This plant has been closed since April last. About 400 men will be taken on at once.

Toronto Relators report many enquiries for business sites from British and U. S. concerns. This undoubtedly is but the forerunner of announcements of new plants locating in Toronto in the near future.

The William Hamilton Co., Peterborough, are building four 56-inch turbines for the Canadian Electric Co. These will be installed in a new plant on the east side of the Otonabee River at Nassau, above Peterborough. A new government dam is being erected there.

The Otley-Simpson Co., of Otley, Yorkshire, have decided to establish a Canadian factory. The location has not yet been announced other than it will be in Ontario. This firm manufactures cheese and meat presses drain excavators and other special equipment.

Mr. Ernest Sumner, president of Sumner and Co., New York, agents for an English manufacturer of belting has just completed a visit to his eastern Canadian representative in Montreal. Mr Sumner states that business conditions in the Eastern states are improving slightly. and he expects that spring will bring business back to normal.

The Dominion Engineering Works Lachine, announce that contracts have been recently placed with them by the Montreal Water Works calling for three thirty-million gallon pumps, twelve 36 inch Johnson combined stop and check valves, and six 42 inch gate valves, this latter being a line which this company has recently taken over. This is for Montreal's new low level pumping station.

A. Cotton, George St. and River Road South, Vancouver, B. C. is erecting a saw-mill.

The erection of a manufacturing plant is contemplated at Grimsby, Ont., by the Grimsby Steel Furniture Co., Limited.

The Sifman Shoe Manufacturing Co., Aurora, Ontario, is erecting an addition to their building of offices at the cost of $25,000.

The ratepayers of the city of London, Ontario, will shortly vote on a by-law authorizing the expenditure of $150,000 on the construction of a dam.

Cobourg, Ont.,—Both the Cobourg and Port Hope plants of the Cobourg Felt Company are running with a large staff, and a good season for this industry is fully expected.

The new building of the Loyal True Blue and Orange Orphanage which is now being erected at Toronto will cost about $197,000.

Ross Meaghen Co., have been given the contract for the excavation and foundation work on the new Collegiate to be erected at Ottawa.

Fire damaged the plant of the Blue-Bird Corporation Brantford, Ont., manufacturers of washing machines. It is estimated that the damage will amount to around $10,000.

Roy M. Wolvin, president of the British Empire Steel Corporation, says that there is a chance of the coal mines of Nova Scotia closing this winter, if the miners refuse to accept a lower scale of wages.

The Provincial Government is going to make a grant of $7,225 for a steel bridge over the Salmon river at Ascot. The Sherbrooke County Council are interested.

The Ingersoll Machine Tool Co., are going into the manufacture of ironing machines for household use. Their sales office is located at 80 Bay St., Toronto.

Redfield & Fisher, Inc., New York state that George H. Wallace, formerly a director of Hoyt's Service Inc., is now a member of their firm, which will now be known as Redfield, Fisher & Wallace, Inc.

Both the Cobourg and Port Hope plants of the Cobourg Felt Co.. are now running with a large staff, and a good season for this industry is expected.

A ten story addition to the Crawford House, Windsor, Ontario, is proposed. Plans have been prepared for an addition containing 112 guest rooms and will cost about $400,000.

J. N. Coupal, Plantagenet Springs, Ontario, contemplates the erection of a Flour Mill at Lebret, Sask., with an electric light and power plant costing $200,000.

The National Railways have placed an order with the Canadian Car Co., for the repair of 1,000 cars. 500 of these will be handled at the Amherst plant, and the same number in Montreal. This work will give employment to a large number of men at both plants.

Canada's Furniture Manufacturers are experiencing a greater measure of activities than earlier in the year. The latest data, based on a complete survey of the industry, showed that production averages 65% of normal.

A site has been purchased at Amherstburg, Ont., by the Midwestern Tractor Wheel Co. that will be used in the establishment of a Canadian branch plant. The organization is capitalized at $1,000,000 and is controlled by Detroit financiers. The site consists of 72¾ acres.

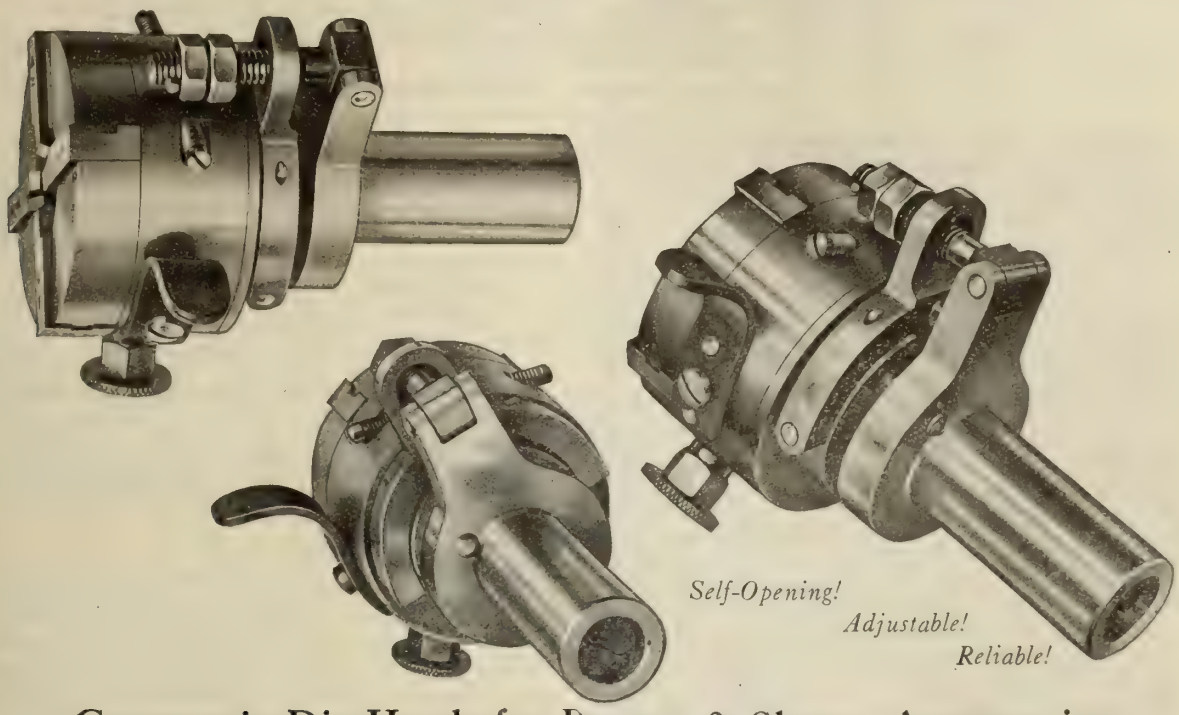
The Canadian export of pulp and paper shows an increase to the value of $51,633 over the month of August this year. Exports of newsprint for the month of September amounted to 1,224,136 cwts. Comparing this with 1,212,225 cwt. in the corresponding month last year is shows a substantial increase of 11,911 cwt. This is an equivalent of 595 tons.

In Chicago a few days ago Mr. James A. Yates, assistant treasurer of the Grand Trunk railway system, was elected second vice-president of the railway treasurers' association. The election of officers took place at the annual convention. For some years past Mr. Yates has been very prominent in the deliberations of the association.

A record in long distance travel in Great Britain has been established by a new through service between Penzance and Aberdeen. The length of the journey is 785 miles, and the scheduled time for the run is less than twenty-four hours, including one stop of thirty-five minutes at Edinburgh.

Right on the Lead

A New High Mark in Screw Cutting



Geometric Die Heads for Brown & Sharpe Automatics and Other Single Spindles

DESIGNED primarily for the Brown & Sharpe Automatic Screw Machines, the D. S. Die Heads are quite as well adapted to other Automatics, and where they are used, there is no reversing of the spindle to back the Die Head off the threaded work.

Note the lever trip, which reduces the force of tripping the Die Head and lightens accordingly the reaction on the threads being cut.

Buffer Springs allow the Die Head to yield slightly when the Chasers come in contact with the work, insuring a good smooth thread from the start.

Shock and wear are eliminated by the spring closing attachment. This is of special value when closing the Die Head rapidly.

Push Buttons eliminate all trouble in inserting the Chasers.

No face plate is necessary, making it possible to use projecting Chasers where required for cutting close to a shoulder.

The Closing Attachment is located in a convenient position to strike a stop on the machine, which automatically closes the Die Head when the turret revolves.

The Chasers are of sturdy construction. They have long bearings in the Die Head skeleton and are supported by hardened keys, which prevent tilting and consequent cutting of taper threads.

The Die Heads are provided with shanks to fit the particular size machine on which they are to be used.

Consider the economy of using one of these Die Heads with its Micrometer Adjustment, over a button die, which has no adjustment.

Geometric Die Heads are sent out on trial to reliable concerns.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S.**

INDUSTRIAL NEWS

Theo Amodeo, 1216 St. Clair West, Toronto, Ontario, will build a garage and service station at the cost of $45.-000.

Additional Contracts for the Prince Edward Hotel, Windsor, Ontario, costing $1,000,000 for the border city Hotel Co., have been granted.

A reinforced steel contract for addition to warehouse costing $95,000 for J. R. Watkins Co., 90 Annabella St., Winnipeg, Manitoba, has been placed.

The representative of one large motor car concern in Toronto recently stated that his company had shipped more motor vehicles to China in the past six months than to any other country in the world.

Some six weeks ago the St. George Pulp and Paper Mills at St. George, N. B. were forced to close down owing to low water. The company, which is a New York concern, resumed operations recently.

Mr. Leitch, advertising manager of the Merchants Bank of Canada, states that it is the opinion of the banking fraternity in general that business is on the turn and that we are now on the upgrade.

The leather industry is picking up. A large firm in this industry situated in Toronto has stated that their business for the month of October 1921 would be three times as large as it was in January of the same year. In some standard lines manufacturing operations are running practically under nomal basis

W. S. Duffield of the John McPherson Shoe Co., Hamilton, Ontario, stated that during the past month there has been a considerable increase in business, and nearly all orders were wanted at once. The firm is employing more hands than it has been for months.

In the Oct. 13th issue we stated that the F. F. Barber Co., had completed arrangements for the exclusive Canadian representation of the Warner & Swasey Co., Cleveland, Ohio. This report was incorrect, and what we intended to say was exclusive Ontario representation and not Canadian.

The Canadian-Mead-Morrison Co., of Montreal report that their general manager of the American and Canadian companies states he has found things very much improved in the Western United States, and that their Boston factory is now fairly busy, a condition which should have some reaction here later on.

The City of Hull, Quebec, is altogether likely to secure a new industry, that of specialty motor car manufacturing, which is backed by a syndicate of Montreal and Toronto interests, and is capitalized at $250,000. Announcement to this effect has been made by Mr. St. Jean, secretary of the Hull Publicity Commission, who stated that an option has been secured on a large tract of property in that city.

Owen Sound. It is understood that about $15,000 will be spent in repairing the breakwater at the harbor entrance which has fallen into disrepair. The department of Marine and Fisheries of the Dominion Government is said to be taking up the work which will be done by day work.

Darling Brothers of Montreal have secured the contract for the construction of six freight elevators to be installed in the old Montreal jail which is being renovated by the Quebec Liquor commission, acting for the Provincial Government. The total cost of the renovation contracted for amounts to $1,000,000 and when renovated the building will be used for the storing of liquor.

Mr. Breen Kennedy, Canadian manager of Wm. Beardmore & Co., of Scotland, leaves for England early in November on a business trip to investigate industrial conditions over there, and also to arrange several matters in connection with their representation in Canada. Mr. Kennedy states that business conditions in this country are steadily improving. This is indicated by the number of enquiries he has had with regard to their products.

Two representatives from Sweden who have arrived in Halifax, Nova Scotia, are here to establish trade relations between Canada and Sweden particularly to buy food products for Scandinavian consumption. They are prepared to export from Nova Scotia large quantities of wheat and other grain, fresh fruit, etc. From Montreal they aim to ship wheat and rye, and from Ontario canned and fresh fruit, and other food products from points right out to the Pacific.

Among the bright spots that are working to the surface in these strenuous days. Port Hope supplies a valuable example. The Matthews Gravity Co., who come in contact with a wide range of industries report a decided improvement, and have found it necessary to double their force. They are now running a full week of forty-four hours. That there seems to be every reason for confidence that better times are coming, is the opinion of the management.

The James Smart Manufacturing Co., Brockville, are practically running full time. In fact part of the plant, engaged in production of school desks is running overtime, owing to demand created by erection of new school buildings all over the country. Hardware demands have also taken on a spurt, due in many cases to the fact that stocks are very low. This is not the time of year when such demand is in evidence, and the condition would seem to assume exceptional business when the spring season opens.

Some weeks ago Canadian Machinery gave a description of the new low level pumping station at Point St. Charles, Montreal. The three, 30 million gallon pumps that are to be installed in the pumping station will be built by the Dominion Engineering Works, Rockfield, P. Q. The price to be paid by the Montreal water board for three direct connected pumping units is $76,000. Westinghouse motors will be used. The I. P. Morris type of pump will be supplied, these being built under licence by the local firm.

It is understood that in addition to the segment castings required for the vehicular tunnel to be constructed under the Hudson, some 4,000 tons of 1¾ in. bolts with nuts and washers; 12,000 tons of structural steel, 3,000 of reinforcing bars, and 1,000 to 2,000 tons of cast iron, wrought iron and steel pipe will be needed. Specifications will be printed sometime in November, and bids will be advertised later on.

Six hundred and twentyone thousand feet of lumber was unloaded at the docks of Meaford a few days ago for the Seaman-Kent Flooring company. This factory has been working overtime, and is receiving rush orders from the west, which furnish excellent business for the concern. The overtime will continue for the next three or four weeks.

Harry Bourne, of Hamilton, has been appointed a foundry inspector for Ontario, by the provincial department of labor. Mr. Bourne is an experienced molder, having worked at the trade for about 20 years. For many years he was secretary of the local Molders' union, and has filled the office of president of both the Hamilton trades and labor council and the Independent Labor party.

The International Wheel and Rim Corporation have secured their Dominion Charter and will shortly have this branch organized. Mr. George Crennan of Cleveland, Ohio, is president and general manager of the Canadian branch and in an interview with this paper stated that he had already secured a draft of orders sufficient to keep their plant going for one year. Mr. Crenan's present address is 504 Sherbourne St., Toronto. Offices will be opened in this city in a few days.

The Watkins Manufacturing Co., of Kansas, will establish a Canadian plant on Rideau Street, Kingston, Ont. The company is engaged in re-babbitting worn out bearings of machines, automobiles and tractors. They receive from garages the worn out bearings and remake them instead of allowing them to be termed scrap. Mr. John M. Hughes, ex-mayor of Kingston has been appointed general manager for the Canadian plant.

Reports from many centres in Canada show that building is not as inactive as some would have us believe. Figures which we have secured show that in the province of Quebec alone for a period of nine months commencing January 1st, 1921, the total value of all permits issued was $2,686,874, a larger sum than any other full year with the exception of 1914. The entire year of 1914 however, was only $72,000 ahead of the total of the first nine months of 1921, therefore if we keep up at the present rate, this year will be a record one.

ATKINS METAL CUTTING SAWS

Present Conditions

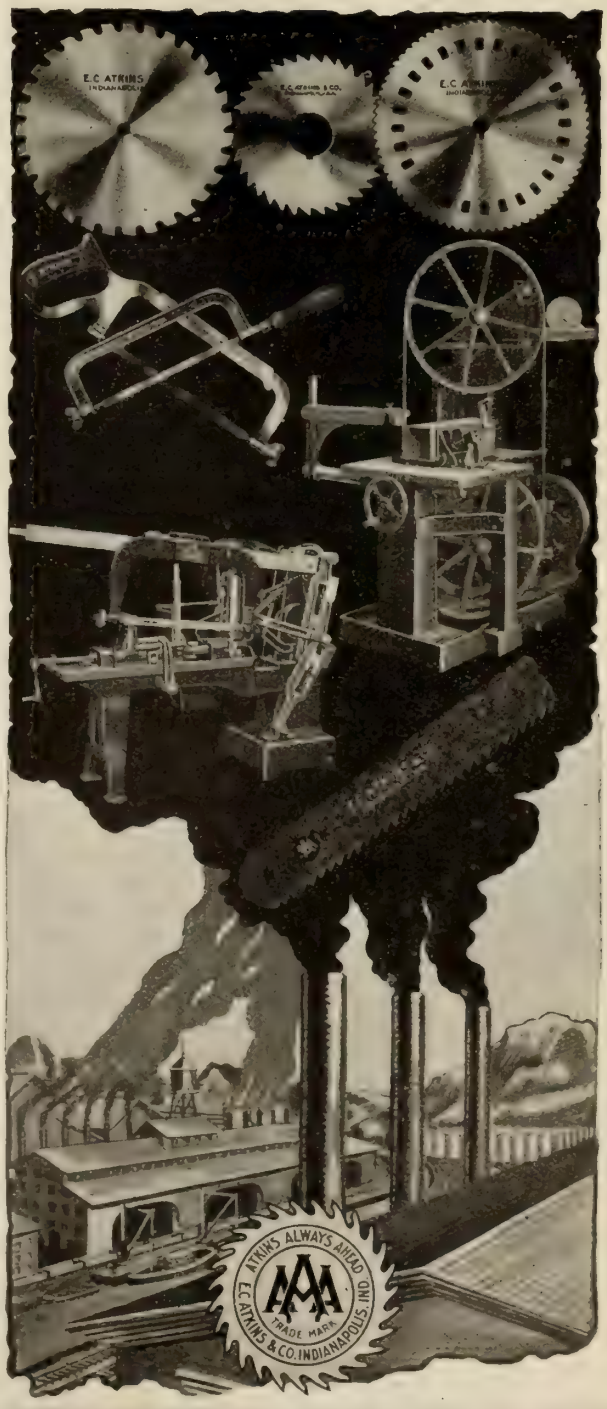
Don't let present-day conditions worry you; everything is fundamentally sound. More economy is being called for, use

Atkins Metal Cutting Saws

Conditions are such that quality and quantity production is essential. The use of Atkins AAA Non-Breakable Hack Saw Blade and Frames, Circular Metal and Slitting Saws, Hot Saws, Cold Saws, Kwik-Kut Hack Saw Machines and Blades and Metal Band Saw Machines, will assure you of efficient, economical operation and give you quality and quantity production.

Write for descriptive literature and prices on any of the above

"A Better Saw for Every Use"



E.C. ATKINS & CO.

Est. 1857 **"The Sterling Quality Saw People"**

Home Office and Factory, Indianapolis, Indiana

Canadian Factory, HAMILTON, Ontario

Branch carrying complete stock, VANCOUVER, B. C.

INDUSTRIAL NEWS

Toronto:—Tenders are being asked by the board of education for Technical School equipment. These must be sealed and addressed to the business administrator and secretary treasurer, board of education, 155 College St., and will be received until Friday noon November 4th. Following is the equipment required: 20 engine lathes and equipment, 1 speed lathe and equipment, 1 hack saw, 1 grinder, 1 drill, 2 motors and small tools.

The United Steel Corporation of India, hope to make a good showing in the steel industry. It is understood that a high quality of iron ore and excellent coking coal have been found close together in the provinces of Bihar and Orissa. As the cost of erecting works in India is considerably below that in other countries it is believed India is capable of producing the cheapest steel in the world. The plant, which will be erected by the Cammell, Laird Company will be capable of producing 750,000 tons of pig iron and 500,000 tons of finished steel annually.

The experimental plant erected by the Dominion, Manitoba, and Saskatchewan Governments, at Bienfait, Sask., for the briquetting of the lignite coals found in that district is ready to commence operations. The plant, erected at a cost of $780,000, half of which was supplied by the Dominion Government, the other half being shared equally by the Saskatchewan and Manitoba Governments, has a capacity of 30,000 tons per annum. It is believed that briquettes turned out by the plant will have heating values comparing favorably with hard coal, and will be placed on the market at about $10 per ton.

The contract for alterations and additions to the recently purchased plant of Durant Motors of Canada, Limited, at Leaside has been let to E. C. Warren, constructing engineer. Work will be started immediately with a view to having the plant ready for the manufacture of automobiles not later than March 1, 1922. Mr. Warren will establish an office at the Leaside plant and take personal charge of the work. Contrary to published reports, Mr. Durant says it is the company's plan to have all of the parts entering into the building of the new Durant car made in Canada, including tires and electrical equipment. Motors for the Durant will be brought from the States until the plans of the Continental Motors Company to establish a Canadian plant are completed.

C. G. Porter & Co., have opened up an office in the New Birks building, Montreal and announce that they have taken over the following agencies, which up to the present have been handled by the Douglas Milligan Co., Ltd., which firm is now in voluntary liquidation: Canadian David E. Kennedy, manufacturers of Cork and Everlastic tile. Canadian Jewett Refrigerator Co., manfacturers. Canadian MacArthur Concrete Pile Co., contractors for general foundations and the installation of the MacArthur pedestal pile and the MacArthur straight pile. The Custodis Canadian Chimney Co., designers of chimneys, and erectors of radial brick chimneys. The Keystone Fireproofing Co. of Canada, installers of the metropolitan system of fireproof construction, and erectors of gypsum blocks. The Reliance-Grant Elevator Corporation, manufacturers of "Reliance & Diamond" hangers; elevator door controllers; door lock, and ball bearing drawer slides. R. Guastavino Co., installers of vault and arch constructions, and manufacturers and installers of Rumford tile.

These are strenuous days for the lumbering industry, according to reports from Ottawa, referring to conditions among the large mills in that city and vicinity. Practically all of these are at a standstill. There are very large stocks an hand and the tough part of it is these represent an outlay far beyond any return possible at to-day's prices. In fact it is reported that one large concern has something like fifty million feet on hand and that is was recently offered to the market at something like $18 a thousand. This quantity of lumber represents a tremendous amount of money and it is not surprising that owners are inclined, if not compelled, to make heavy sacrifices in order to liquidate. It is not so long ago that lumber was as high as $65 a thousand. Pattern lumber is still at a pretty fair level. One foundry reports that they recently made a quantity purchase at $72 per thousand but that they had paid as high as $110.

Kayer Ellison Company, 126 Craig Street, West, Montreal, representing the steel manufacturer of that name report that since Armistice they have added to the actual number of their customers by 100 per cent. They have not, of course, increased the volume of sales proportionately owing to conditions over which they have no control. It is highly significant, however, that this concern should have been able to accomplish what they have during a period when there was so much inertia to overcome. They explain the result by the fact that they have not weakened their oganization but on the contrary have strengthened it, bringing their sales force up to a high state of efficiency by the introduction of new blood wherever needed and by getting out of the routine in the search for new firms to add to their list in order that with improved conditions they would be ready in every department to take advantage of them as they now are.

The Canadian Locomotive Co., Kingston, are all set for a strong start in the industrial getaway. The plant has been practically shut down since May, but in the meantime all equipment has been completely overhauled and repainted, then a two-pit extension to erecting section and a new wing 65x185 feet, with travelling crane, has been added at a cost of something like $110,000. This building will, for the present, be used for storage purposes but is so constructed that it may be immediately converted for manufacturing purposes if necessary. There are also two small additions to be used as tool, logging and bolt rooms, also a new forging furnace, and an extra tire machine has been installed. Under normal conditions this plant employs from 800 to 900 men. The recent building and overhauling operations have given work to a small force of foremen and other employees. It is the feeling of the management that the railways cannot much longer remain out of the market for new equipment, and that when the demand does develop, it should come with considerable volume. The plant was never in better condition and in its preparedness indicates every confidence in the future.

MARINE NEWS

One of the largest dredges in the world is now nearing completion at the yards of the Canadian Vickers, Ltd., Montreal, and is expected to be handed over to her owners, the Department of Marine and Fisheries, in about three weeks. It will probably be operated on the ship channel below Quebec, and will leave for that port immediately on delivery. The dredge is 284 feet long between perpendiculars, and 292 feet long over all, with a breadth of 48 feet and a depth of 20½ feet.
akoustolith tile.

M. Campbell, president of the Kingston Navigation Co., who has had the steamers St. Lawrence and Brockville plying on the river and lake routes, has under consideration extensive plans for improving the service for next season. The steamer St. Lawerence is to be extensively overhauled this winter, with a view to increasing her efficiency as a passenger steamer. The steamer Brockville will continue on her route, taking in Picton and Belleville and intermediate points, as long as the water is open. Her freight business is very heavy at present.

OBITUARY

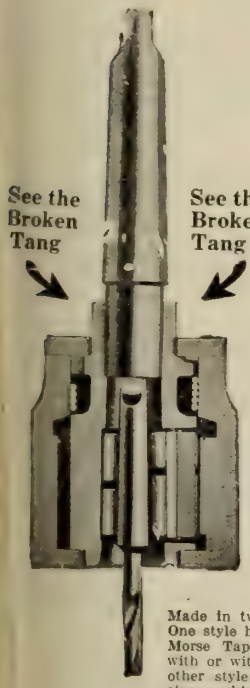
The recent death of Lieut-Col. Senator Frederic Nicholls, will be felt by many industrial circles, for Mr. Nicholls was well known amongst mechanical men. He was born in England in 1856 educated at Stuttgart, Wurtemburg Germany, and came to Canada in 1874 He lived for a short time in Montreal then moved to Ottawa. Later he moved to Toronto, taking a position as reporter. After this he became secretary of the Canadian Manufacurers' Asscciation which then was assuming an important position in Canada, following the inauguration of the national policy in 1879. He also was responsible for the start of the paper called "The Canadian Manufacturer," and was with this perodica until about 1893. Then came his entr into electrical business. Together wit others, he developed the Canadian Gen eral Electric Co., with a capital of $18

Good Mechanics and Good Tools Get To-gether at--

In order to satisfy the most men with the best tools a "high quality" standard is essential.

Aikenhead's

The reliability of our supplies can be tested by one unfailing way. Ask your friends!



Made in two different styles. One style holds No. 1, 2 & 3 Morse Taper Shank Drills—with or without a tang. The other style is made in three sizes, which hold all sized straight shank tools from ¼ to 1 inch.

WAHLSTROM
Automatic Drill Chuck

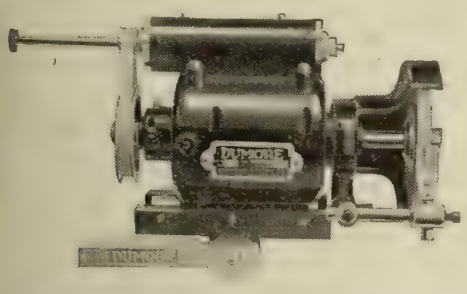
Even such a small article as a chuck can waste or save a surprising amount of money in the course of a year. With the WAHLSTROM **Automatic Drill Chuck** the balance is on the **savings** side.

This mechanically perfect chuck, is self-centering, fully automatic and absolutely non-slipping. It saves time and money because it works just as well with broken tangs as with good ones. The smooth, hardened and ground jaws grip on the **side** of the shank enabling the tools to be used long after the tangs have become useless.

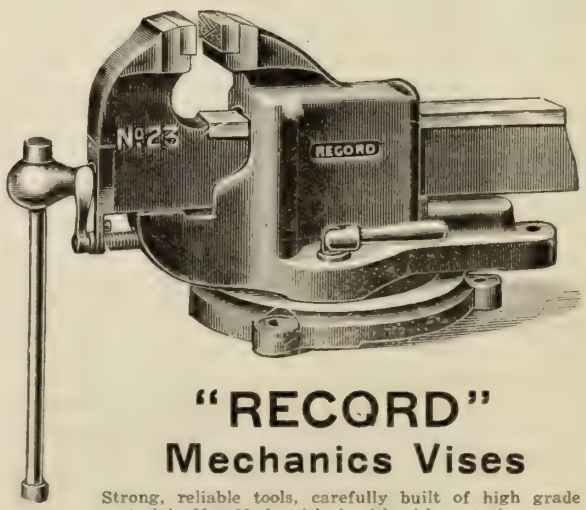
And the WAHLSTROM Chuck conserves energy! With it the operator can make tool changes in just two seconds, without stopping the spindle of the machine. **You can use it for ten days, free.** Your name and address will bring it.

Handy — Efficient — Powerful
DUMORE Electric GRINDERS

For general tool room use and for grinding hardened tools this No. 2-A.C. DUMORE grinder is unequalled. A portable tool-post type—always on the job—with a speed of 10,000 R.P.M. and an arm speed of 30,000 R.P.M.



Equipped with universal motor, operating on either D.C. or A.C. Selected bearings. Net weight, 15½ lbs.



"RECORD"
Mechanics Vises

Strong, reliable tools, carefully built of high grade materials No. 23 furnished with either stationary or swivel base. Quick-gripping jaws. **Buy them at Aikenhead's.**

Aikenhead Hardware, Limited
17 Temperance Street, Toronto, Ont.

000,000 and assets of more than $31,000,000 although their original assets consisted of only $10,000. To speak of all the companies he helped organize would take considerable space. Sufficient to say he had many interests, and he has held some wonderful positions in his day. He was a very energetic man, brooked no rivals, and thoroughly understood his business. As J. J. Ashworth, assistant general manager of the Canadian General Electric Co. puts it, "No one had a better grasp of the details of the manufacturing enterprises than he. Particularly was this true of everything that related to the C.G.E. The commercial life of the country will greatly miss his efforts in this direction. In his social relationships he was one of the most human of men and in all his business affairs strictly just."

James Cant, Superintendent of the Wallace Shipyards in Vancouver died a few days ago of heart disease. He was born in Dundee, Scotland, 54 years ago, and was for years manager of the Caledonian Shipbuilding Company. He came to Canada in 1912 to take charge at the Wallace yards.

Sir John Kennedy died in Montreal a few days ago in his 84th year. Sir John had been prominently connected with the Port of Montreal since 1875. He graduated from McGill University sixty years ago and later became Chief Engineer of the Great Western Railway and resigned from that position in 1875. It was then that the deepening of the St. Lawrence ship chnnel to 24 feet was determined upon, and as soon as the necessary legislation was obtained, the management of the work, as well as that connected with the Montreal harbor enlargement, was put into his hands, with the title of chief engineer. The method of deepening advised by Mr. Kennedy as being the most advantageous to the shipping trade of the harbor was adopted for that and all subsequent deepenings of the ship channel carried out by the harbor commissioners. In 1888 Mr. Kennedy prepared the plans for the harbor enlargement which is practically responsible for the present up-to-date harbor enlargement which are practically was commenced in 1890, and by 1906 the harbor, as it is to-day was clearly outlined.

In 1907 Mr. Kennedy's eyesight failed him and he resigned as chief engineer, but was appointed consulting engineer, a position which he held until his death. The services which he rendered to Canada were recognized by knighthood in 1916. In March, 1917, the degree of L.L.D. was conferred on him by McGill, and in May of this year that of D.C.L. was conferred by McMaster University, Toronto. Up to a month ago he was a daily visitor at the offices of the harbor commissioners. He served on several Royal commissions. Among them were, the one in 1886 inquiring into the leasing of water power on the Lachine Canal; in the same year on a similar body to solve the problem of spring floods in Montreal, and in 1888 on the commission to inquire into the advisability of completing the Trent Valley Canal. He was also on the commission in 1917 which reported against the Hydro Radial system in Ontario. He was one of the ratepaying engineers who persuaded the Montreal Civic administration some years ago to abandon plans being followed for the new Montreal Aqueduct system.

He was one of the 19 founders in 1887 of the Canadian Society of Engineers, now the Engineering Institute of Canada. He was the sixth president in 1892. His interest in the Institute never diminished, and until a short time before his death he was a regular attendant at the weekly meetings. His services as an engineer and citizen were recognized by the Institute in 1907, when he was elected one of ten honorary members. He was also a member of the Institute of Civil Engineers of Great Britain, and since 1915 chairman of the advisory committee of the Council for Canada. He was a member of the American Society of Civil Engineers since 1875, and a director from 1898 to 1900.

THINKING ENGINE IS TESTED CAREFULLY

In our editorial columns this week we speak of the "thinking" locomotive. This device automatically prevents railway collisions and nearly all sorts of railway accidents. The mechanism is controlled by electricty running at a very low voltage through the rails. The railway is divided into insulated sections of suitable lengths and the locomotive is provided with an induction coil placed two inches above the tracks. This "picks up" the current which, transformed into a higher power, magnetically sustains a weight in the engine cab. This weight, if dropped, will act on the locomotive's mechanism and bring it to a standstill, But the voltage is so low that it is sufficient for only locomotives and hence if two approach each other the current becomes insufficient and the weight drops, causing first a blowing of the whistle, second the shutting off of the steam, and third, application of the brakes.

Does not Depend on Human Element

It is stated that the installation of the new system on eight lines in England will begin immediately. The system operates even if the engine driver is drunk or asleep. The human element is only on the mechanic who controls the supply of current to the locomotives, but the worst that could happen from his carelessness would be a momentary suspension of the traffic.

Mr. Angus the inventor, claims that his system will greatly increase the safety of moving traffic on congested lines. Its novelty is the absence of any "shoes," "clamps," or other mechanical contacts which it is claimed have made all previous systems unsatisfactory. Finally Mr. Angus claims that the system is very economical; in fact he purposes to install it on the English railways free of charge, taking as his profit half of the resultant saving in the operating costs.

BUSINESS MEN GIVEN GOOD ADVICE

In Mr. O'Connor's opinion, the business man of to-day is confronted with the option of sitting down to wait for the clouds to roll by, or to get up and push those clouds away." Mr. O'Connor is general manager of the Murray-Kay Co., Toronto, and the above remarks were given a few days ago in an address before the Lions' Club at Toronto. Among many other thing things he said, that manufacturers cannot put their spare money into tax free bonds, then go out and play golf or something else, and think that is going so save the situation.

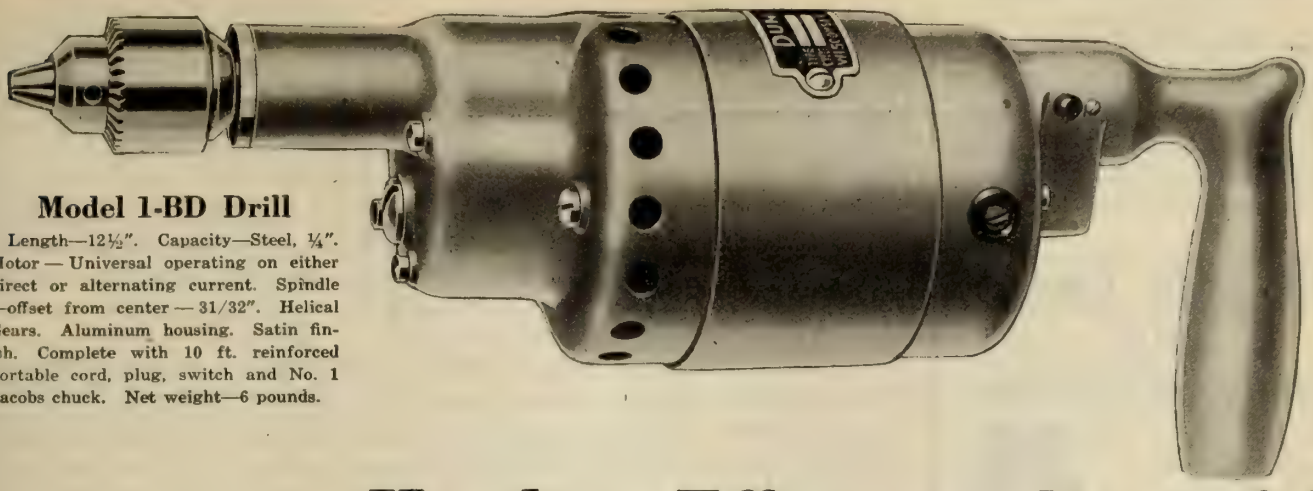
"Such a plan is so ephemeral, and so obviously not the solution to any country's financial problems," remarked Mr. O'Connor, "that I am surprised that men who have built fortunes for themselves can become converts to it. Capital cannot exist in a strong box. The only place that capital can keep its life is out in the open. Nothing would be more fatal to any community than the common adoption by all who had savings of such a plan."

In Mr. O'Connors opinion, business will not be stabilized until business men can look upon each other without suspicion.

PORTLAND CEMENT

The U.S. Geological Survey, department of the interior, say that the movement of portland cement continued on a large scale throughout September, more than 11,300,000 barrels having been shipped from mills. Shipments of portland cement during the third quarter of the year were approximately 33,970,000 barrels, establishing a record for this quarter. For the nine months ending September 30, 1921, the shipments amounted to 74,045,000 barrels, which exceeds the former record volume moved in the corresponding period of 1920. Favorable operating conditions are indicated by the large September production of 10,027,000 barrels of finished cement, which established a record for that month. The average daily production was greater than that of August, and had there been as many days in September as in August the September production would have shown the larger total. Production for the third quarter likewise established a record, and for the nine months ending September 30 the production was about 99.8 per cent of the record quantity made during the period last year.

The Bureau of Foreign and Domestic Commerce, department of commerce, reports that imports of hydraulic cement in August amounted to 10,988 barrels valued at $216,892. The exports of hydraulic cement in August were 84,52[illegible] barrels valued at $3,253,463, the total exports for the eight-month period were 848,971 barrels, valued at $3,253,463.



Model 1-BD Drill

Length—12½". Capacity—Steel, ¼". Motor — Universal operating on either direct or alternating current. Spindle —offset from center — 31/32". Helical Gears. Aluminum housing. Satin finish. Complete with 10 ft. reinforced portable cord, plug, switch and No. 1 Jacobs chuck. Net weight—6 pounds.



Model 2-BD Bench Drill

Motor specifications identical with Model 1-BD.
Height—20½".
Stroke—3¼".
Rack and pinion feed.
Capacity—Steel, ¼".
Drills to center of 7⅞" piece. Ball Bearing thrust. Aluminum housing. Adjustable table. Complete with 10 ft. reinforced portable cord, switch, plug and No. 1 Jacobs chuck. Net weight 21 pounds.

Handy—Efficient—Powerful

DESIGNED by men who know the practical advantages of small, light tools that get to the spot where needed without waste of time, Dumore Drills save time, money and energy. Equipped with perfectly balanced motors, Dumore Drills are accurately built and have an almost unlimited range of usefulness. For speed and accuracy on fine and sensitive jobs Dumore Drills will supplement the work of your big machines—adding to the capacity of your shop and cutting down production costs on many classes of work.

Send for details of how you can use Dumore Drills to advantage.

Wisconsin Electric Company

2941 Sixteenth Street Racine, Wisconsin

DUMORE GEARED ELECTRIC DRILLS

HAMILTON ENGINEERING SERVICE
LIMITED

Consulting and Designing

Tools, Jigs, Fixtures and Special Machinery. Let us shoulder your problems.

195 KING WILLIAM ST. HAMILTON

"Maple Leaf"
BRAND
Stitched Cotton Duck Belting

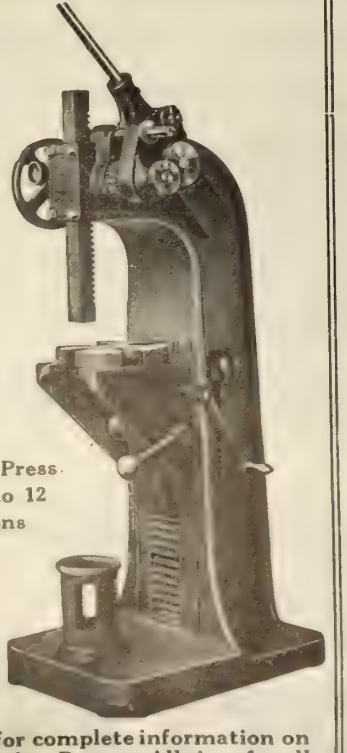
"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.



Have us send you samples and see just why "Maple Leaf" sets the standard in economy, strength and durability.

Dominion Belting Co. Ltd.
Hamilton, Canada

Quebec Branch: 51 Duluth Bldg., Montreal



No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger — Windsor, Ont.

SELLING GOODS TO THE JAPANESE

Speaking on the value of advertising in the markets of the Far East, M. Malabar, office of trade commissioner, Yokohama, says that the Japanese are an exceedingly artistic nation, and their attention is at once drawn to any advertisement which is such that it appeals to their artistic sense, which is indeed so strongly developed that any industrial product or article which may be brought to their attention in some journal, newspaper, magazine, poster, etc., by well-designed advertisement portraying the product will often be the means of arousing a desire to procure that article without delay. The more widely an article is advertised, the more strongly and urgently does the desire to possess it grow, as the Japanese loves to be considered progressive and "wide-awake."

The manufacturers of the United States—who thoroughly understand advertising owe a great deal of their success in Japan to their genius for advertising. Not only do they produce advertisements which immediately attract the attention of the reader in Japan because of their artistic qualities, says Mr. Malabar, but they also see that such advertisements are repeatedly brought before his eyes; and the results fully justify their efforts in this direction.

Canadian manufacturers are urged to pay more attention to this means of promoting the sales of their products in the Japanese market, and it is said that the results will fully justify the expense. The trade commissioner will be pleased to render assistance in the way of advice to any manufacturer desiring to advertise in the papers or magazines of Japan. He will be able to give information as to the best channels for each advertisement, will be able when it is necessary to have the same translated into the Japanese language (i.e., where advertisements are both verbal and pictorial), and will personally report on any interest awakened by such means.

SMITH BELTING
83 YORK ST. TORONTO

SPECIAL MACHINERY
Dies, Tools, Jigs, Repairs
Speedy Service—Phone Adelaide 2
HENRY C. THOMAS
337 King St. West, TORONTO, Ont.

MONTREAL LETTER

(Continued from page 55)

the volume of business is not setting any record, but it has the appearance of being of a steady, dependable nature. Prices still run considerably above the 1914 schedule, but are slowly being reduced. The railways are purchasing along these lines in fairly large quantities. It is rumored that the National Railways expect to open their repair shops at Port Arthur. This will mean large orders for small tools and supplies.

Non-Ferrous Metals

"Marking time" is a good expression to use when attempting to describe the week's business in non-ferrous metals. Prices have remained stationary and the small volume of business passing, is about the same as that of the past few weeks. The larger brass foundries are following the methods pursued by the iron foundries, and are only purchasing from "hand to mouth." This, coupled with the small volume of business presents a very colorless situation.

All lines of scrap metal markets present the usual inactivity. As has been stated in these columns many times, there is but little prospect of improvement this year and it is altogether too risky to prophesy beyond that.

PORTABLE TOOLS

Continued from page 35

er, planer, and portable horizontal boring mill. Each of the machines mentioned is self contained and is portable, yet one would find it extremely difficult to pick up such a tool and walk away with it. In many cases it is good policy to take the machine to the work, rather than the work to the machine, and an example of this is shown at Fig. 3. Here we see a portable planer cutting out tee slots in a large floor plate section. At the same time as this is going on, the portable boring mill drills the holes shown in the photograph. Each machine is self contained and motor driven, so that although heavy machines in themselves, they are nevertheless portable in the broad sense of the term.

Another small portable tool, which should be mentioned, is the die filing machine. This type of tool is especially useful in the making of armature dies, or in fact on any type of die having a peculiar shape and narrow slots. Of course, the use of such a machine is not confined to dies for it will accomplish filing on any style of work. It is chiefly used, however, on die work.

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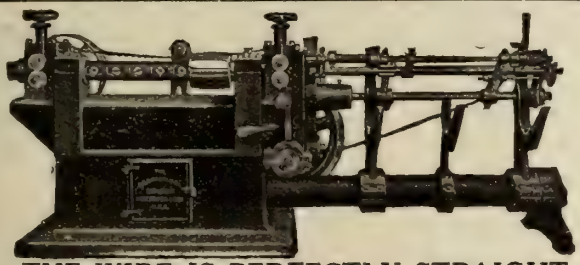
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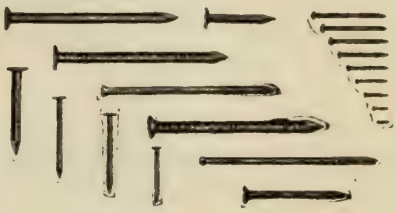
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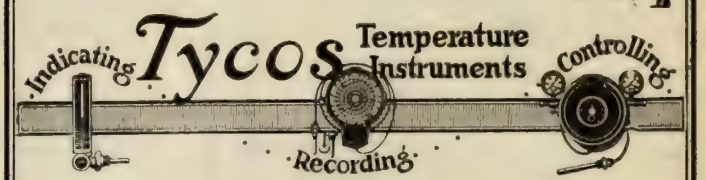
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Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc,, etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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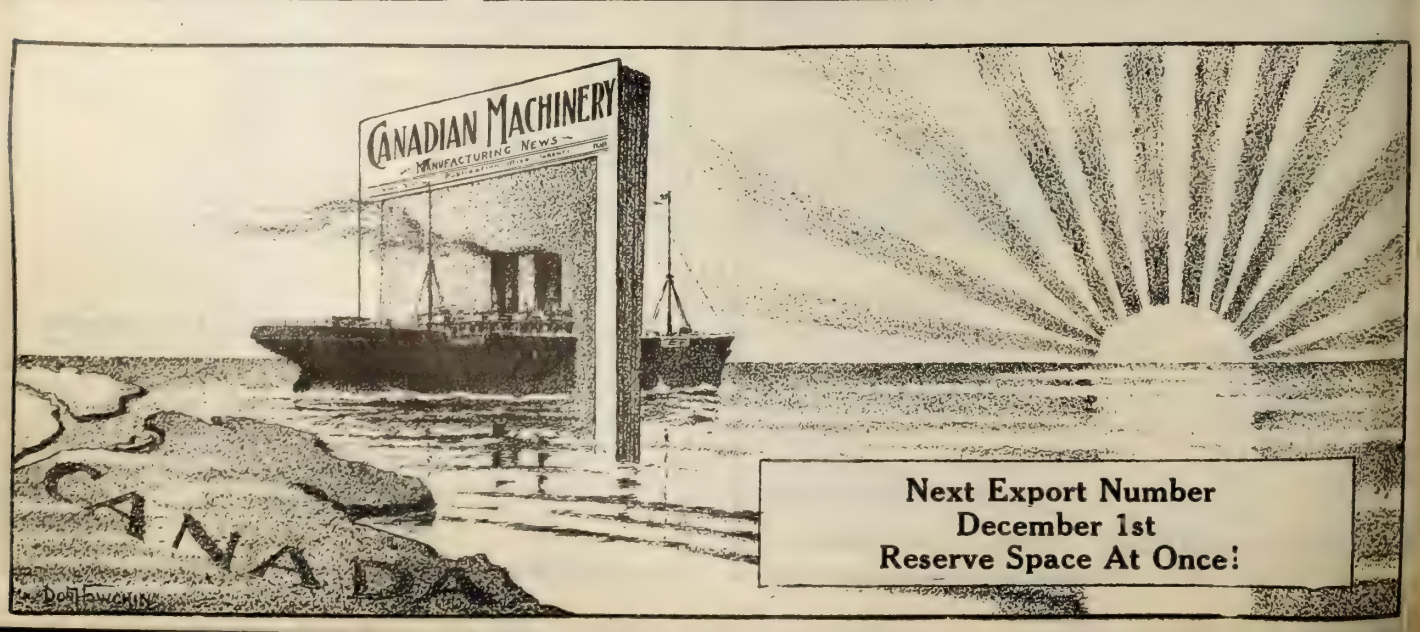
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No. 79—P. & W. Duplex Spindle Profiler.
No. 82—Cincinnati Plain Miller, Lincoln Type.
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No. 103—Flather Plain.
No. 104—Armstrong Whitworth Plain.

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No. 134—Rivet No. 3 Boring Grinder.
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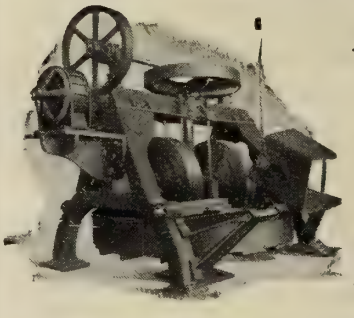
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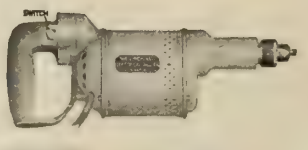
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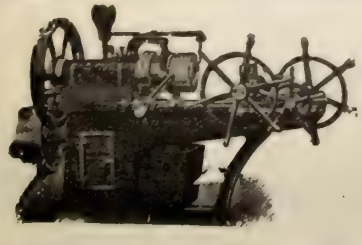
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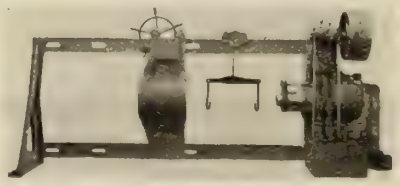
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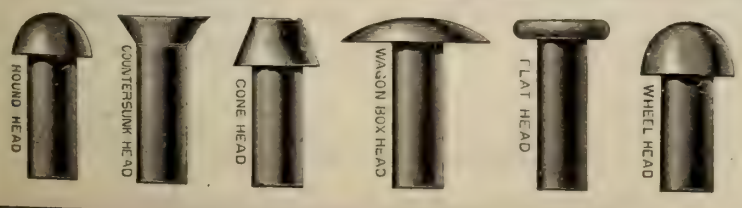


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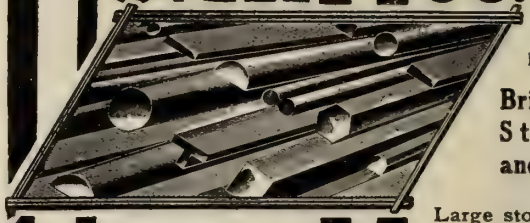
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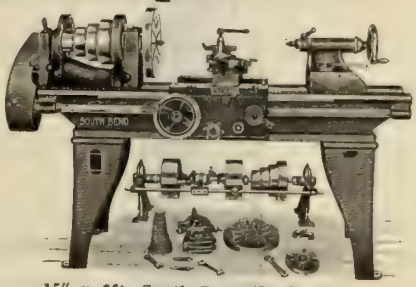
We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us. **Ask us.**

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

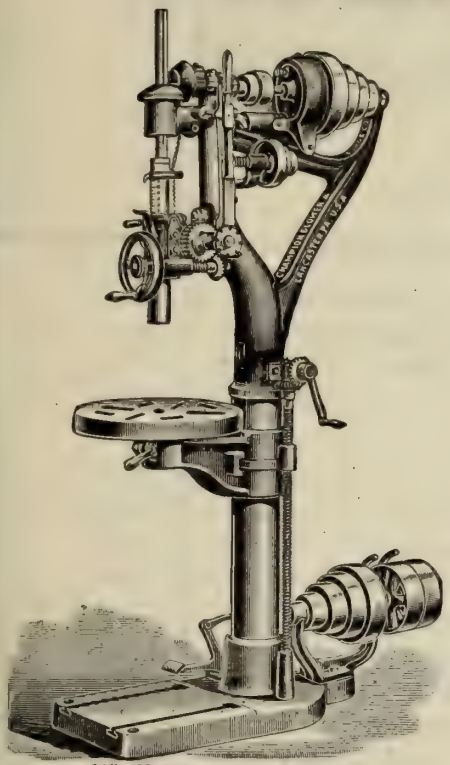
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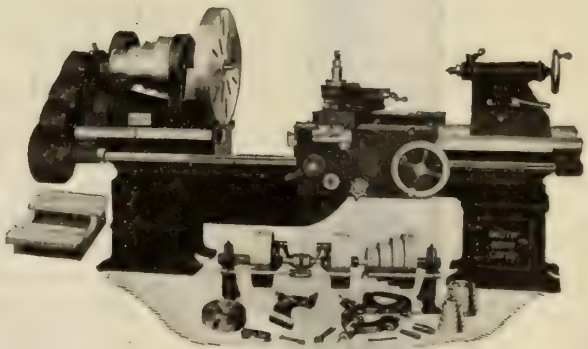
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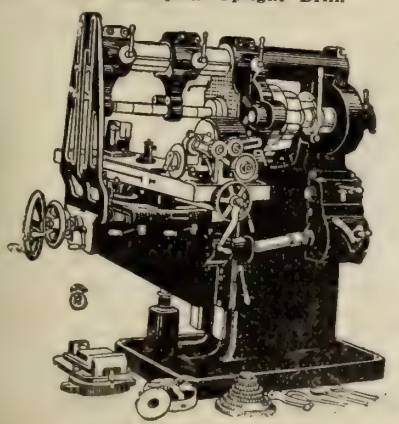
15" x 6ft. South Bend Engine Lathe.



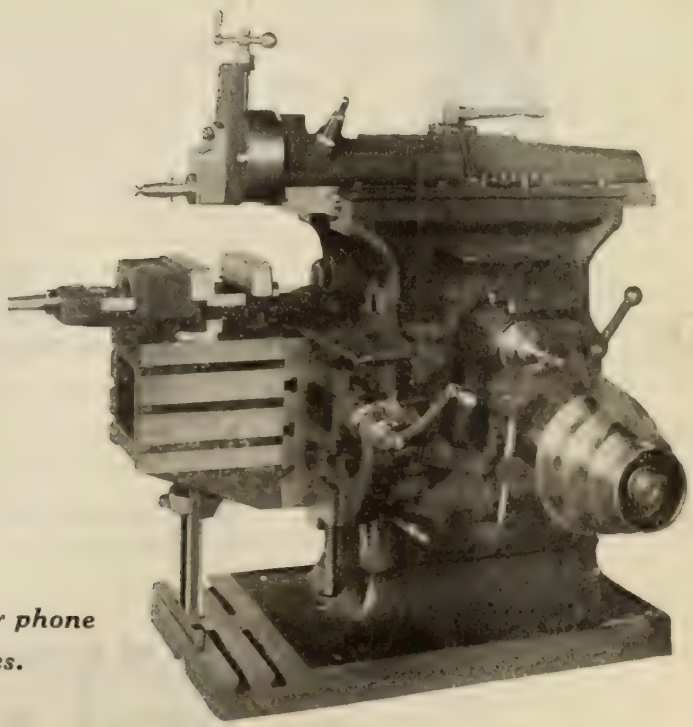
20" Champion Upright Drill.



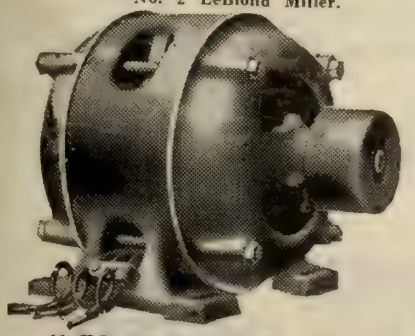
21" x 30" x 12-ft. South Bend Gap Lathe.



No. 2 LeBlond Miller.



16" McKenzie Shaper.



10 H.P. Canadian Westinghouse Motor.

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Made in Canada

PRODUCTION requirements in an ever-increasing number of plants necessitate the use of a strong, accurate drill, specially designed for hard drop forgings, steel castings, and other alloy steels equally tough and difficult to drill.

For this service we have developed a hot rolled process drill known as the Canadian-Detroit Double-D (DD) Rolled Drill. It combines the strength of the forged type drill with the accuracy and uniformity of the milled type.

The flute of the DD is formed straight from the bar stock by successive passes through specially built and patented rolls at a temperature of 1850° F. This mechanical rolling of the flutes produces a refinement and uniformity in the grain of the steel and gives additional density at the centre and at the outer edge. Each drill is rolled separately, and the rolls are so designed and operated as to produce the same uniform increase in web thickness as is obtained in high-grade drill of the milled type.

The fluted drill is reheated and twisted in a specially designed automatic machine. The twisting process is held absolutely uniform, giving the same increase in helix angle from shank to point, 27° to 32°: this standard has been adopted on our milled drills and has been proven by exhaustive experiments to be the most efficient.

The DD has increased production and cut drilling costs in many of the finest plants in Canada. A fair test will convince you.

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We also manufacture and carry in stock all sizes and types of high speed and carbon milled drills.

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Hi-Carbon (electric furnace)
Special Analyses

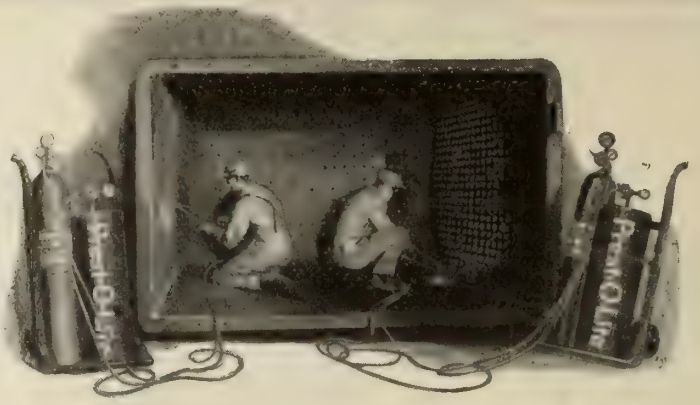
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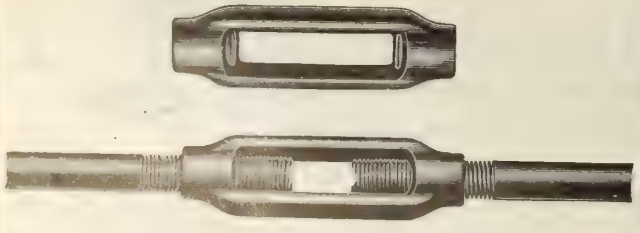
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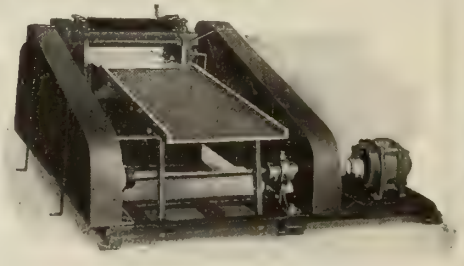
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is completely guarded. Note the direct connected motor and countershaft on sliding base, also the receiving table.



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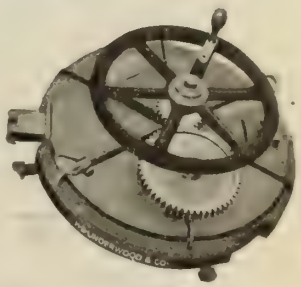
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Locomotive Cylinder or Dome Facing Machine

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Gearing is all cut from the solid. When working, the clutch is thrown in by moving the lever with clutch pin attached (shown in illustration, on top near the hand crank) and the machine feeds automatically. All working parts are covered and easily oiled. Taper socket can be furnished to take the place of hand wheel for air motor drive.

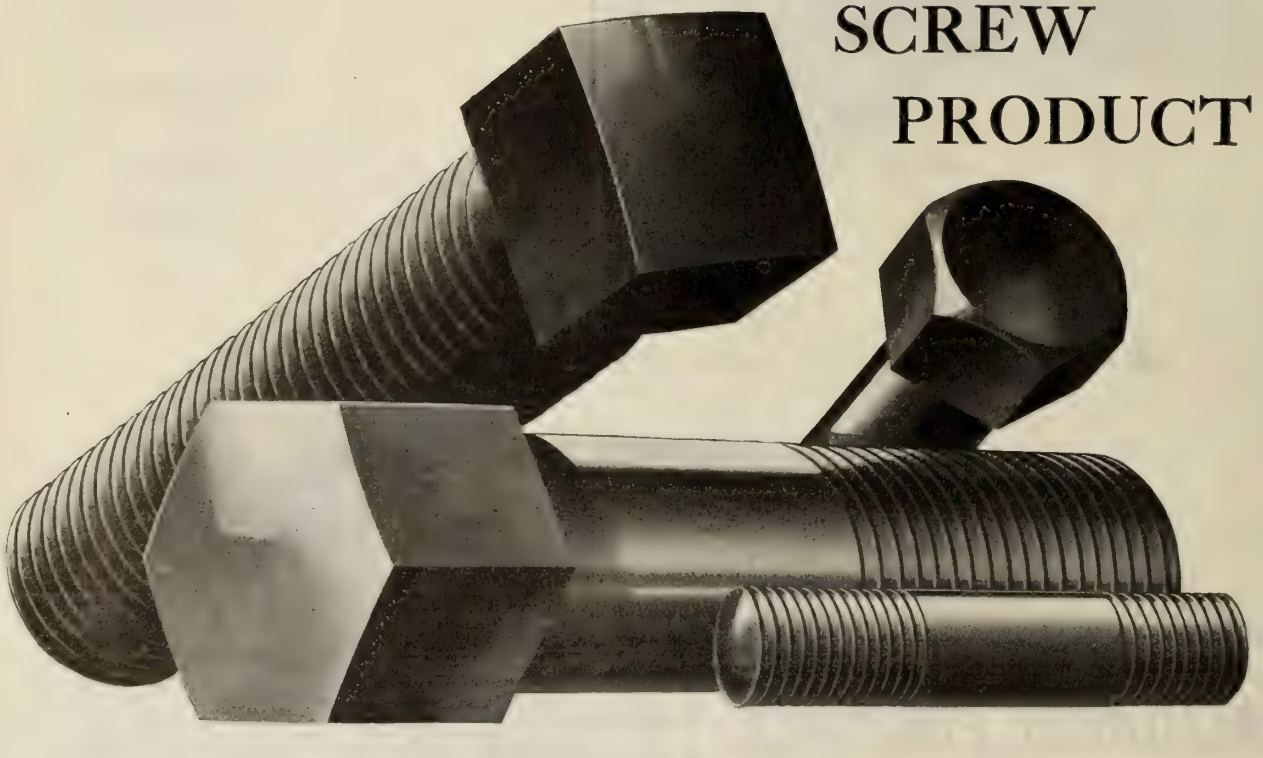
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Plain and Castellated S.A.E. Nuts
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Screw Machine Product up to 2¼" diam.—to specifications
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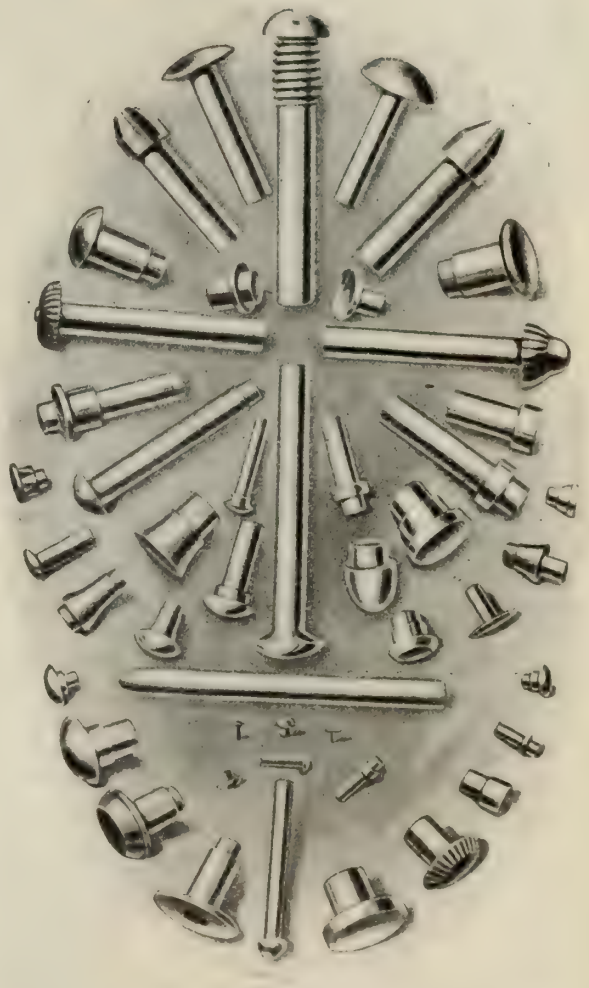
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LAYING the blame on the drafting room doesn't help us. Theoretically they should have noticed those transposed figures when they checked the tracing, but the fact remains that the error crept in in spite of the checking.

"And what is the result? It will cost us our entire profit on the job to correct the results of that mistake. And we could have bought several PHOTOSTATS with what we will lose.

"That mistake **couldn't** have occurred if we had made PHOTOSTAT copies of the blueprint instead of tracing it. The PHOTOSTAT makes photographic facsimiles so you don't even have to check them.

"And compare the time it takes to make PHOTOSTAT copies against the time it took our drafting room to trace that blueprint and to make additional blueprints. Why, it's a matter of minutes against hours. By copying blueprints, pencil sketches, drawings and orders with the PHOTOSTAT we can get all our work into the shop days earlier than we do now.

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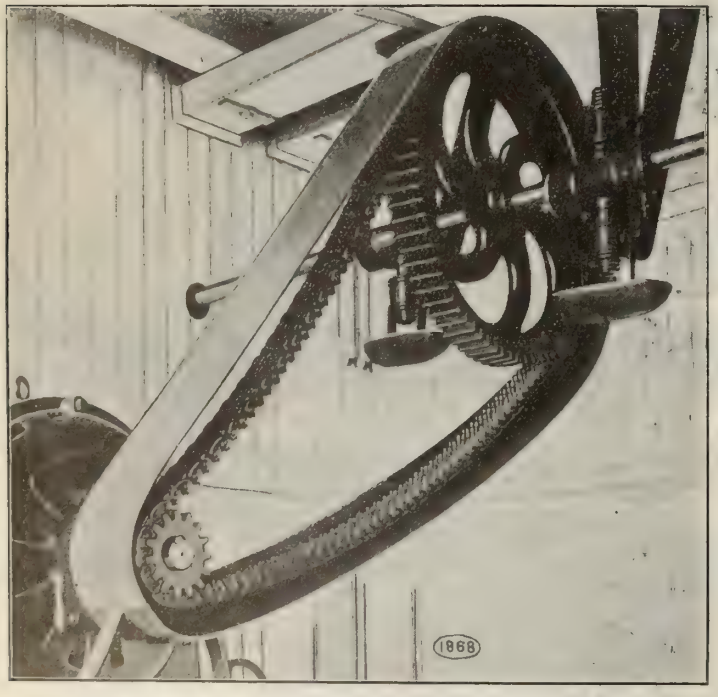
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MAXIMUM EFFICIENCY IN POWER TRANSMISSION ASSURED BY

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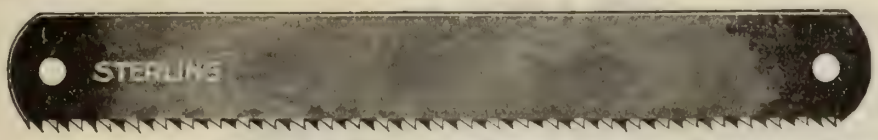


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Guarantee satisfaction. A trial will convince you of their superiority.

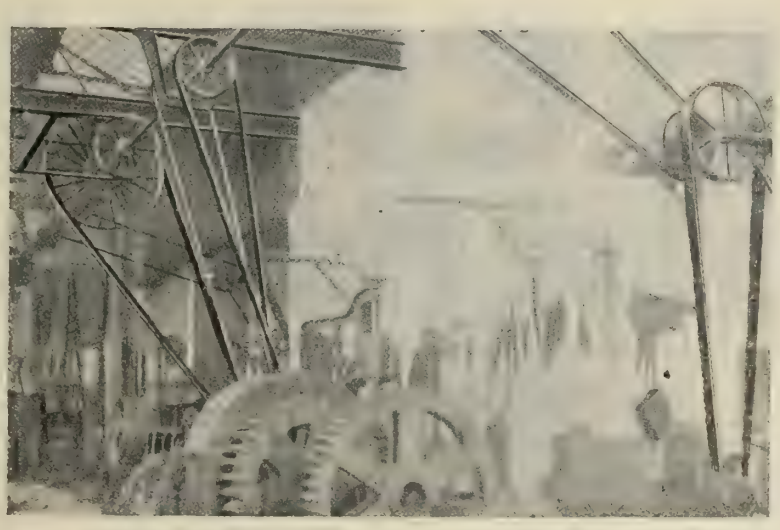
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Solid Woven Belting



Solid Woven Hair Belting
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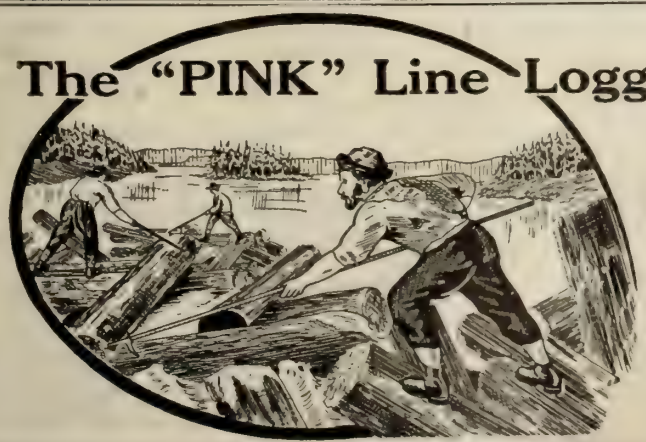
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These beltings will solve your driving problems and save you money.

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The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

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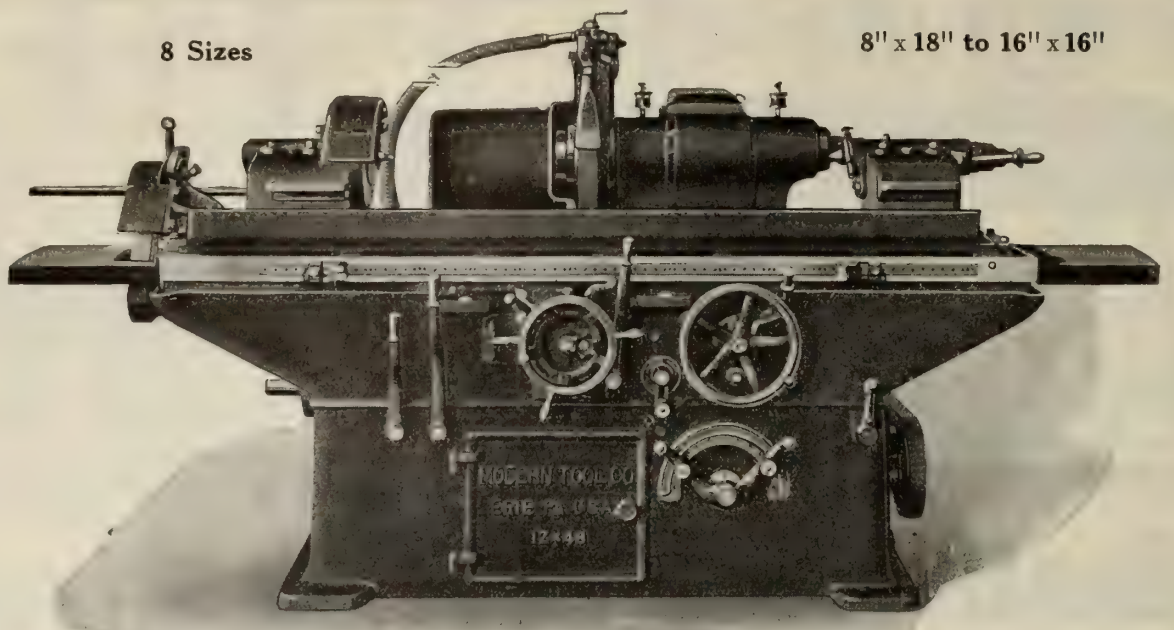
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We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

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8 Sizes

8" x 18" to 16" x 16"



MODERN
Plain Grinding Machines

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The shaft is ground, and mounted on anti-friction bearings; runs at constant speed. Power can be applied from a line shaft or direct from motor. All parts are balanced to eliminate vibration.

Wheel Drive

More powerful than other types of same racing. A 4 in. endless belt carries the full power from main shaft direct to wheel spindle, giving constant smooth drive.

Gear Case

All speeds and feeds are secured from one gear box, a separate unit, which may be readily removed for inspection or renewal of bearings. Gears are in mesh at all times, and are engaged with shaft by our patented positive ball drive clutch, which permits instant change. Gears of steel with hardened bushings run in grease.

Send Us

—Blueprints and specifications, and we'll tell you what a Modern will do on your job.

Motor Drive

A constant speed motor may be attached to the main drive shaft of the machine by belt, silent chain, or flexible coupling.

All Modern Plain Grinders are specially designed for most convenient connection to motor.

Table Drive

This is through worm and worm wheel insuring smooth, uniform travel. Four table feeds, 22 in. to 104 in. per minute are secured by lever on front of machine.

Wheel Side

Travel is on "V" and "Flat" ways, giving true, accurate movements and long life. A gib prevents raising of slide when heavy cuts are taken.

Bearings

Wheel spindle has bronze bearings with outside taper. Quick take-up for wear without dismounting is provided.

Main drive has anti-friction bearings.

Headstock has ball bearings.

Gear box has phosphor bronze bearings.

All provided with proper lubrication.

All shafts are ground.

MODERN TOOL CO., Erie, Pa.

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WE WILL SUPPLY
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All sizes in Stock. Immediate Deliveries.

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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

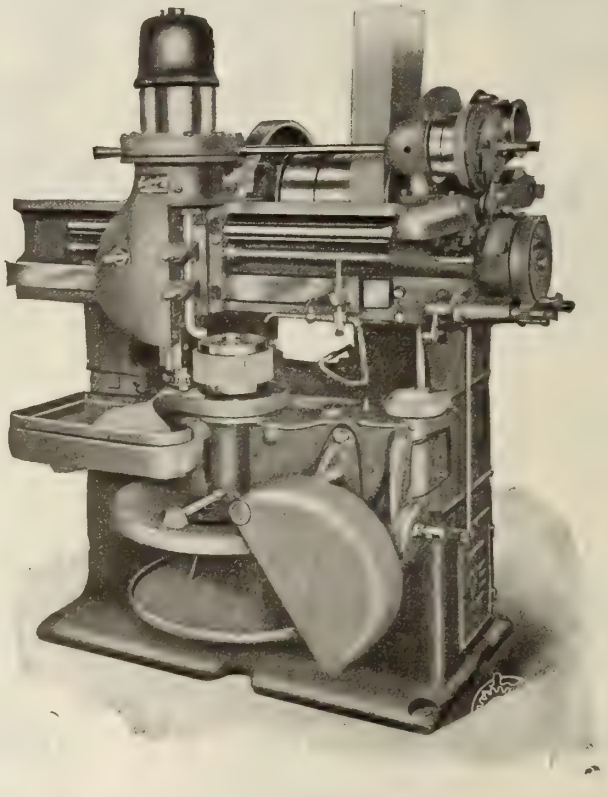
A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this little word "IF."

When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of Gear Cutting with the "IFS" Left Out.

Send for your copy to-day



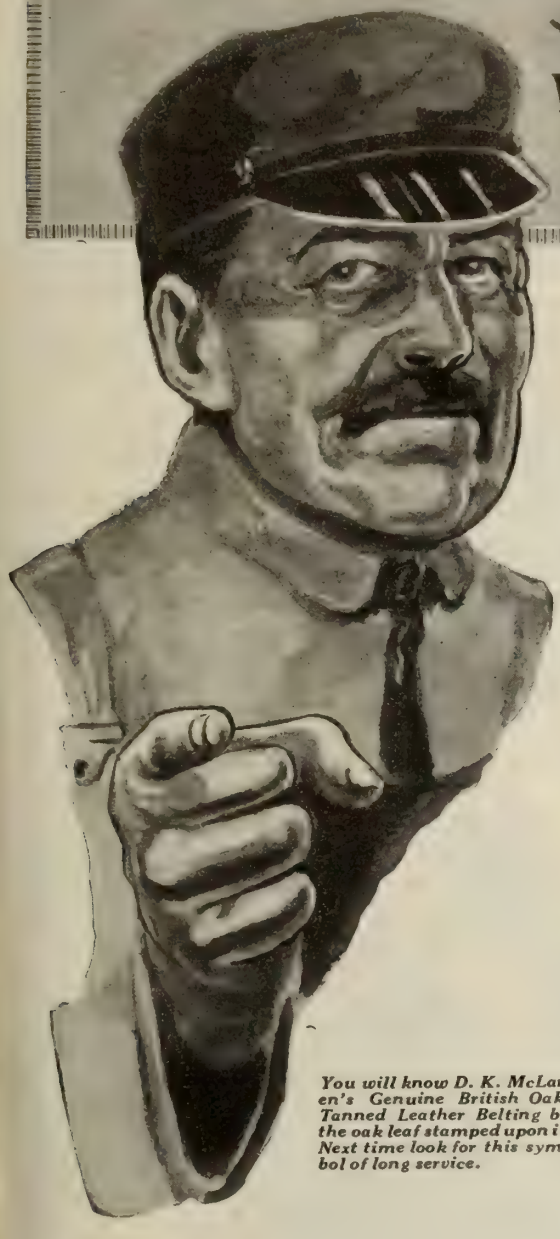
The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana. Alfred Herbert, Milan, Italy; Alfred Herbert Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India), Limited, Calcutta, India.

"Belting trouble ends where D.K.McLaren's Belting begins"



You will know D. K. McLaren's Genuine British Oak-Tanned Leather Belting by the oak leaf stamped upon it. Next time look for this symbol of long service.

And this fact has been proven over and over again!

Why, you ask, can D. K. McLaren's Leather Belting do for me what other beltings have failed to do? How can this belting eliminate slippage? How can it reduce stretch to practically a negative quantity? How can it prevent break-downs and power losses? What is the reason for such high efficiency in a belting?

Part of the answer is found in the fact that D. K. McLaren's Leather Belting is all leather—and the best leather at that. It is taken from the choicest steers and only the **backs** are used. That is why it is so strong, so flexible, so long-lasting.

The rest of the answer is found in the tanning process. **British-Oak-Tanned!** This preserves all the hide's natural strength and gives it added value.

A sure way to prove the economy of using D. K. McLaren's Leather Belting is to compare its hug, when slightly slack with the extraordinary tension required to make other belts grip. You will be satisfied that considering "value per dollar," D. K. McLaren's Belting is the cheapest on the market.

A list of the firms all over Canada using D. K. McLaren's Belting will be forwarded on request.

GENUINE OAK

D·K·McLAREN
LIMITED

GENUINE OAK

HEAD OFFICE AND FACTORY

351 ST. JAMES STREET, MONTREAL, P. Q., CANADA

VANCOUVER, B.C.
334 Cordova St. West

TORONTO, ONT.
194 King St. West

ST. JOHN, N.B.
90 Germain St.

INCREASE THE CAPACITY OF YOUR MERCHANT

There are two kinds of business policies of the merchandising field to-day.

The first believes the goods are sold when they have been sold to the merchant. Having bought the goods it is up to him to sell them and to get rid of them the best way he can.

The other thinks of merchants in terms of their capacity to sell his goods to the ultimate consumer, and having sold them to keep them sold and keep them coming back for more. The former very often finds new competitors coming into the field, and taking away a great deal of the business he has come to expect should be his.
The second approaches his merchant on a man to man basis. He encourages him to build. He shows him clearly and carefully what he is doing to help him create a market for the products he is distributing. Through the business newspapers the merchant reads, he shows him the turnover possibilities in his line. In fact, he shows him how to make more money for himself, and incidentally make more for the wholesaler or manufacturer.

The second and most successful type of business realizes that training does not stop when he has trained and sold his own selling force on the goods he is merchandising. He realizes that this is only a beginning, that the great force of retail merchants who finally dispose of his goods to the ultimate consumer must be trained, must have knowledge, must have information, so they in turn can prove and sell the ultimate consumer.

The one great way to reach the merchants who are selling your goods is through the MacLean Trade newspapers, which merchants are reading every day and every week of the business year. They are reading them for new ideas, methods, for merchandising plans, for schemes to make more money. Now as never before they are studying the market pages and price quotations of every issue. Firms who are taking advantage of this avenue to better business are finding results far in advance of their expectations.

THE MACLEAN PUBLISHING COMPANY LIMITED

TORONTO MONTREAL WINNIPEG VANCOUVER

Publishers of the following specialized trade and technical newspapers

Trade Newspapers

Weekly

Druggists' Weekly
Hardware and Metal
Canadian Grocer

Monthly

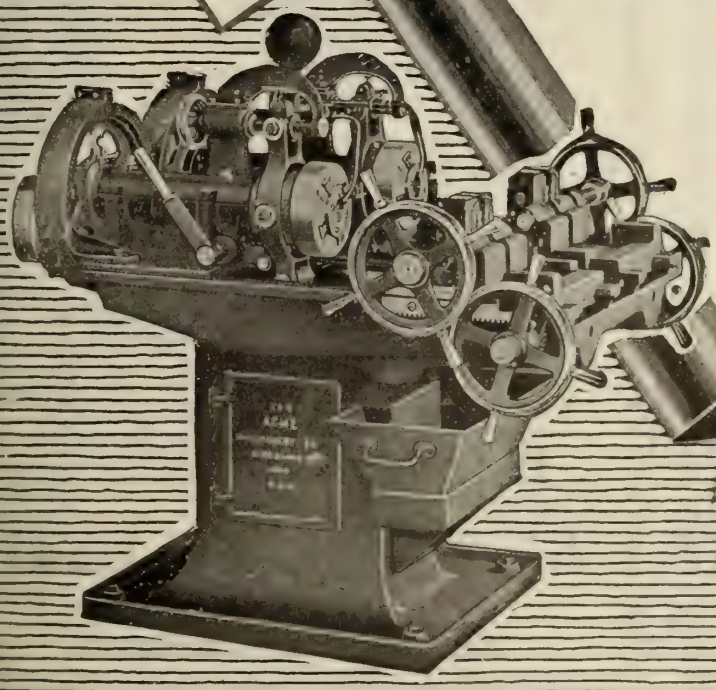
Dry Goods Review
Men's Wear Review
Sanitary Engineer (Semi-Monthly)
Bookseller and Stationer

Financial

The Financial Post

BOLTS

SQUARE HEXAGON TEE-HEAD



Cut Them In Your Own Plant

and Save Money on Cost and Delay in Deliveries

ACME BOLT CUTTERS

are made in various sizes for cutting bolts from ¼ to 1 in. diameter. Their heads allow micrometer adjustments while they are in motion. The dies can be changed from one side to another in less than one minute and produce clean, accurate, highly-finished threads.

May we send catalog?

The Acme Machinery Co.

4530 St. Clair Ave. Cleveland, Ohio

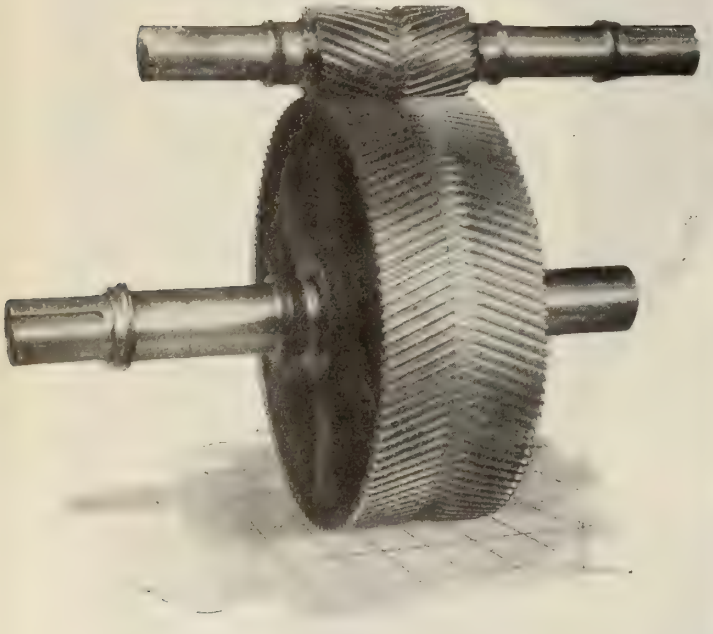
We make a complete line of Bolts, Rivet, Heading, Upsetting and Forging Machines, Bolt Cutters, Hot Pressed Nut Machines, Hammer Heads, Bolt Pointers, Nut Tappers.

Representatives for Canada:
The John Bertram & Sons Company, Limited, Dundas, Ont.

ACME BOLT CUTTERS



We
make
Double Helical
Gear Drives



Let us quote you
on
High Class Gear Work

Hamilton Gear
& Machine Co.

Van Horne St.- TORONTO



MADE IN CANADA

WILLIAMS' SUPERIOR

DROP FORGED HAMMERS

Are dependable tools because:—

Their heads, drop-forged from a special grade of tough steel, carefully hardened and tempered, neither crack, chip nor splinter.

They are fastened most securely and solidly to the handles—can't work loose—can't fly off.

Their handles are made of the best grade of clear, straight-grained hickory, flared at the grip to prevent hand-slip.

The weight and length of each tool are properly proportioned to give perfect balance, and, hence, increased striking power.

Williams' quality Hammers of all kinds and sizes. Catalog on request.

J. H. WILLIAMS & Co., Limited

"The Drop-Forging People"

Formerly Canadian Division of
THE WHITMAN & BARNES Mfg. Co.

45 Thorold Road - St. Catharines, Ontario



MADE IN CANADA



500% More Threads

MURCHEY

Solid Adjustable Taps

Murchey Solid Adjustable Taps, equipped with high speed chasers, will cut five times more threads than a solid carbon tool. Yet the chasers sell for about the same price.

The Logical Conclusion then is Murchey for Economy!

Besides this Murchey equipped machines can be operated at twice the speed of machines with carbon tool set-ups, and the chasers are always cutting full size. *These facts mean so much to you that*

You should write today for samples and the complete story.

Murchey Machine & Tool Co.

75 Porter St., Detroit, Mich.

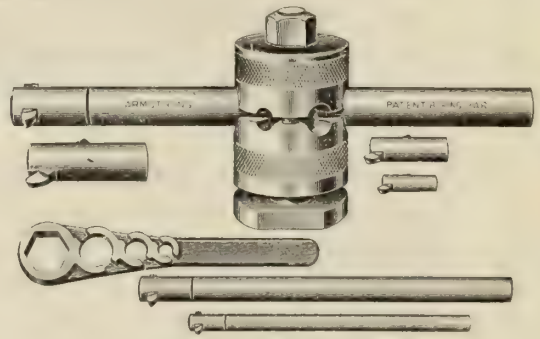
Fenwick Freres & Co., Paris, France



Armstrong 3-Bar Boring Tool

A slight turn of one nut releases or fastens both Bar and Holder.

Bars can be changed as needed almost instantly, thus allowing the operator to use the stiffest bar possible for each job, with the result that speeds and feeds can be increased and time saved.

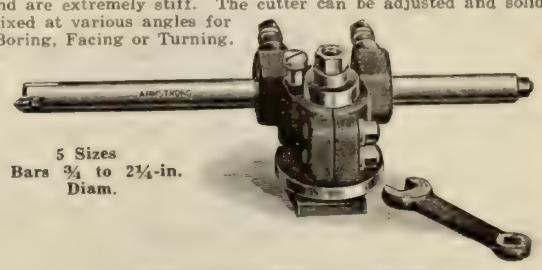


No. of Tool	1-B	2-B	3-B	4-B
Diam. Bars.	½, ¾, 1⅛	9/16, 15/16, 1 5/16	¾, 1⅛, 1½	15/16, 1 5/16, 1 13/16
Length Bars	8, 11, 16	9, 13, 18	11, 16, 21	13, 18, 24
Size Cutters.	3/16, ¼, ⅜	3/16, 5/16, 7/16	¼, ⅜, ½	5/16, 7/16, ⅝
For Lathes.	14 to 16	16 to 18	20 to 22	24 to 32

Adjustable Boring Tool

Patented

This tool combines Convenience, Adjustability and Rigidity to a remarkable degree and is well adapted to a very wide range of work. The holder is easily adjustable to different heights and will hold bars of various diameters. The Bars are made from high carbon steel seamless tubing of heavy gauge and are extremely stiff. The cutter can be adjusted and solidly fixed at various angles for Boring, Facing or Turning.



5 Sizes
Bars ¾ to 2¼-in. Diam.

NEW CATALOGUE B-20 FREE

Canadian Agents—Williams and Wilson, Montreal; A. R. Williams Machinery Co., Toronto, Winnipeg, Vancouver, St. John.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

306 N. FRANCISCO AVE. CHICAGO, U.S.A.

AN IMPORTANT QUESTION

For the Advertiser to Answer

Is the Publication Soliciting Your Business a Member of the Canadian National Newspapers and Periodicals Association?

YOU would never engage a man on an important piece of work until you gained a thorough knowledge of his qualifications. It would not be wise. You first of all require a clear record of his character and ability, in addition to a statement of his aims and aspirations. When you are in possession of this information you have a real basis for judging his fitness to serve you.

It is just as important that you should know the character, ability and aspirations of the publication in which you desire to carry your business message.

You should know if the paper is circulating and has an influence among those men who are responsible for results—the men who buy, or influence the buying, of machinery, tools, power and any other equipment or merchandise which you may sell.

Facts are essential. When you are in possession of the facts you can make every dollar spent for advertising a judicious investment. To enable the advertiser to make such judicious investment is the purpose of Canadian National Newspapers and Periodicals Association. From this Association the advertiser may secure complete information concerning the character and aims of the leading Canadian publications. The facts are fully presented for your consideration—and they are presented RIGHT.

CANADIAN MACHINERY

is a member of the Canadian National Newspapers and Periodicals Association, along with the following publications which constitute the Association's Technical Newspapers Section:

Canadian Engineer
Canadian Foundryman
Canadian Machinery
Canadian Manufacturer
Canadian Railway and Marine World
Construction
Contract Record and Engineering Review
Dominion Dental Journal
Electrical Dealer & Contractor
Electrical News
Marine Engineering of Canada
Municipal World
Power House
Sanitary Engineer

Canadian National Newspapers & Periodicals Association
70 Lombard St., Toronto

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself.

Write.

The Walton Co.
Hartford, Conn.

The **Rockford Economy**



Small But Powerful

Every tool room needs the Rockford "Economy" Back Geared Engine Lathe. It possesses all the speed, accuracy and power of a large lathe yet is small and convenient. Made in 12", 14", 18" and 22" swing. You owe it to yourself to get full particulars.

Rockford Lathe and Drill Co.
Rockford, Illinois, U.S.A.

When labor is expensive, there is all the more reason to use efficient tools.

Much time and effort can be wastefully expended on a filing job.

If, at each stroke, a file does not cut keenly, discard it and buy a new one.

Watch for the least loss of efficiency.

And insure maximum cutting-service by specifying one of these brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

Valvular Tank Trouble

WHEN oxygen tank valves leak—in transit or in operation—dollars are dissipated in the air instead of being pocketed by efficient welding or cutting work at the blowpipe tip.

Dominion Oxygen cylinders—like the product—are perfected in every detail. The Wedge Valve on a Dominion Oxygen tank cannot leak. It is the evolution of years of painstaking study, both in design and structural material.

Forged from bar stock, it resists the wear and tear of internal friction and if foreign matter, by any chance, score the face the valve re-seats itself while the tank is fully charged and in operation — a unique time and money-saving feature. And a twist of the fingers is all that is necessary. No tools are required.

This insurance against interruptions and failures has commended itself to all users of Dominion Oxygen. It also means that Dominion Oxygen reaches the consumer free from impurities and with cylinders filled to capacity—there can be no leakage en route or in application.

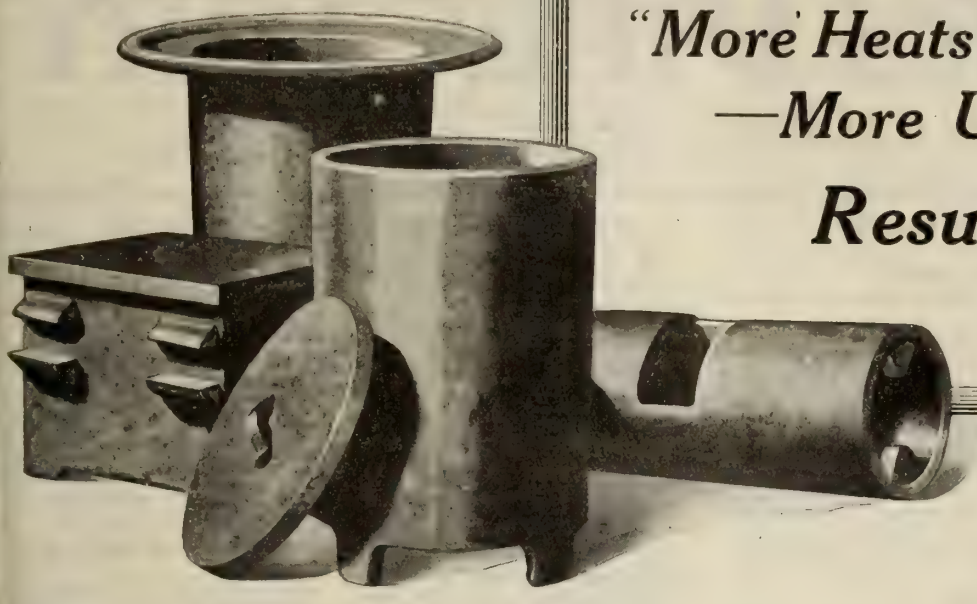
And with six centrally located distributing stations in full operation, the Dominion Oxygen Company, Limited, is prepared to supply consumers with any quantity of uniformly pure oxygen anywhere. Our policy of filling all orders on the day of receipt means the quickest and most satisfying oxygen service in the Dominion.

Dominion Oxygen Company, Limited

Hillcrest Park, Toronto

Hamilton Montreal Welland Windsor Merritton D19





"More Heats per Dollar —More Uniform Results"

That's How a *USER* Expresses Himself

"More Heats per Dollar—More Uniform Results" carries a world of meaning to the heat treating man in search of the ultimate. Simply add the subject and you have the answer you've probably been looking for in your own carbonizing work.

That subject is Cast Nichrome Containers and the "More Heats per Dollar—More Uniform Results" is simply a Nichrome user's "compact" way of stating the reasons why hundreds of other companies are using Cast Nichrome Containers.

If you haven't FULL information as to WHY Cast Nichrome gives such long uniform service and contributes so much to high grade results, we'll be glad to give it to you. Somewhere Cast Nichrome Containers are being used under conditions similar to yours. Shall we show you?

Ask for Bulletin N-21

Manufactured under HENDERSON Patents by

CANADIAN DRIVER-HARRIS CO.

WALKERVILLE, ONT.

American Office and Works

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CAST Heat Treating Containers

Endure in High Temperatures

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Abrasive Discs
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Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Acetylene, Dissolved
Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Accumulators, Hydraulic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Air Cocks
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Air Lifts
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Anchor Belts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland, O.
Ford-Smith Machine Co., Hamilton, Ont
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que
Railway Roller Bearing Co., Syracuse, N.Y.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Bronze
Railway Roller Bearing Co., Syracuse, N.Y.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Lyman Tube & Supply Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Hinged
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing, Flexible Steel
Flexible Steel Lacing Co., Chicago, Ill.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belt Joiners, Conveyor
Flexible Steel Lacing Co., Chicago, Ill.

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.

Belts, Abrasive
Federal Eng'r'ng Co., Ltd., Toronto, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Bins, Ore
MacKinnon Steel Co., Sherbrooke, Que.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Machine and Carriage
Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brakes, Magnetic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Brass
Brown's Copper & Brass Rolling Mills Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Brass Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont

Bronze
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O

Bulldozers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

BUYERS' DIRECTORY

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bernard Industrial Co., A., Fortierville, Que.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Smith's Falls Malleable Castings Co., Smith's Falls, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bort
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto,
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis,

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scotland.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Hiram, Walkerville, Ont.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Volts Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers Que.
Rockwell Co., W. S., New York City
Walker & Sons Metal Products, Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Springfield, Vt.

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
ohannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

ages, Measuring (See Tool Work)
anfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

ages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ges, Special Measuring (See Tool Work)
reenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

ges, Standard
rmstrong Whitworth Co. of Can., Ltd Montreal, Que.
rkins & Co., Inc., E. C., Indianapolis.
ansson Inc., C. E., Ploughkeepsie, N. Y.

es, Thread
ckworthie, Ltd., John, Birmingham, Eng.
anfield & Sons, Ltd, W. H., Toronto, Ont.
eenfield Tap & Die Corp. Galt, Ont
ansson Inc., C. E., Ploughkeepsie, N. Y
arrett Co., L. S., Athol, Mass.

Coal Compressed
Air Liquide Society, Toronto, Ont.

Compressed
ational Electro Products Ltd., Toronto, Que.
st-O-Lite Co. of Can., Toronto, Ont.

Cloths
mond State Fibre Co. of Can., Ltd., oronto, Ont.
Diep Tire & Rubber Goods Co., Ltd., oronto, Ont.
Odyear Tire & Rubber Co. of Can., td., Toronto, Ont.
Roth Mfg. Co., Jersey City, N.J.

Gages, Vacuum and Pressure
Tor Instrument Co., Toronto, Ont.

Gear Blanks
Cada Foundries & Forgings Co., Welland, Ont.
C Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., ronto, Ont.
D. Foundries & Steel, Hamilton, Ont.
Hilton Gear & Machine Co., Toronto, tario.
Philadelphia Gear Works, Philadelphia.
Dominion Engineering Works, Limited, ntreal, Que.

Gear Counters
Mfg. Co., R. A., Battle Creek, ch.

Gear Cutting Machines
Beam & Son Co., Ltd., The John, Dundas, Ont.
Bilgram Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Pratt, Ltd., H. W., Toronto, Ont.
Whitcomb Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Fairsmith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Irish Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Cross Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Renold Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Leased
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia, Pa.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
National Electro Products Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis,
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Riveting

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation

Diamond State Fibre Co. of Can., Ltd. Toronto, Ont.

Iron Bars

Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves

Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Jacks, Hydraulic

Norton, A. O., Boston, Mass.

Jacks, Planer

Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens

J. Oven Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines

Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine

Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine

Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments

Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ort.

Lathe Tools

Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench

Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)

Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine

Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret

Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)

Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving

Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand

Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting

Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand

Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading

Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning

Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe

Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.

Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery

Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants

L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes

Dennis Wire & Iron Works, London, Ont.

Lubricants

Oakley Chemical Co., New York, N.Y.

Lubricating Systems

Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists

Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel

Can Steel Foundries, Montreal, Que.

Mandrels, Expanding

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid

Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy

British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers

Parker Co., Charles, Meriden, Conn.

Micrometer Calipers

Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments

Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic

Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench

Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand

Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain

Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford,

Milling Machines, Thread

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical

Garlock-Walker Mchy Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal

International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric

Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery

Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples

Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.

International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits

Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen

L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw

Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners

Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems

Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers

Bowser, S. F., & Co., Ltd., Toronto, Can

Oils

Canadian Oil Companies, Ltd., Toronto Ont

Oil Hole Covers

Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble

Imperial Oil Ltd., Toronto, Ont.
Brantford Oven & Rack Co., Brantford, On

Oxygen

Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont
National Electro Products Ltd., Toronto, Ont.

Oxy-Acetylene Apparatus

L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Packing, Hydraulic

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam

Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montre

BUYERS' DIRECTORY

Atlas Press Co., Kalamazoo, Mich.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Pneumatic Tools
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gerry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Preshringer Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Circulating and Coolant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill.
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser S. F. & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co. Ltd. Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser S. F. & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co. Ltd. Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co. Ltd. Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John., Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robinson Co., F. B., New Haven, Conn.
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton

BUYERS' DIRECTORY

Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extracters
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Stewart & Co., Duncan, Glasgow, Scot.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.

Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg Co., Providence R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont
Tallman Brass & Metal Co., Hamilton, Ont

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
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Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
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Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

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Standard Tube & Fence Co., Ltd., Woodstock, Ont.

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Can. Steel Foundries, Montreal, Que.
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Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

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Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

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MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
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Chesterman & Co., Ltd., J., Sheffield, Eng.
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Hepburn Ltd., John T., Toronto, Ont.

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Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

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Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

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Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

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Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.

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National Electro Products, Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

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Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

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Positive Clutch & Pulley Works, Toronto, Ont.
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Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
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Cook Co., Asa S., Hartford, Conn.
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National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
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Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
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Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal. Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

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MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
A. R. Williams Machinery Co., Montreal, Que.

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Valves
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Apparatus.
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Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Toronto, Ont.
L' Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

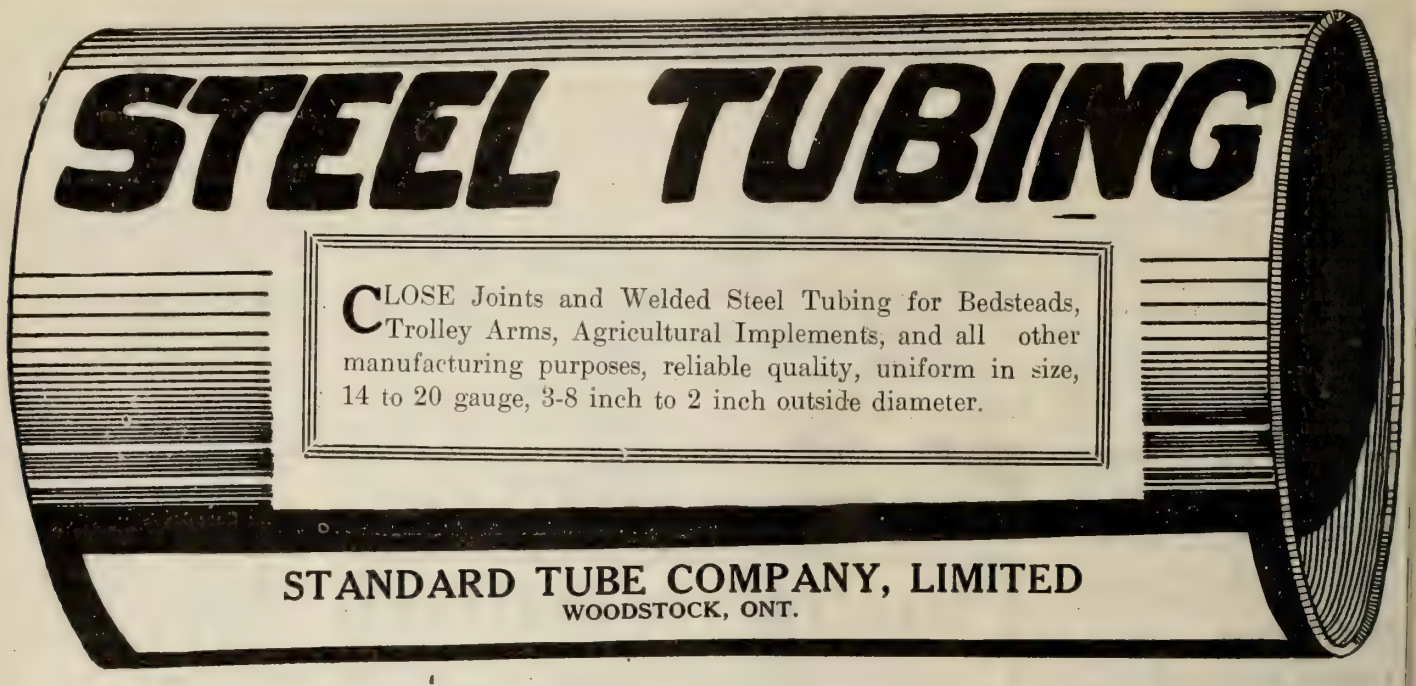
Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

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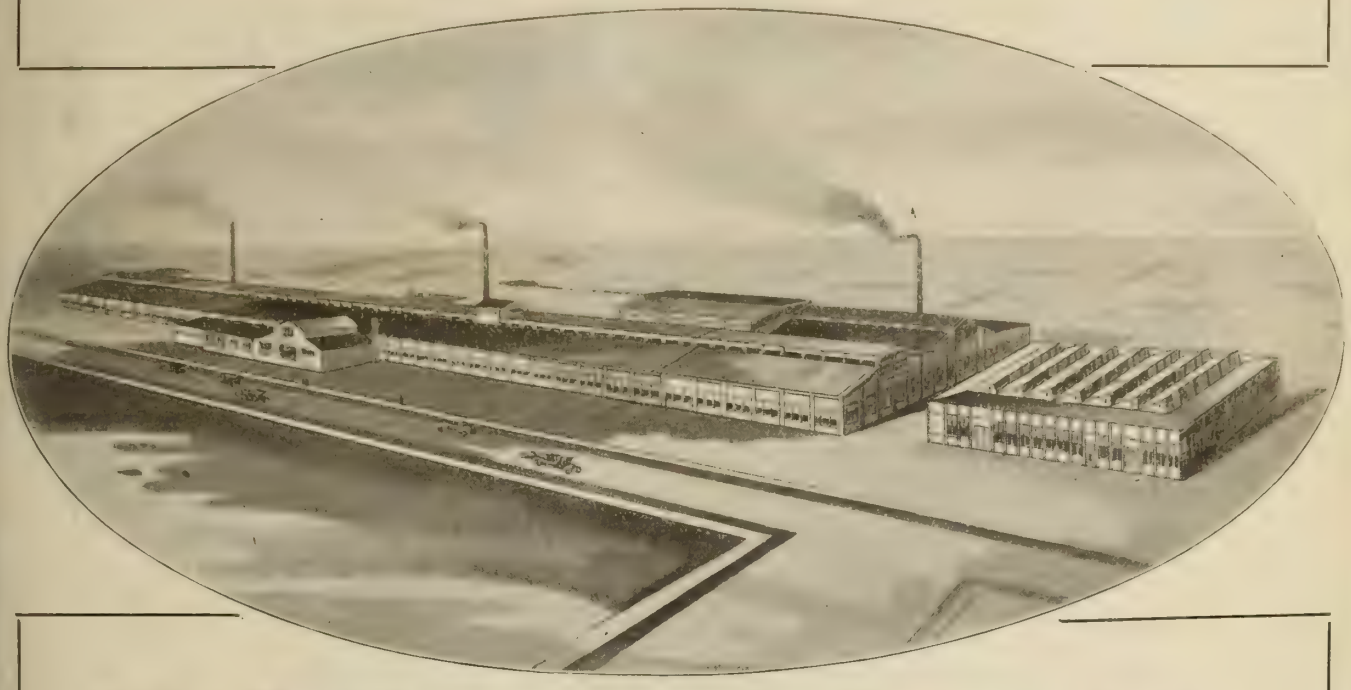
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AND MANUFACTURING NEWS

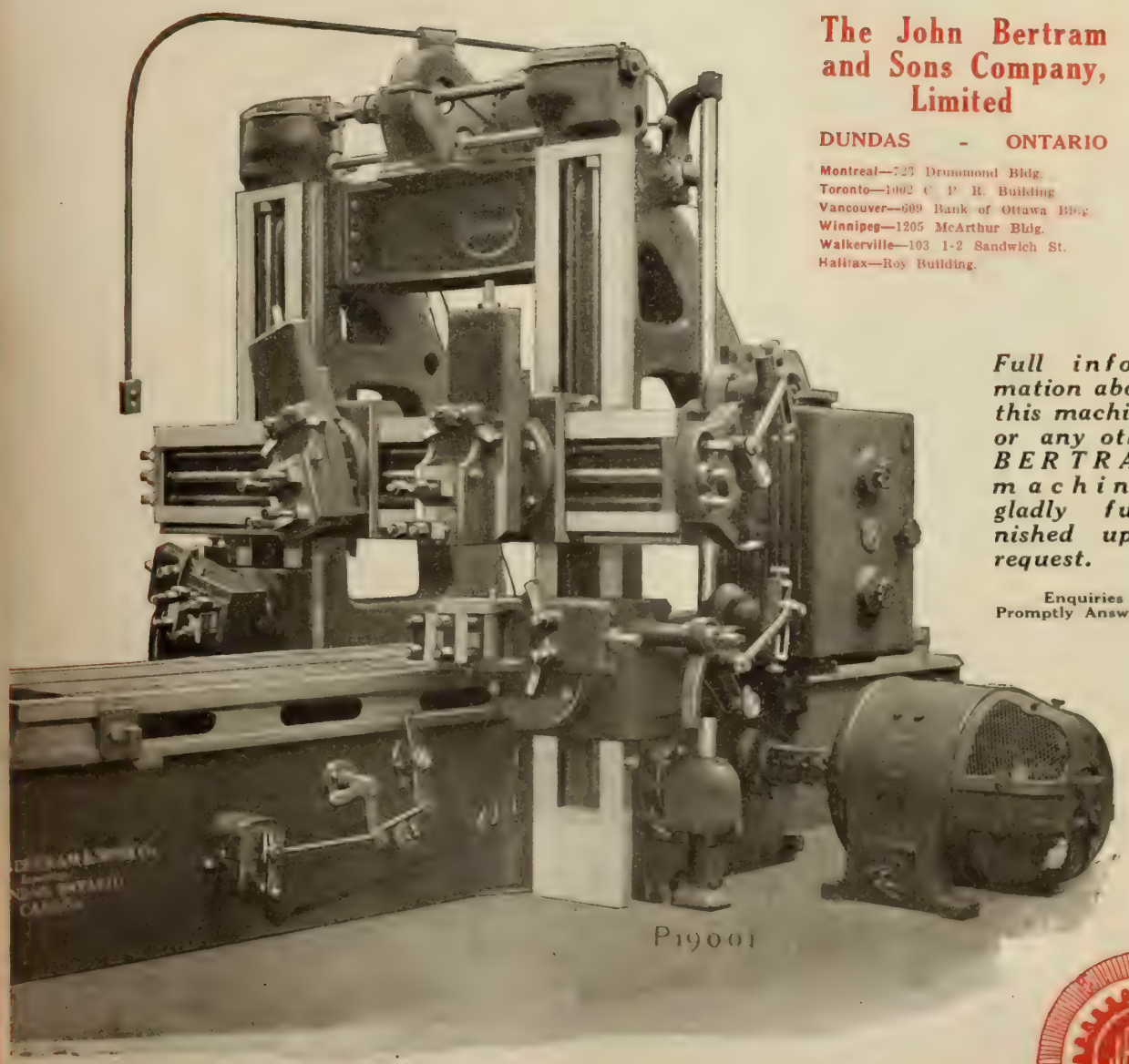
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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

JBBSCo

42" x 42" SPECIAL PLANER

Two heads on cross rail—Two side heads—Equipped with Reversing Motor Drive—Steel gears and rack.



The John Bertram and Sons Company, Limited

DUNDAS - ONTARIO

Montreal—723 Drummond Bldg.
Toronto—1002 C. P. R. Building
Vancouver—609 Bank of Ottawa Bldg.
Winnipeg—1205 McArthur Bldg.
Walkerville—103 1-2 Sandwich St.
Halifax—Roy Building.

Full information about this machine, or any other BERTRAM machine, gladly furnished upon request.

Enquiries Promptly Answered

JBBSCo

You can't help noticing the good qualities of

Pratt & Whitney Taps

Their free cutting qualities, their extreme accuracy and their extraordinary ability to outlive others distinguish them.
The con-eccentric relief—a distinctive P & W feature—is the secret of their goodness. One-third of the cutting edge is concentric. The remaining two-thirds has eccentric relief. Taps can be sharpened at the only correct point—on the face of the cutting edge. Sharpening in no way affects their size.

Yes, they cost a little more than some others, but they're well worth the difference. Carried in stock as are all other P & W Small Tools at our sales offices and agencies as listed.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Works: DUNDAS, Ontario

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HALIFAX, Roy Building | VANCOUVER, B. C. Equipment Co.

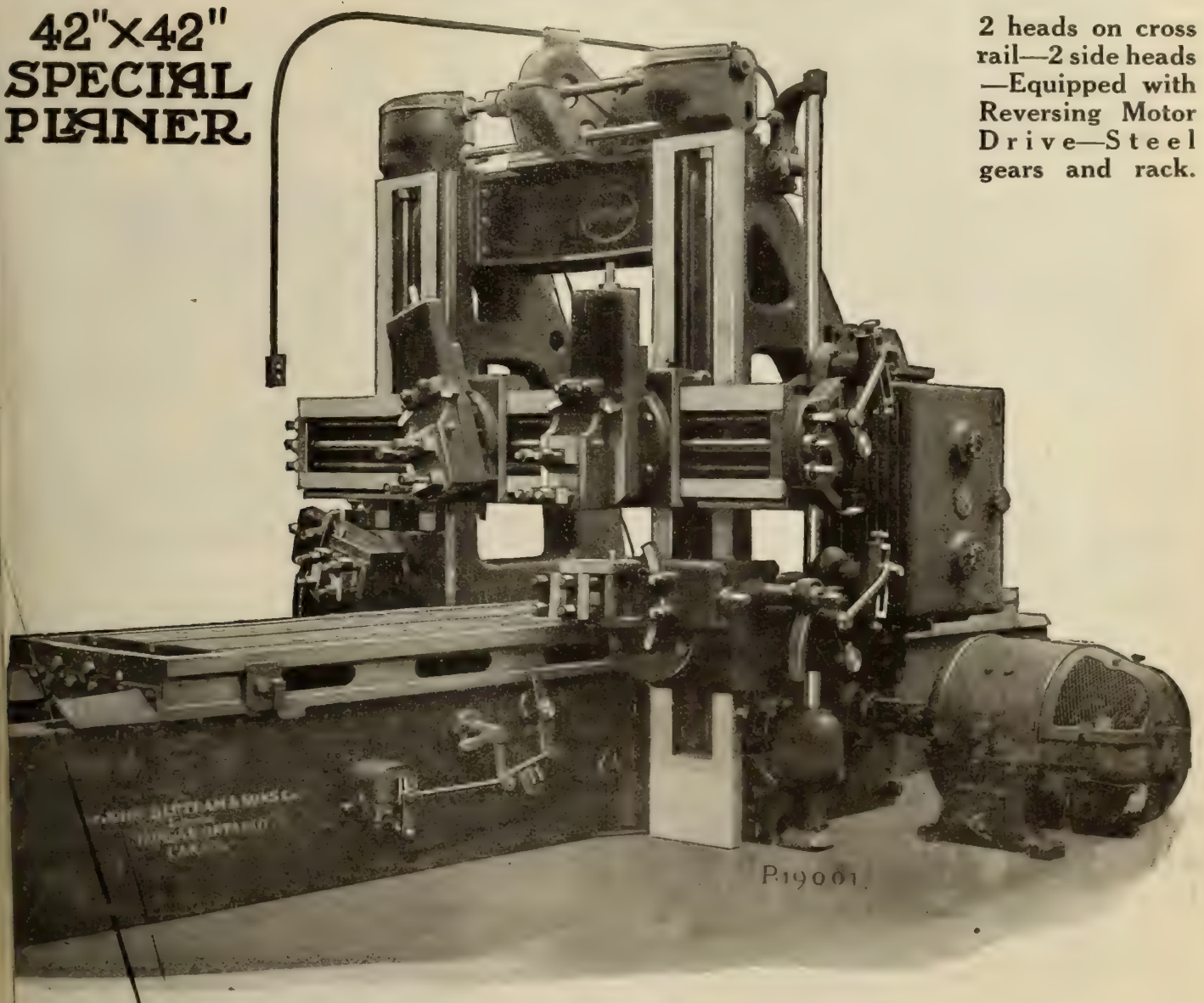


The BERTRAM Page

MACHINE TOOLS

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The John Bertram & Sons Co., Limited

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We are constantly acquainting new file users with the fact that our five brands of files have been the standard of file quality for over fifty years.

Our advertising is also steadily emphasizing that a file should be replaced immediately it has become the least bit dull.

Are you getting the benefit of this advertising, by stocking one of these five famous brands?—

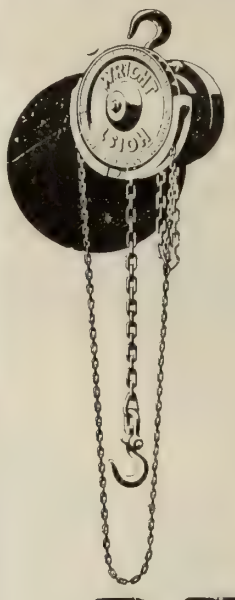
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Nicholson File Company

Port Hope - Ontario

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With a reputation behind it and one which has all the safety devices and refinements to be found in any tool of its kind.

We would like to tell you of some of the exclusive features.

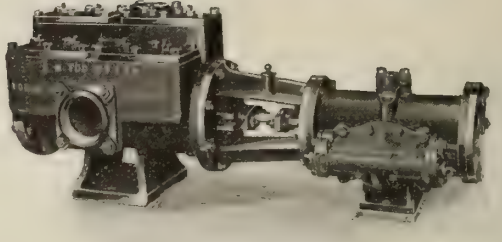
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Vacuum Pumps

Get that heating system of yours in good order before the Cold Weather arrives. If your pumps need repair parts get them quick!

Complete overhauling done if necessary, and done with dispatch and thoroughness. Ask your engineer about it at once, and phone us.

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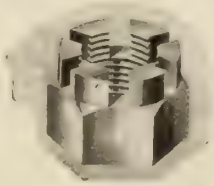
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ALL STEEL HARDENED
Spindle, Nut and Screw made of Bar Steel. Body drop-forged. Long lasting under hardest use.
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"The Tool Holder People"
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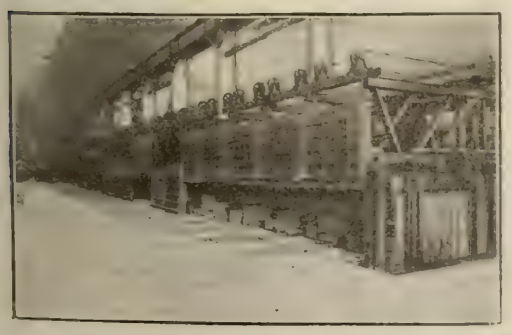
Your rush orders filled promptly by



The Galt Machine Screw Co., Limited
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Side-Opening Heat-Treatment Furnace, 105 Ft. wide and 53¼ Ft. long.

The furnace, underfired with oil or gas, is used for the heat treatment of material ranging from die blocks to shafts 100 ft. long.

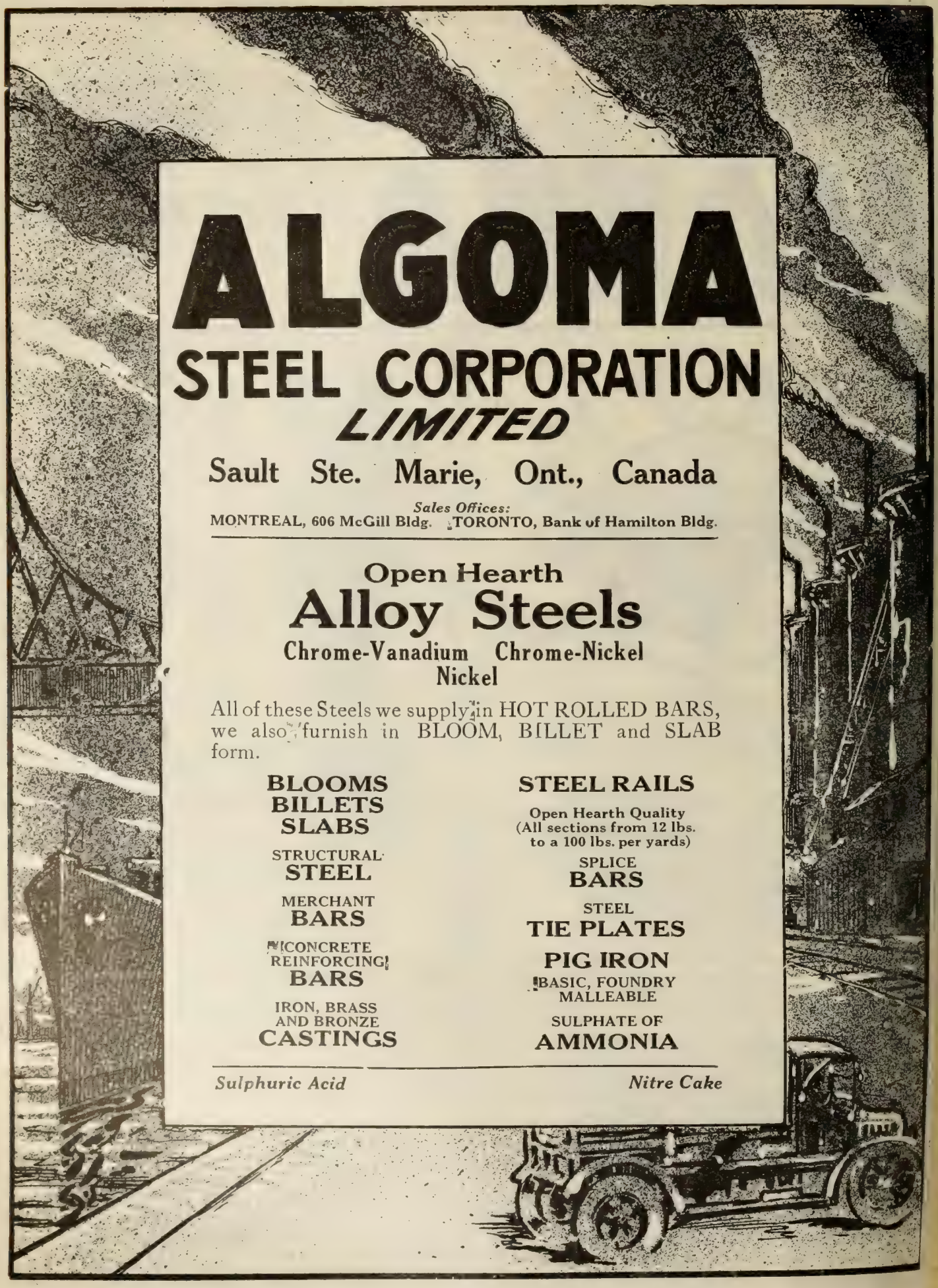
It can be divided by movable partition walls into a number of sections. Each section may be heated separately or, after removing the partitions, in conjunction with any or all of the others

Complete details are given in Bulletin 222-T. Write for copy to nearest branch.

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Screw machine product up to 2¼ in. diam.—to specifications. Hardened and ground screw product—to specifications.

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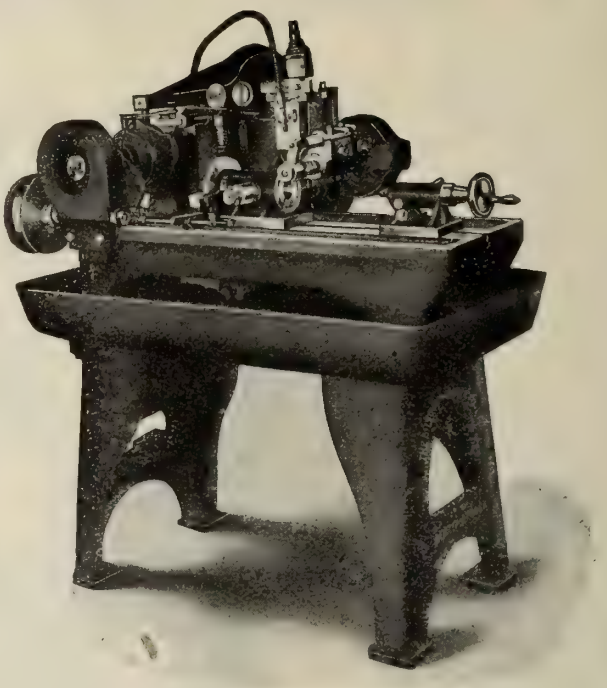
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Gives You the "Newest" in GEAR MILLER Practice

The "newest" in Gear Miller Practice as interpreted by Bilton, is *more* work, *faster* work, and *better* work per minute.

The Bilton is a compact, up-to-the-minute machine, that easily and accurately produces plain and form milling, as well as serrating, notching, slotting, fluting, etc.
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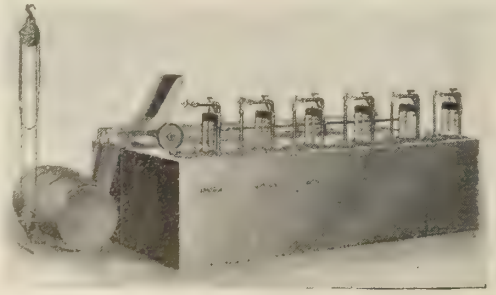
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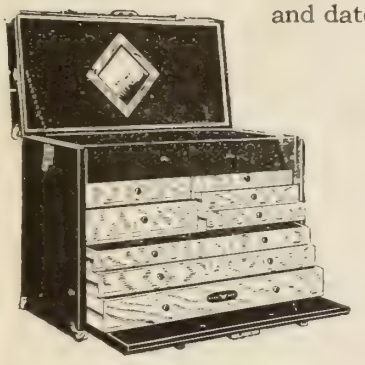


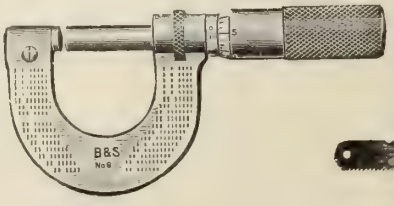


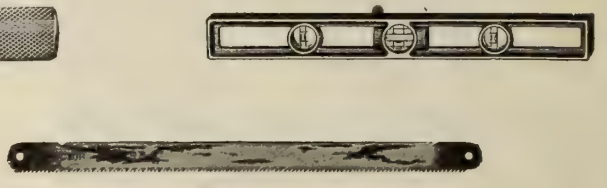
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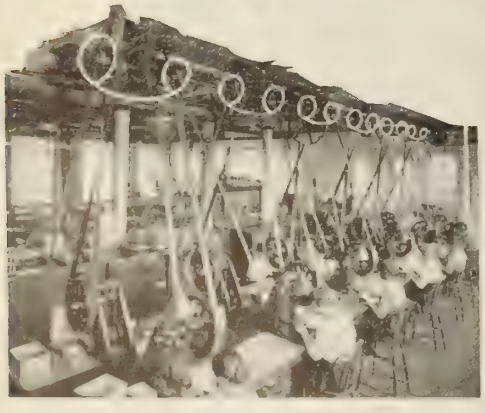






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THE JOHNSON FRICTION CLUTCH



It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

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Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

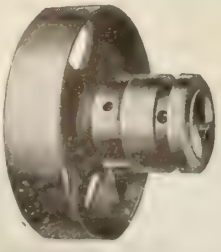
Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

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You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

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FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.

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FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

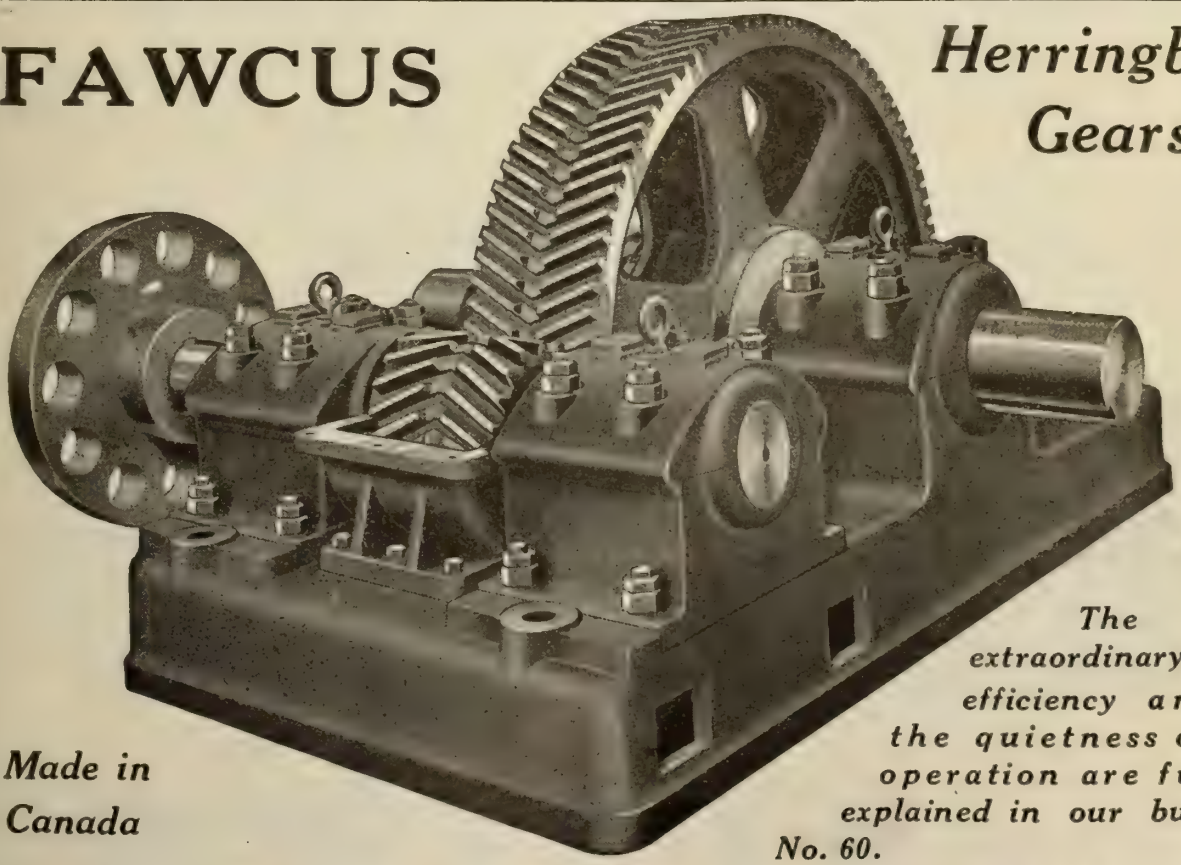
Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

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WE WILL SUPPLY
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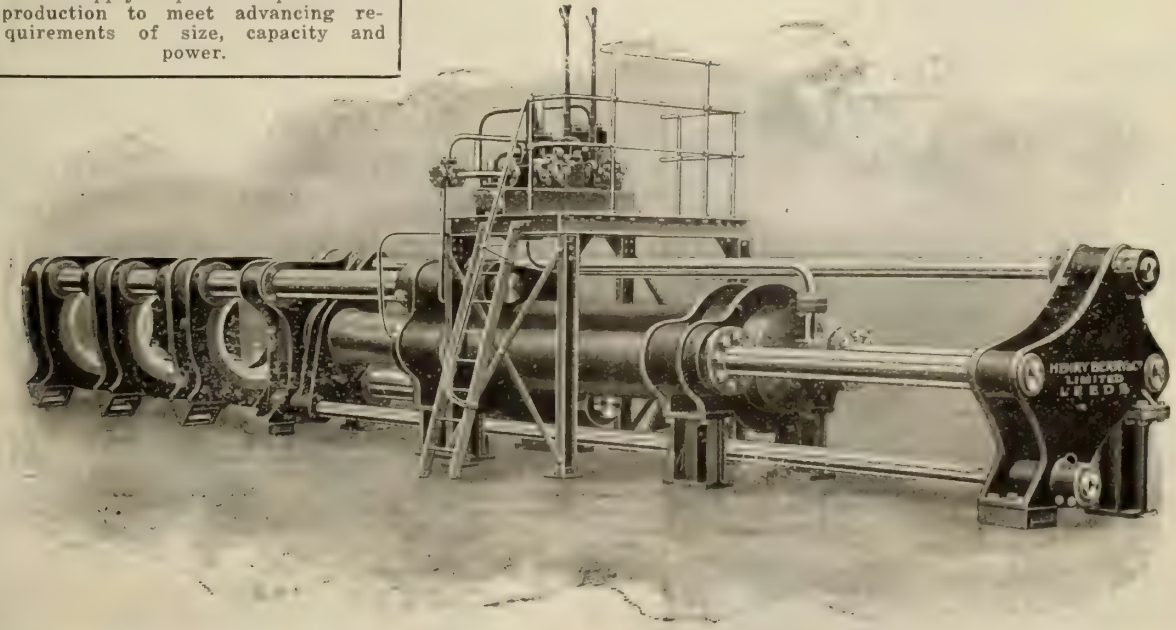
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We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

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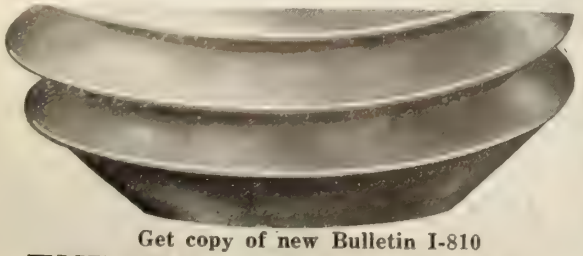
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"MADE IN CANADA"

Electric Travelling Cranes, Hand Cranes, Electric Hoists, Air Hoists, Foundry Equipment, Cupolas, Ladles, etc., etc.



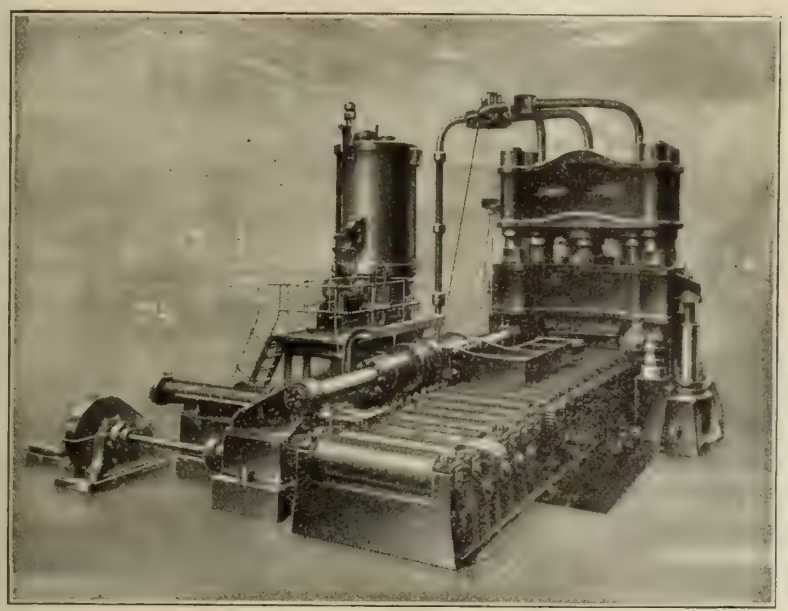
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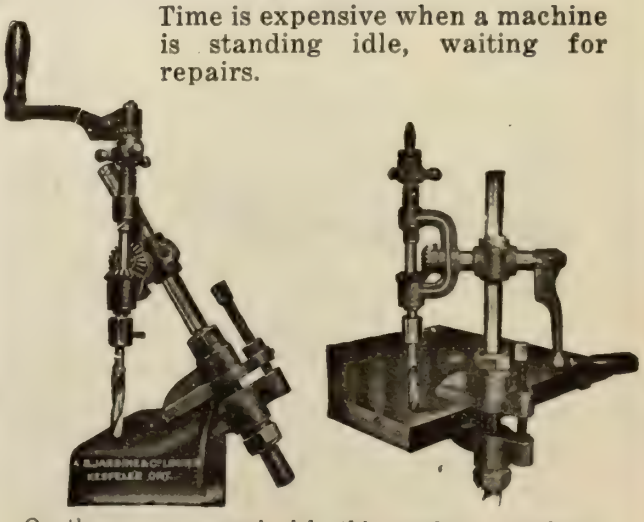
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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

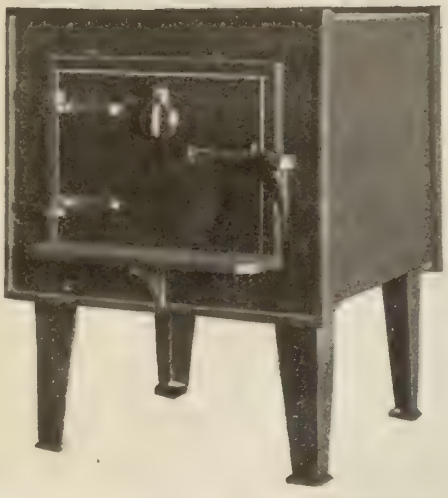
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KLEER-HEET ELECTRIC FURNACES

A Handy **KLEER-HEET**

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For Tool Room Use



MUFFLE— 8" wide by 5½" high by 14" long operating temperatures 300 to 1900 degrees Fahr.

UNITS - KLEER-HEET— quick replaceable, built in 22 sections, each replaceable separately. Operates for about 5 cents per hour.

110 and 220 volt sizes $225.00
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TORONTO **MONTREAL**

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Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force can not replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every month will keep you posted on the latest developments for machinery equipment.

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Cylinder Grinding has grown to such proportions that it occupies a very prominent place in the grinding field. The most accurate equipment must be used and a quick set-up obtained in order to produce the highest quality of work in record time.

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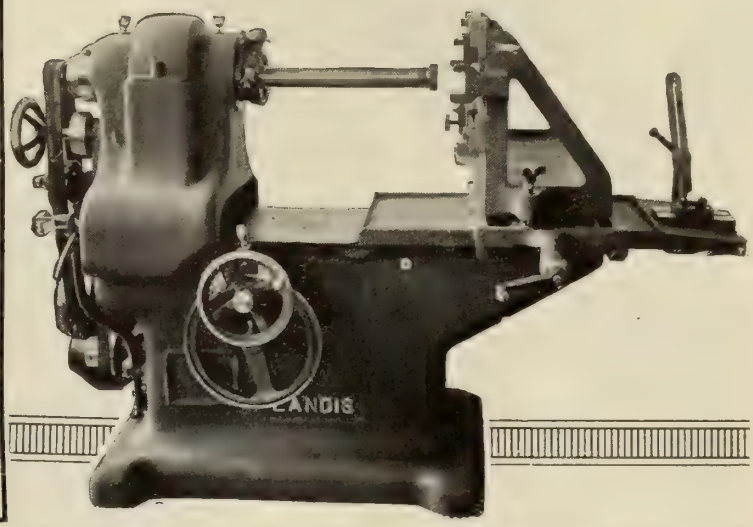
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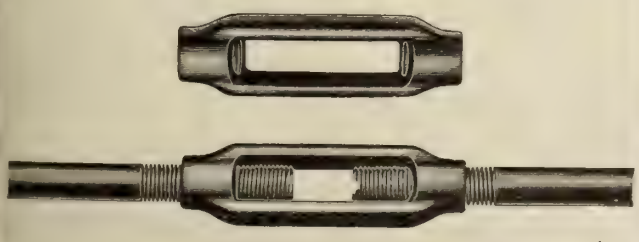
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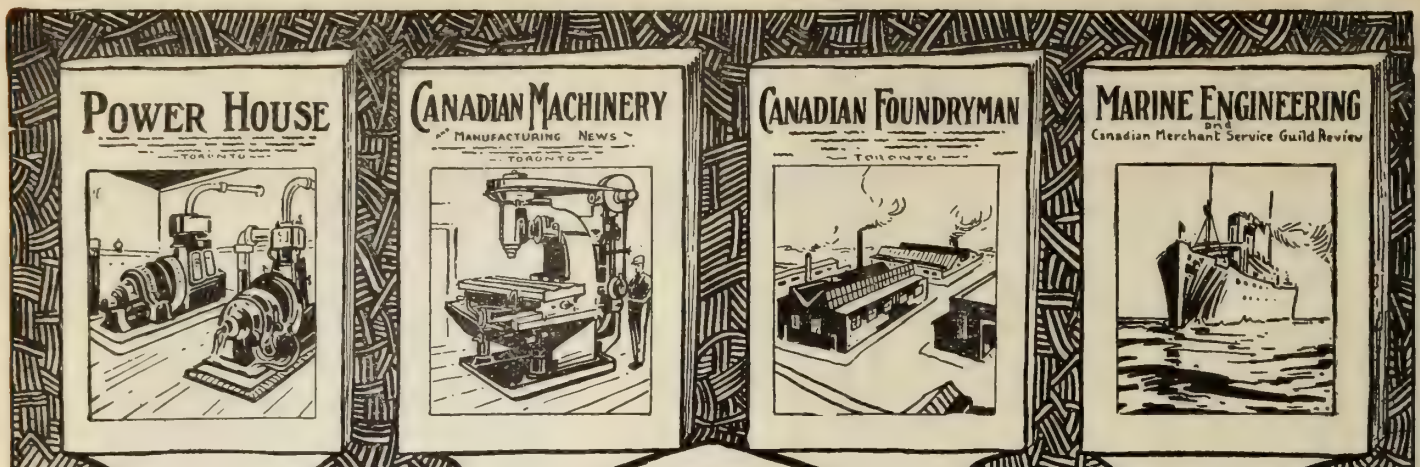
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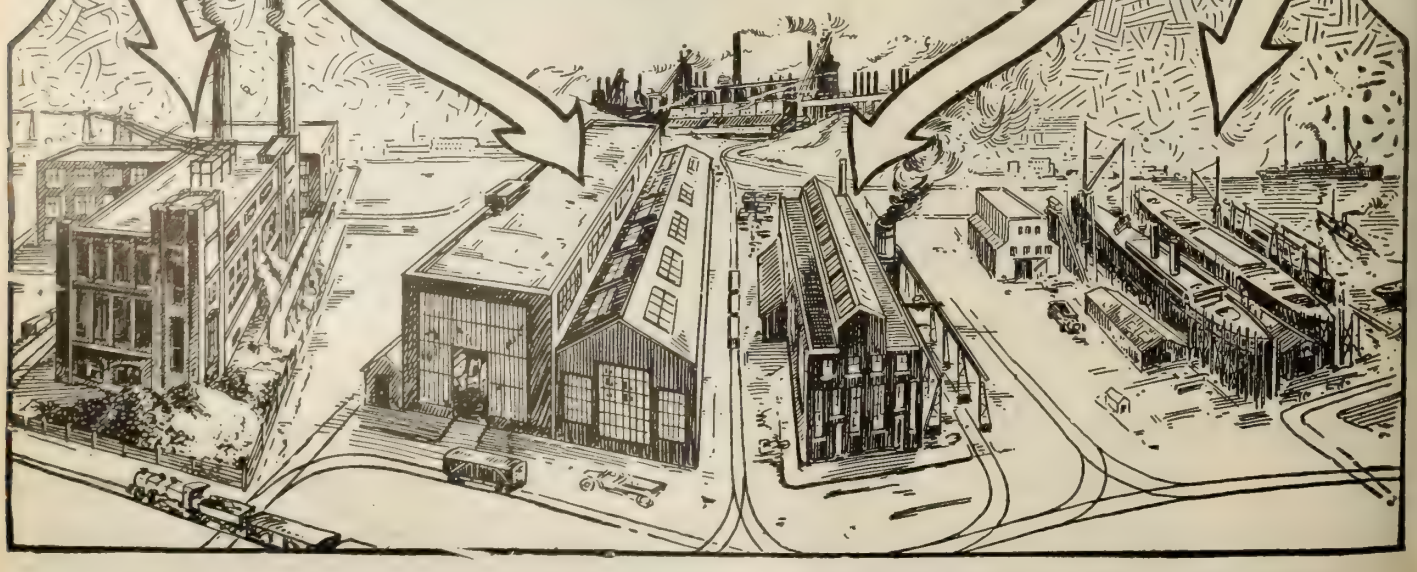
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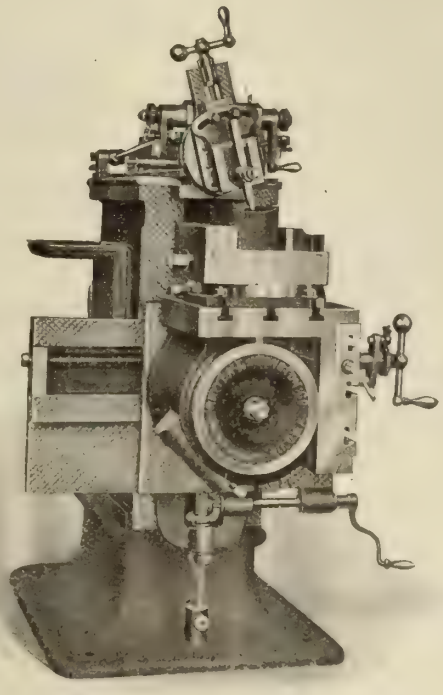
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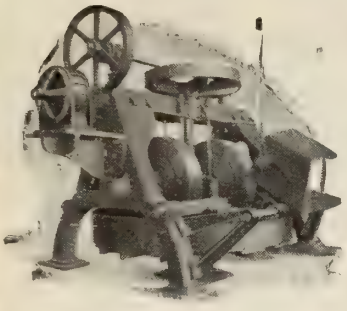
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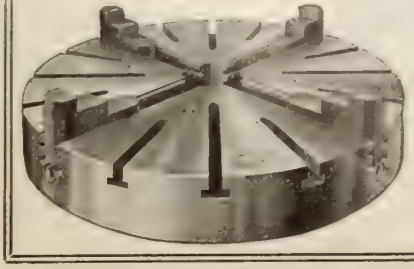
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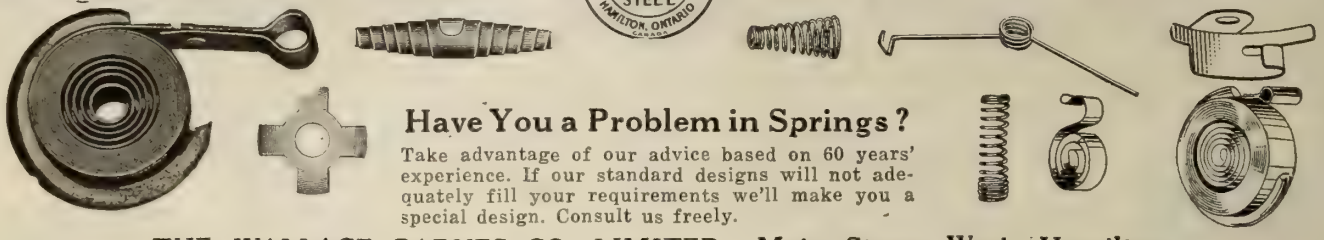
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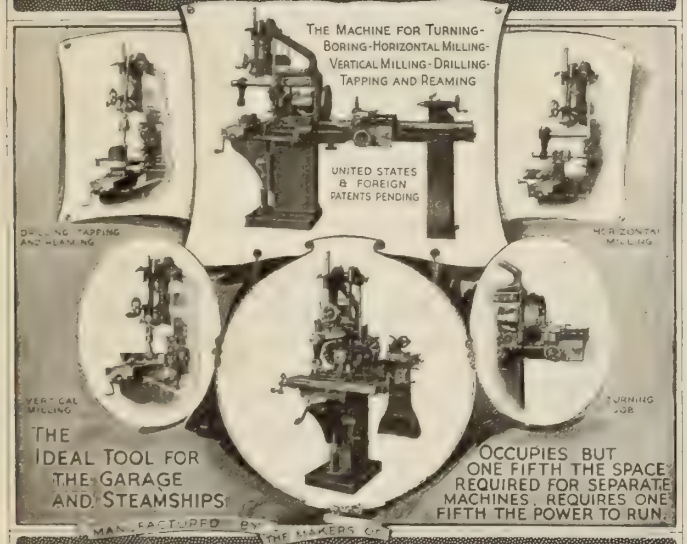
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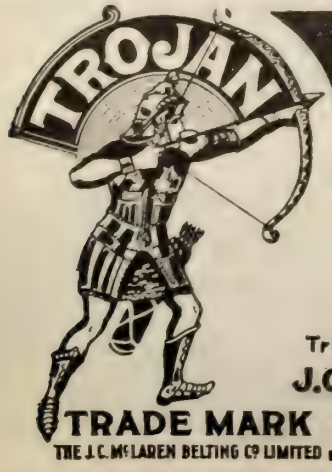
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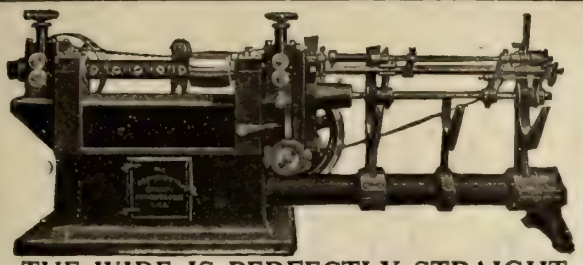
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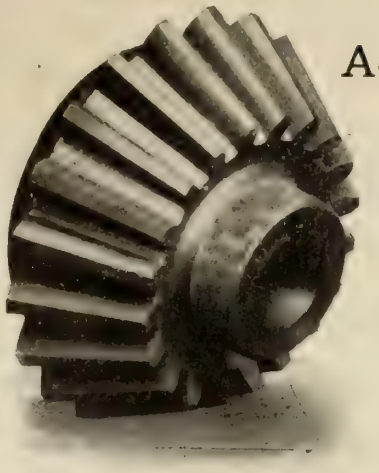
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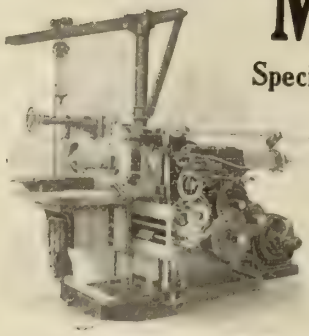
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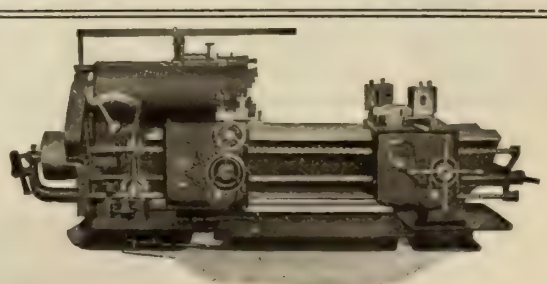
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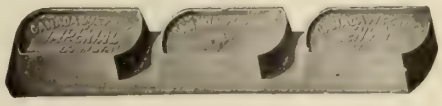
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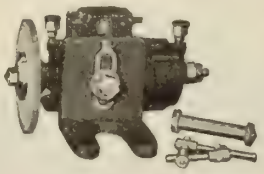
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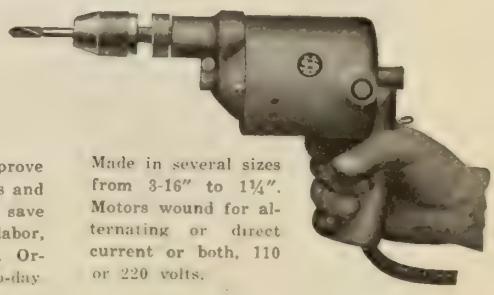
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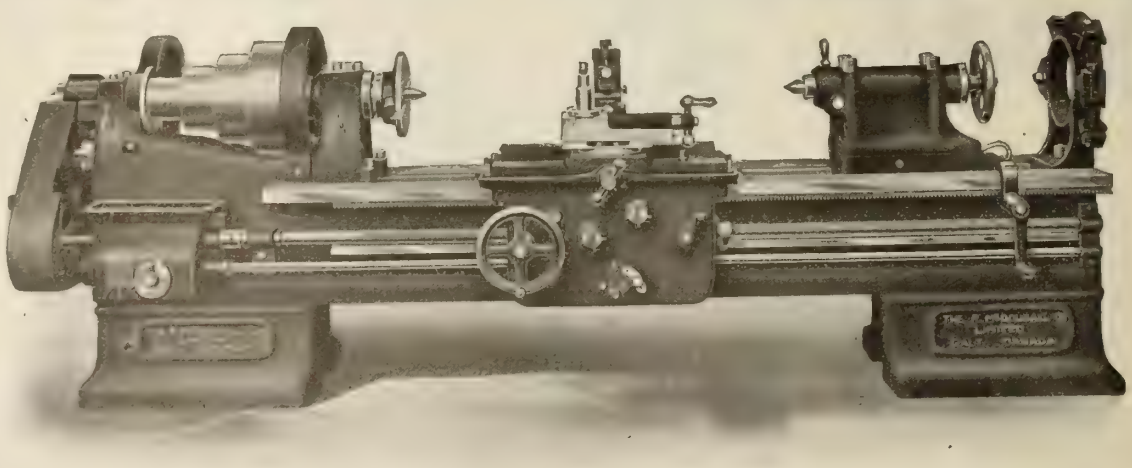


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VOL.XXVI. NO.19 NOVEMBER 10 1921

Typical Applications of Ball and Roller Bearings

Discussion of Earlier Types — Interesting Experiments Which Have Been Made — Points of Importance — Load Carrying Capacity—Question of Wear—Lubrication is Important Factor —Sectional Views of Applications

*By O. H. WILLISON

SEVERAL articles have recently been written dealing with the history of ball and roller bearings, and it is therefore unnecessary to go over this ground again. The object of this article, however, is to describe what is necessary in a good bearing, to deal with some typical applications, and to discuss some of the causes of failure. It is generally conceded that the old cup-and-cone type of ball bearing is useless where heavy loads have to be carried. They will work satisfactorily at light loads and medium speeds, and, much as we may smile at them now, we should remember that they served their purpose and led the way to present day practice.

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*Author is Bearings Engineer with the Lyman Tube & Supply Co., Montreal.

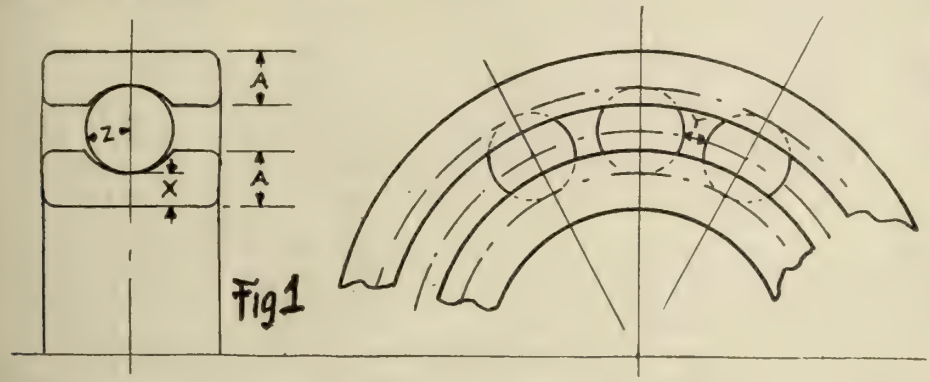


Fig 1

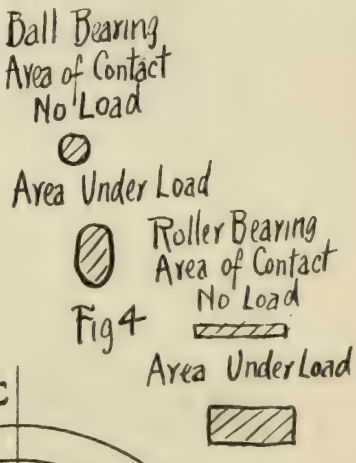


Fig 4

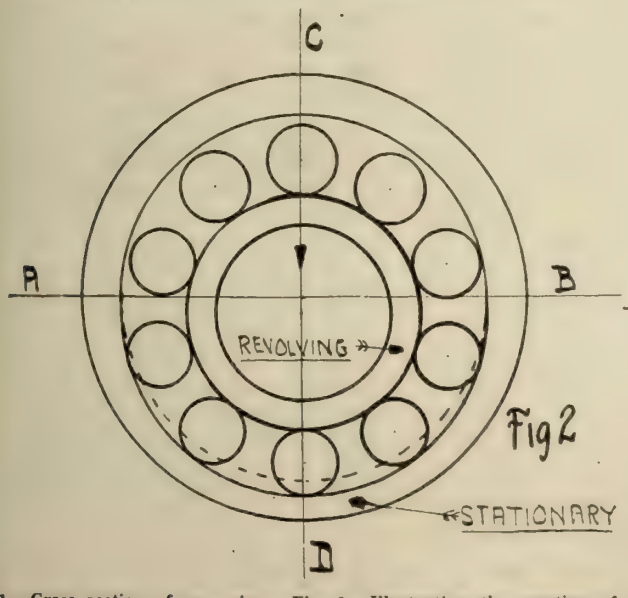


Fig 2

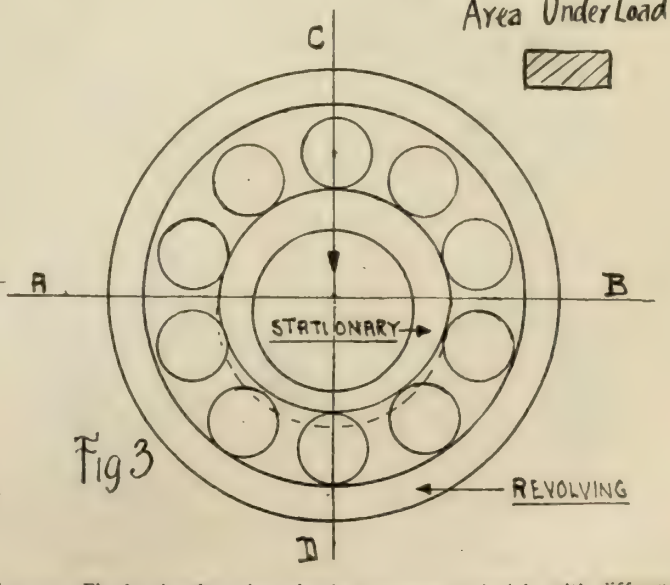
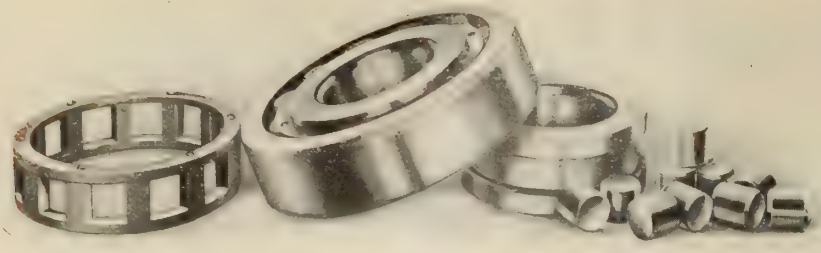


Fig 3

Fig. 1.—Cross section of race ring. Fig. 2.—Illustrating the question of wear. Fig 3.—Another view showing the same principle with different conditions. Fig. 4.—Ball and roller bearings compared in sketch form.



Typical roller bearing showing it both in assembly and detail.

race should be as near that of the ball as is commercially feasible to ensure a clearance.

To illustrate the advantage of the grooved track over that of the flat, some interesting experiments were conducted in the testing laboratory of The Hoffman manufacturing company, Chelmsford, England, at which the writer was present. Balls 1-1/8" in diameter were subjected to a pressure of 10,000 lbs. on flat and grooved surfaces respectively. The exposed surfaces were etched, and, after removing the load and the balls, the unetched area, i.e., that actually in contact with the ball under loading, was carefully measured. The pressure per unit of area was computed and found to be:—

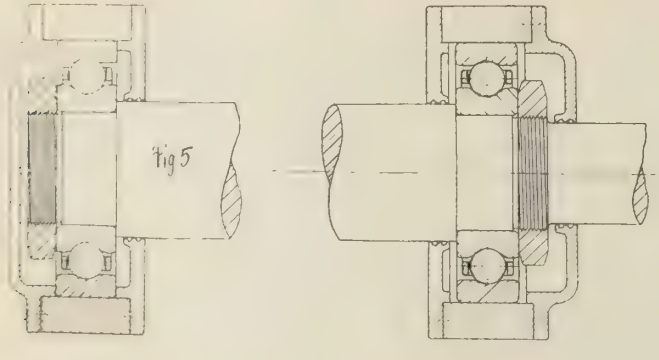
Flat Surface—708,461 lbs. per square inch.

Grooved Surface—324,550 lbs. per square inch.

The grooved and curved surfaces in each instance were actual races upon which the ball would run in a bearing, and the results clearly indicate the reason for the increased capacity of the grooved ball track as against that of the flat type. It is obvious also that any radical departure from this grooved type of bearing would result in decreased carrying capacity of the bearing, because, the higher the pressure per unit of area, the less will be the ability to carry load.

The load carrying capacity of a ball bearing is influenced largely by its design and manufacture. The outside dimensions of all single row bearings are standardized and cannot be altered, so that the principal dimensions that can affect this load carrying capacity, other things being equal, are the number and size of the balls. It will be found, however, that other things are not equal, and that each manufacturer has a different proportion for the internal dimensions of the bearing.

The size of the ball should be as large as possible, but is limited by the thickness at the bottom of the track: The cross section of the race rings (Fig. 1) should be thick enough to prevent distortion of the race by a housing, which is not quite true, or busting of the inner race when forced on a shaft. Strength against distortion is a very important consideration. The rings should be made sufficiently heavy to ensure their being properly hardened without fear of cracking. Some makers cut this thickness down to one-quarter the diameter of the ball, while others work



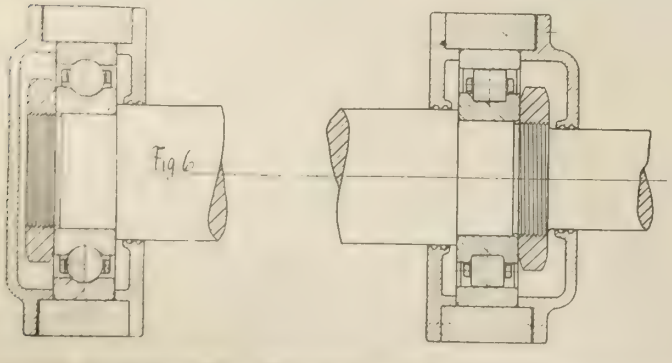
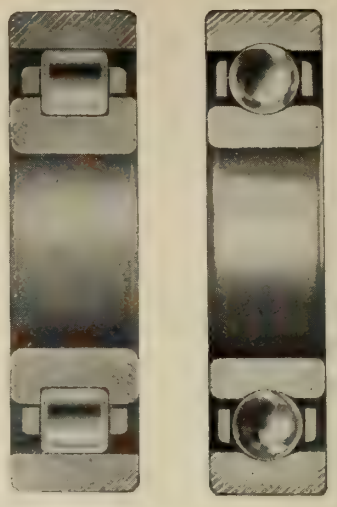


Fig. 5.—A simple form of mounting. Fig. 6.—A case where ball and roller bearings are both used.



Sectional View of Ball and Roller Bearings.

up to one-half the diameter. It is evident that it is not fair to base a load table on the diameter of the balls, if this has been obtained by reducing the thickness of the race to such an extent as to weaken it, and thus reduce the load carrying capacity of the bearing as a whole.

Points of Importance

Next in importance to the size of the balls is the number of them. The diameter of the pitch circle being settled the amount of space for the balls is fixed by the thickness considered necessary for the cage "Y". This thickness should not be cut down too fine, as experience has proved the desirability of a strong rigid cage. In the case of bearings that are running with a steady load, the pressure required to keep the balls in their place is practically nil, but, where the load varies, or they are subjected to jars and shocks, a stout and strong cage is necessary to prevent the balls from bunching, and, from the way some cages are torn to pieces, it is evident that the strain which can come upon a cage is considerable. Some makers cut the thickness of the cage between the balls down to one-tenth the diameter of the ball, while others work up to one-third the ball diameter. Here again it is not reasonable to calculate a load table on the number of balls used, when weakness of the cage cuts down the load carrying capacity of the bearing as a whole. To obtain the best results, the ball cage should be tough and uniform yellow metal. An iron cage tends to lap down the balls.

Next to the number and size of the balls the curvature of the ball race "Z" is important. In order to make the point of contact under load as large as possible, the curvature of the race should be as near that of the ball as is commercially possible to ensure a clearance. Different manufacturers have their own standards, and these vary from about two per cent to twenty per cent larger than the ball. The sides of the track "A", both of the inner and of the outer race should be carried up as high as possible, although this can be carried too far and the load carrying

capacity of the bearing weakened in consequence.

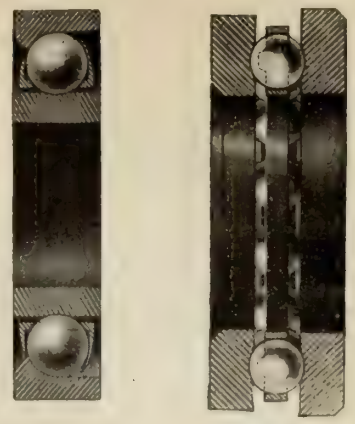
The strongest race is undoubtedly what is called "the unbroken ring or nogap type"; that is, where there is no transverse slot for introducing the balls, and the sides of the race are carried up as high as possible. This adds to the depth of the cross section and increases the power of the races to resist distortion. Unfortunately, however, this design limits the number of balls to those that can be put in by placing the races eccentrically. More balls can be inserted by use of a transverse filling slot, but this weakens the race and the balls are liable to be damaged if great care is not taken when they are inserted. The greater number of balls that can be used by this method, if carefully carried out, should, however, more than compensate for the somewhat weaker race.

The material of which the balls and races are made should be of the very hardest, consistent with absolute uniformity and freedom from cracks; a suitable mild steel, (and this should not be confused with what is usually known as ordinary machinery steel) properly carburized, is the most suitable for the races, for the reason that the ball tracks can be made harder than any other method. It requires such careful attention and such skilful handling in manufacturing, however, that comparatively few ball bearing manufacturers have adopted this method. The great difficulty with chrome-carbon steel bearings is that of obtaining a uniform hard race.

Load Carrying Capacity

It will be seen from the foregoing, then, that the load carrying capacity of a ball bearing depends not only on the size of the balls used nor on their number, not alone on the depth of groove or on the fact that the raceway is of the nogap or unbroken ring type; not alone on the quality of the steel in the raceway or in the method of hardening, but, on the scientific balancing of all these points by a manufacturer who has had years of experience, and a system of inspection which renders it impossible for a defect to go unnoticed.

There is one other point in connection with the load carrying capacity of ball and roller bearings that has not received its proper attention from manufacturers, and that is the nature of the



Sectional View of ball journal bearing and single thrust bearing.

applied load. The capacity of the bearing cannot be determined, as we have said above, by the number or size of the balls; nor, can it be determined by the weight necessary to crush the ball or rollers, but by the elastic limit of the steel. As soon as this limit is exceeded, the surface begins to peel or brittle away, and it will be obvious that this point can be brought about by many conditions of loading, also, that it is not so much the amount of load which a bearing is called upon to carry which affects its behavior, as the conditions under which it is dealing with the load.

For instance, when the duty consists of supporting a dead mass with the bearings mounted in a substantial housing on a rigid base plate bolted to a solid cement foundation, the effect on the bearing is more severe than when the load is imposed by gearing or some spring method. In the first place, all shocks must be absorbed in the bearings themselves, while, in the second case, this is dissipated to some extent by the "give" in the various parts of the mechanism.

A somewhat remarkable example of this, recently came to the attention of the writer: A motor was to be mounted on ball bearings, loads, etc., were calculated, and the proper bearing applied. Shortly after this, an enquiry was received from a concern who wished to install a thrust bearing on the propeller of an aeroplane. The calculated thrust would have meant a bearing of large dimensions, whereas, in actual practice, a very much smaller bearing was entirely satisfactory; due, simply, to the fact that in the case of an aeroplane the shocks and stresses are dissipated through the various parts of the machine, whereas, in the motor the bearings were called upon to take all the shocks and loads, and these could not be passed along in the form of "give."

This goes to prove that load tables, as published, are not of much use, except as a guide to give us the relative load carrying capacity of one size bearing compared with another. It is obvious that if a bearing is selected by reference to a load table without taking into account the nature of the work it has to do, the results will not be satisfactory. Unfortunately, many designers of machinery still adhere to this practice, although most users have formed their own coefficient for the various makes of bearings. Here it may be well to point out the impossibility of making any adjustment for wear in radial bearings by means of lateral displacement of the races.

The Question of Wear

Referring to Fig. 2. The shaft and inner race revolve in a stationary race and housing. Any wear that takes place will be equal around the revolving race but will only occur in the stationary outer race when the load comes, namely, the bottom. This outer ball race, therefore, will be larger across the vertical diameter C-D where the wear has taken place, than across its horizontal A-B where there has been no wear. Fig. 3 illustrates the same principle, except that the outer race is the revolving member, consequently, the inner or stationary race wears down. This applies with equal force to any type of roller bearing. Several designs of roller bearings have been placed on the market at various times. To ensure satisfactory results, the rollers should be of steel in solid form, perfectly parallel, and they should run between hardened and ground surfaces. The action of rollers, if on cast iron, grinds it into powder, whereas, if they run on soft steel, the surface flows under the rolling action and eventually peels. Long rollers have the disadvantage in that it is difficult to keep their axis parallel with that of the shaft. It is obvious that the slightest variation in diameter will cause one end of the roller to travel in advance of the other, with resultant skidding and wear in the bearing, and, even should they be perfectly parallel throughout their length, it is impossible to ensure the load being uniform, which gives the same result. To my mind hollow rollers are unable to withstand shock loads to the extent of the solid ones, while those of the helical spring type or the rolled tubular form are prone to hardening difficulties and certain failure where heavy loads are concerned. Taper rollers limit the scope of the bearing to shafts using two journals while great care must be exercised in their adjustment at the outset. Experience has proven that the best results can be obtained from a roller bearing in which the length of the roller is

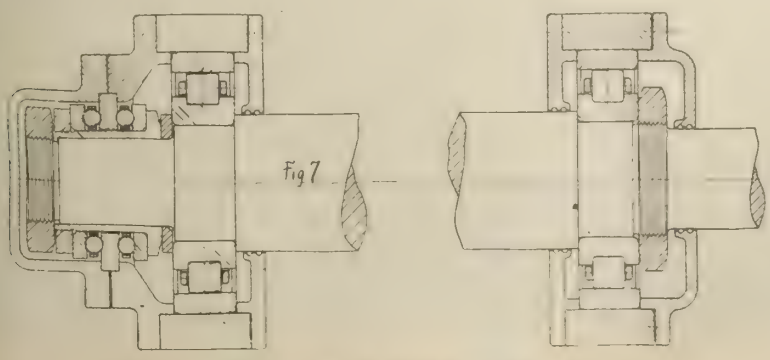


Fig. 7.—Heavily loaded shaft with a definite end thrust.

equal to its diameter. The rollers run in a groove formed in the inner ring, the flanges on which correct the rollers should there be any tendency to skew.

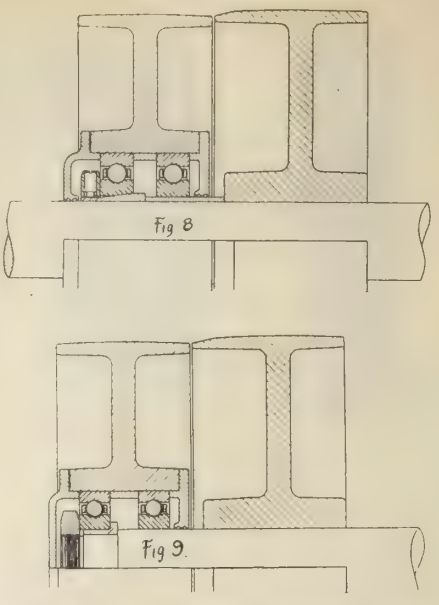
A bearing of this type was used, amongst others, by Prof. Goodman in obtaining data for his paper entitled, "Roller and Ball Bearings", which was read before the Institution of Civil Engineers, London, in February, 1912. In the paper the author says: "It gave excellent results on test". Many roller bearings have a tendency to generate end thrust, and this formed one of the main points in the paper referred to. However, the author states that "it gave excellent results as regards friction and end thrust."

This end thrust may be attributed to one of two things—either the rollers are not made truly cylindrical, or, the load is applied in such a manner as to impose a tilt on the roller and thus a tendency to climb endways. This first difficulty has been overcome by the development of special automatic grinding machines, from which it is possible to obtain rollers in large quantities perfectly cylindrical; in fact, the precision is so fine that the rollers produced by them in the ordinary commercial way are issued under a National Physical Laboratory certificate, and are being used in many shops in England as shop gauges.

Bearings of this type have a carrying capacity fifty per cent greater than ball bearings of the same size, and, as they are made in the same "International" sizes, their advantages are obvious. They are not intended to supersede ball bearings, but have been designed to take care of heavy loads under conditions where space is limited and where a ball bearing of required capacity would be of such a large diameter as to make its use impracticable. The fact that roller bearings do not produce end thrust has been proven in actual practice by the long periods they have been running under heavy loads. Several applications are shown and are well worth careful study.

Moreover, it has been found under actual working conditions that the short roller bearing is just as efficient as a ball bearing, and a glance at Fig. 4 (which is greatly exaggerated) will illustrate this point. The point contact of a ball develops to an area when the ball is under load and distortion takes place. The line contact of the roller develops also when the load is applied. Areas have been measured by the method previously referred to and it has been found that there is no difference between them. Tests taken have shown that the co-efficient of friction is as low with this type of bearing when loaded to its rated capacity, and in many cases lower than the corresponding size of ball bearing.

The question of "creep" in a bearing is not very well understood, and it is evident that some ball bearing manufacturers themselves have not as yet solved the problem. The writer hopes to deal with this question very fully at a later date, and to correct from experience gained one or two wrong impressions concerning it.



Figs. 8 and 9.—Showing application of ball bearings to loose pulley.

Question of Lubrication

It is impossible to give too much attention to the question of lubrication, and experience has proven that in the majority of cases grease is the most suitable. All anti-friction bearing manufacturers have developed bearings having highly polished surfaces, and they have a right to insist that when in use they be given not only sufficient lubrication, but that a lubricant be used which will not in any way impair their chances of success.

Until recently this was not given very much attention, with the result that bearings failed, not through faulty design, defective material or installation, but owing to an inferior grease having been used. To-day, however, manufacturers of lubricants have an intelligent knowledge of what is required. It is not necessary to describe in detail the component parts of a good ball bearing grease. Suffice to say that it should be pure mineral product free from acid and alkali, and about the consistency of vaseline. If users will remember this and obtain their supply from an accredited source, no trouble should be experienced.

Equally important with the proper lubrication of a ball bearing or roller bearing is the necessity of protecting the moisture entering the housing. This has been one of the bearing manufacturers' greatest problems, and it has taken years of patient propaganda on their part to get users to take the necessary steps to attain this end. The ordinary installation presents no difficulty, but where particles of dust or emery are in proximity to the housing, great care should be taken. The difficulty has been overcome largely by using flingers, which throw off all foreign matter, or by the use of labyrinth packing, past which it is almost impossible for any foreign matter to get.

Protection from water has been achieved in much the same manner, although the best way to keep water out of a housing is to keep it well packed with grease. No difficulty need be experienced if users will follow the advice given by makers of bearings.

Fig. 5 illustrates the simplest form of mounting a revolving shaft on two ball journal bearings, and it is well adapted for applications where the load is not heavy. One bearing only is held for end thrust, and this should always be the one most lightly loaded. The inner race of each bearing must be a tight press fit on the shaft, and held securely against a shoulder by means of a lock nut. Care should be taken in machining the shaft that the lock nut automatically tightens itself against the direction of rotation Two or three shallow cut grooves in the bore of the end cover make an effective seal against dirt, although, if the bearing is exposed to particularly dusty conditions, a felt washer should be held against the end cover by means of a collar. Generally, though, this is not necessary.

Fig. 6 illustrates a horizontal revolving shaft where one end only is heavily loaded, and where there is not sufficient room for a larger ball bearing. In this case, a roller bearing as described above is installed. The inner race of this bearing must be a tight press fit on the shaft and held securely by a lock nut, care being taken that the face of the nut does not bear against the bearing to a greater diameter than the bottom of the roller track. If necessary, the face of the nut should be relieved to an extent necessary to insure this. The outer race should be a tight fit in the housing, not a driving fit, and must be held firmly endways, care being taken that the spigots on the end covers are adjusted to insure that the rollers track centrally. The end thrust is taken by the ball bearing at the other end of the shaft.

Even where the end of the shaft is completely enclosed, it is desirable to use end covers, owing to the difficulty of machining a blind hole parallel throughout its full length.

Fig. 7 illustrates a heavily loaded horizontal shaft with a definite end thrust. The journal load is supported by two bearings of the roller type, and the end thrust is taken on a double thrust bearing. The inner races of the journal bearings are a tight fit on the shaft, and held securely against the shoulders. The outer races are also held securely endways, any lateral movement in the shaft due to expansion being taken care of in that the outer race is parallel throughout the entire width; the inner race and rollers can therefore automatically track in their correct position. The double thrust bearing is a single unit built up on a sleeve and correctly adjusted ready for use. The sleeve should be a push fit on the shaft and clamped firmly against distance piece by a nut securely locked in position. It is important that the recesses provided in the end covers for the central race of

(Continued on page 35)

Cutting Helical Gears on Automatic Machine

Various Operations on Automatics, Including Making of Stud—Dust Cap—Cutting Helical Gears—Chart Showing Tools Used —Machine Equipped with Rear End Threading Attachment

By H. A. WILSON

AS THE design of modern machine tools has been advancing along varied lines for many years, the automatic and semi-automatic lathe has been receiving more and more attention. Perhaps no one particular branch of the automatic lathe has more interesting features than the automatic screw machine. Probably because the product of these machines, when considered individually, is of modest value, many unconsciously take it for granted that the machine that produces such a humble little thing as a screw or a stud, is of humble value also. That is bad logic. The fact that these very same screws are of modest value is actually because the machines that enter into their production are among the greatest achievements in the vast field of machine tool development and design.

The consuming public to-day calls for these products in quantities termed by millions and at the same time is only willing to pay an insignificant sum for such articles. Furthermore the demand for accuracy is a very definite factor to be reckoned with in this particular production. Whether it is for the reasons suggested or for others more remote, the fact remains that few men, other than those whose daily duties keep them in close touch with these machines, seem to appreciate the quality and quantity of work done on them, or their extremely ingenious design. Thus they have to literally battle their way for a living, as no sentimental interest has been enjoyed by the battery of screw machines in the average shop. They had to produce, and that was all.

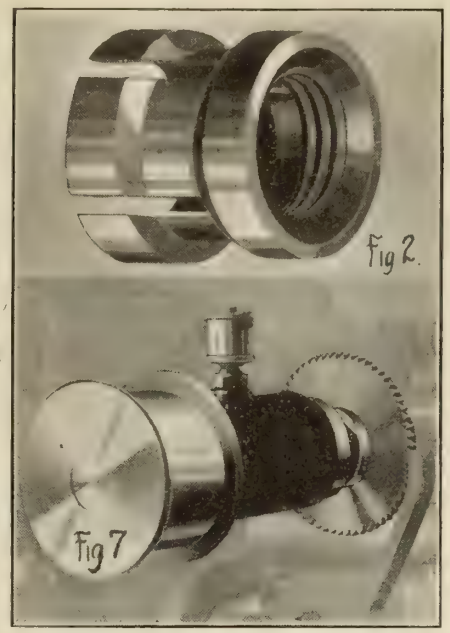


Fig. 2.—Dust cap for automobile tire valves produced on an automatic screw machine.
Fig. 7.—End milling attachment for slotting dust caps for tire valves.

Of later years the versatile qualities of the machine have demanded the attention of mechanical men, as the fields of machine shop endeavor extended. The purpose of this article is to draw attention to some of the more ingenious uses to which these machines were put, and also to mention some of the unusual jobs accomplished.

Fig. 1 shows a rear end threading attachment now being used on a No. 2 automatic screw machine. This attachment has been chosen from several rather interesting applications of the screw machine, to a variety of regular work. The job chosen is one of the commonest that a screw machine on production work, is called upon to perform—namely that of making studs. The machine illustrated is making special studs for gas engine cylinder heads. It has been working on two lengths of studs ½ inch and 7/16 inch diameter respectively. The ½ inch diameter stud is 3¼ inch long and the 7/16 inch diameter 4¼ inch long—14 and 20 threads to the inch with varying lengths of threads.

With this attachment added to the No. 2 automatic screw machine the operation of threading the rear end of the stud is completed in practically the same time consumed as in making the first thread. That is to say, the operations are going on simultaneously, and in addition, the necessity of extra handling is eliminated, as all operations are fully automatic.

The sequence of operations on the 3¼ inch stud is as follows. The bar is advanced to the stock stop. The long thread ½ inch diameter x 14 threads x 1-5/16 inch long is cut in the turret. In this case the stock is revolving in the spindle of the machine, being held by the automatic chuck, and the die head is stationary in the turret. Then the automatic swinging arm of this special attachment is lowered, and advanced over the piece. When the piece is cut off it raises it to the clamp jaws of the attachment which grip the piece while the short thread ½ inch diameter x 14 threads x ⅞ inch long is cut by the die on the attachment. When this operation is completed the clamp jaws open and drop the stud. Simultaneously with this operation of the attachment, the long thread is being cut on a new piece by the dies in the turret.

By way of further description it will be noted that the dies of the rear end attachment are held in an opening die holder mounted on a revolving spindle. The clamp jaws hold the piece stationary during the threading operation. The mechanisms that control the opening and closing of the clamp jaws, and travel of the die spindle, are governed by cams, located on an auxiliary cam shaft shown on the front of the machine. The die spindle is driven through gears by a flat belt from the overhead counter shaft. The sequence of operations on the 4¼ inch stud is similar to that on the short stud, only the short thread 7/16 diameter x 14 threads x ¾ inch long is cut by the turret dies and the long thread 7/16 inch diameter x 20 threads x 1 inch long is cut by the

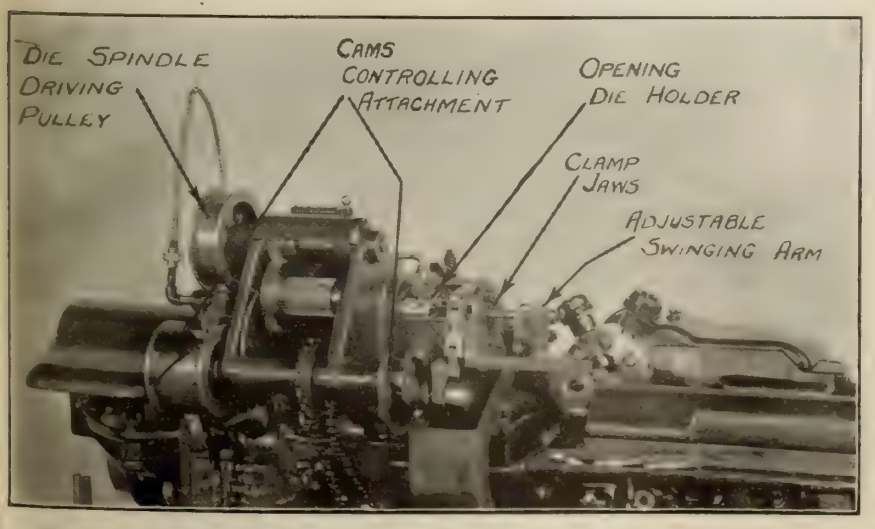


Fig. 1. General view of Machine, showing rear end Threading Attachment

*We are indebted to the Brown & Sharpe Mfg. Co., Providence, R.I., also the National Acme Co., Cleveland, Ohio, for the use of illustrations and drawings. Fig. 1, shows Brown & Sharpe machine; Figs. 2, 3, 4, 5, 6, 7 and 8, deal with National Acme work, while Figs. 9, 10, 11, 12 and 13 refer to Browne & Sharpe work.

die in the attachment. Following is the information in tabulated form.

Machine with rear end threading attachment. Piece:— automobile cylinder head studs:— material, ½ inch screw stock; length of stud, 3¼ inch; thread, ½ inch—14—⅞ inch long cut by attachment die; thread ½ inch—14—1-5/16 inch long cut by turret dies; Net Production 80 studs per hour.

Materials, 7/16 in. screw stock; length of stud 4¼ inch; thread, 7/16 inch—14—¾ inch long cut by turret dies; thread, 7/16 inch—20—1 inch long cut by the attachment die; net production 105 studs per hour.—Note net production means 10% less than gross production time being allowed for grinding tools and putting in rods when figuring time on large quantities.

Dust Cap Work

A rather unusual job for an automatic screw machine is that of a dust cap for tire valves. This was performed on a No. 52 multiple spindle automatic screw machine. The piece is shown in Fig. 2. Under actual service conditions another part is used in connection with this piece to make a complete dust cap. This additional part fits into the piece shown, and is held in place by the spring action of the split head.

In order to get efficient tooling and a high production speed, the regular arrangement of the machine was changed. The chart shown in Fig. 3. gives the various working positions of the four spindle head, the direction of rotation of the head, and the operations performed. The first change from the usual method was to arrange to have the stock fed out from the fourth position instead of in the first position. To accomplish this it was necessary to design a special attachment and in addition to provide for the cutting off of the finished part in the third position. This attachment is illustrated partially in Fig. 4 showing the cut-off side of the machine, the attachment appearing at the extreme right operating in the third position of the spindle.

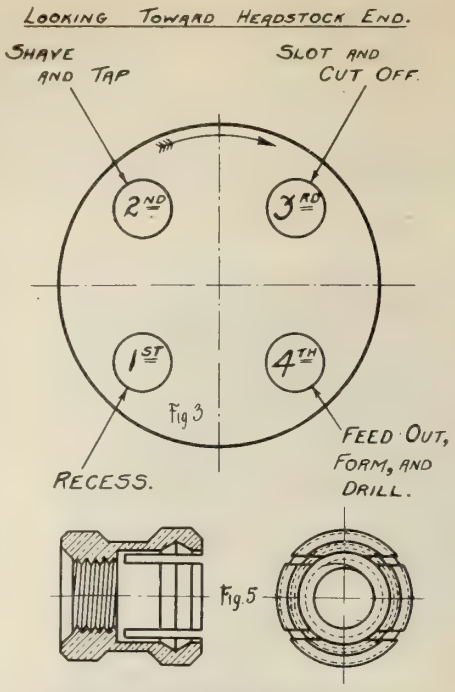


Fig. 3.—Chart of spindle positions and operations.

Fig. 5.—Cross section and end view of dust cap.

Fig. 5 shows a cross section and end view of the part being machined. The first operation, as stated before, occurs in the fourth spindle position. The solid round brass stock is fed out, and the piece formed and drilled. The forming tool is of the usual design. Owing to the two diameters of bore a combination drill is used. The same transverse motion that feeds the forming tool into the work also feeds in the cutting tool operating in third spindle position and referred to in the previous paragraph. This is accomplished by means of the "double-decked" construction shown in Fig 4.

The next operation is in the first spindle position. It will be noted that there are two internal recesses, one in the front, or slotted end, of the piece and the other at the extreme rear of the piece. A double recessing tool is used to cut the recesses. This tool is fitted in a special tool holder on the main multiple end tool holder. This small tool holder is fitted into a slide which permits of transverse motion. This tool is advanced into the work up to a stop. Previous to the arrival of the tool holder carrying the tool, at the longitudinal stop, a hardened steel adjustable projection on the tool holder in the transverse slide, comes in contact with a cam on the forming slide, and the tool is cammed over against the transverse stop, it simultaneously having longitudinal and transverse motion. Thus the recessing is accomplished and the work passes on to the second position. Fig. 6 shows the tooling for the first position.

In the second position a patented shaving tool is used to finish the work all over. This tool is operated from the top slide and is shown plainly in Fig. 6. The main end tool holder advances and feeds the tool into the work and up to a stop which stop insures accurate outside diameter. The piece is also tapped in this position. In the third position the piece is slotted by the end milling

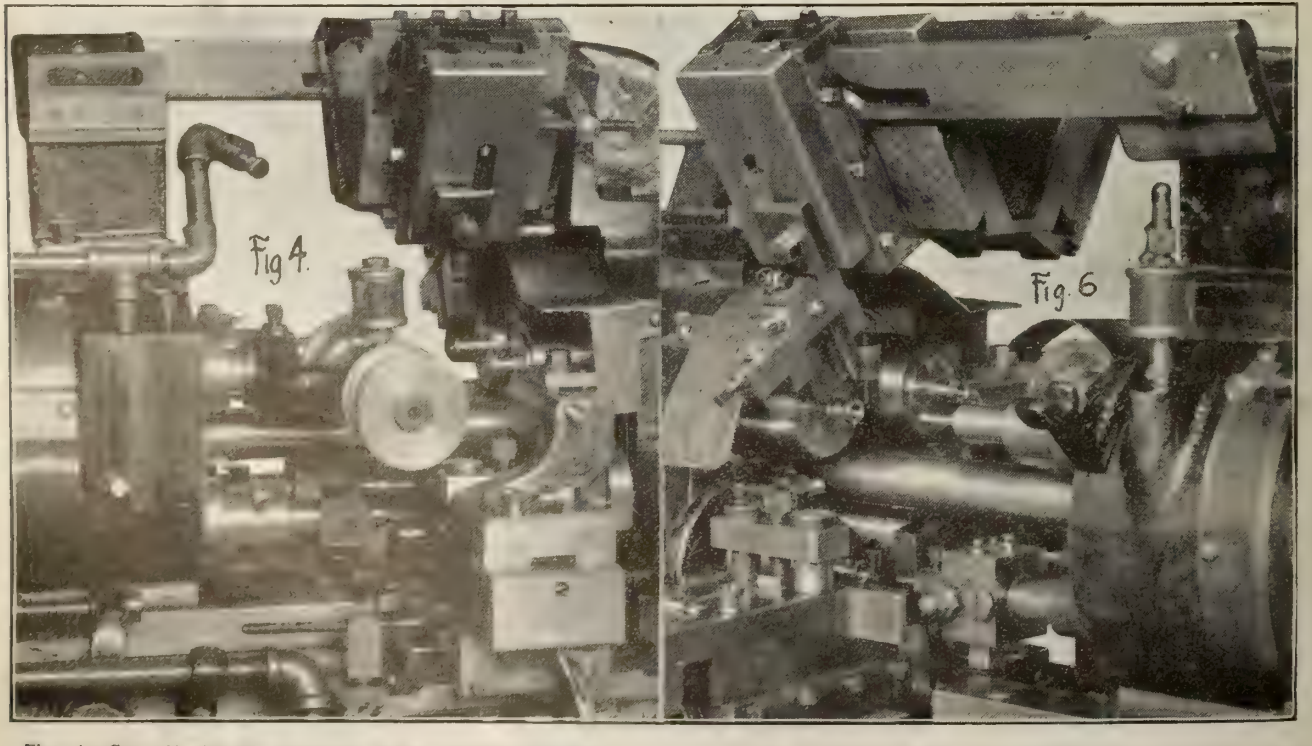


Fig. 4.—Cut off side of automatic screw machine showing special attachment for cutting off work in third spindle position

Fig. 6.—Forming side of automatic screw machine showing tooling for recessing automobile dust caps for tire valves, and for shaving the pieces with patented tool.

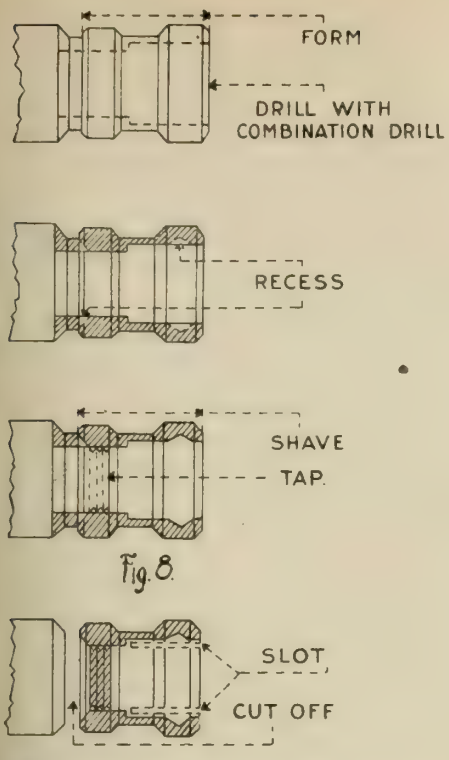


Fig. 8.

Fig. 8.—Operations chart of dust cover for tire valves.

attachment shown in Fig. 7. The pulley shown is driven by a belt from the countershaft. Two milling cutters, or metal slitting saws, are mounted on the arbor and the advance of the end tool slide feeds the saws into the work. In order to accomplish this operation the spindle must be stopped in the third spindle position. However, the design of the machine permitted of this. The spindle starts immediately after this sub-operation is completed, and the cutting off follows quickly thus completing the sequence of operations. Fig. 8 is a chart of operations.

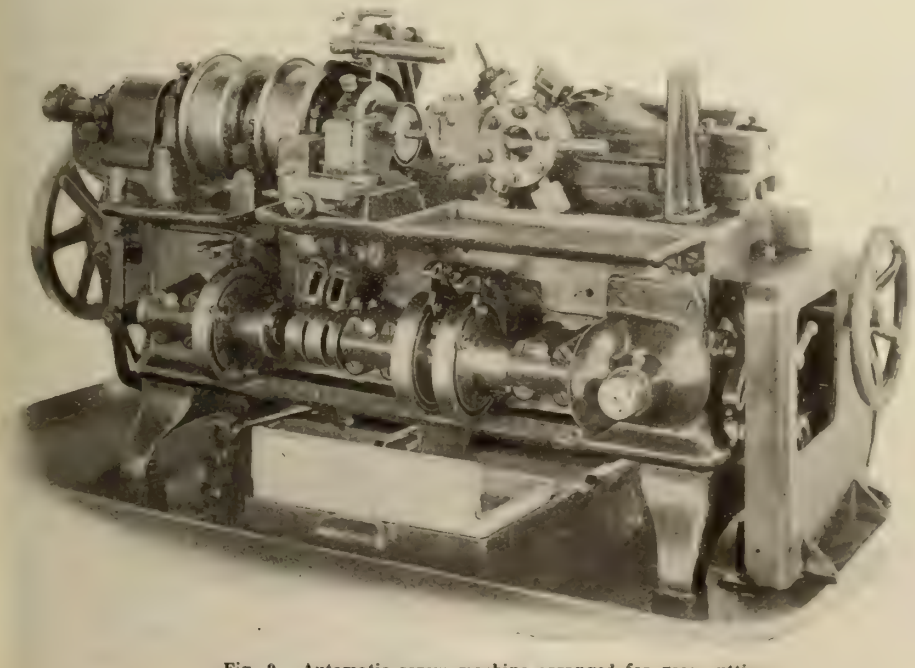


Fig. 9.—Automatic screw machine arranged for gear cutting.

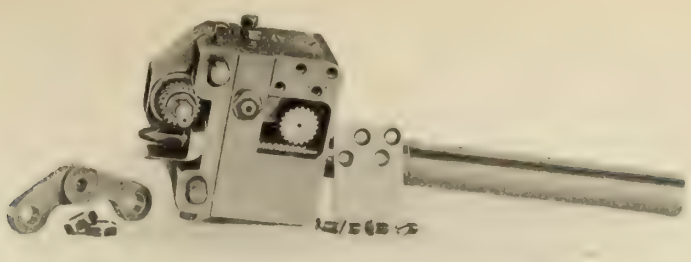


Fig. 10.—Upper view Front view of helical tooth generating tool.

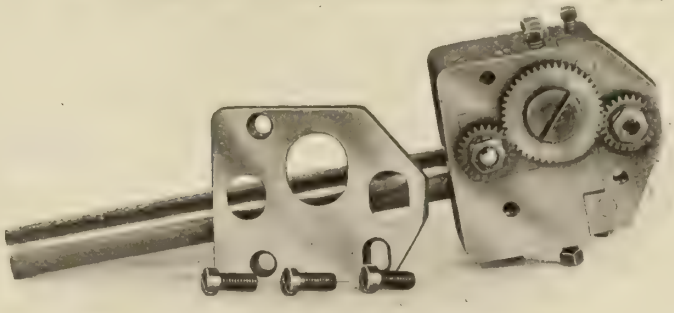


Fig. 11.—Rear view of the tool with gear guard removed.

Cutting Gears

Probably a more unusual application of the automatic screw machine is one where helical typewriter gears were cut out on one of these machines. Previous to using the screw machine to cut these gears they were produced on a small hand-operated gear-cutting machine, of special design, which machine performed the work in the same way that helical gears were cut in a milling machine, that is to say that the blank was fed forward and rotated at the same time under a revolving formed cutter. It was then returned to the starting position again, indexed, and fed forward for the succeeding cut, and so on until the gear was completed. This same type of screw machine had been successfully employed in cutting triple worms for gas meters so it was decided to attempt to tool up the machine for cutting helical gears. The machine is shown in Fig. 9 rigged up for producing gears. Figures 10 and 11 show front and rear views of the tooth generating tool and Fig. 12 shows details of its construction. The principle of its operation will best be understood from the latter engraving.

When the tool comes into action, the blank has been formed in the machine to the point shown at D in Fig. 13. The hole has been drilled and reamed and the outside diameter formed to the required dimensions. When the tool is brought up to the work the three-cornered driving centre G enters the drilled hole, and is thereby caused to revolve with the blank. As it is screwed firmly into the long driving gear H, this latter is also set in motion in unison with the spindle of the machine. Gear H has helical teeth cut on it engaging mating teeth in helical gear J, which is mounted on a short horizontal shaft having spur gear K keyed to it at the rear end. This gear, through a large idler, L, drives gear M, which is keyed to the cutter spindle S. Cutter, N, mounted on the spindle has the form of a helical gear properly cut to mesh with gear to be formed. It is made of hardened tool steel and is ground on one face, which face is set as shown in the end view, so that it is in the plane of the axis of the work. By means of the train of gearing just described, it will be seen that cutter N may be caused to revolve in unison with the work as though it were in mesh with the latter after the teeth have been cut.

Driving centre G and the front bearing of gear H are supported in a sliding bushing O seated in the body P of the tool. A plunger Q in the shank of the tool is pressed by a long and stiff spring against the end of the bearing of H. This serves to keep G pressed into the hole of the work. As the tool advances over the work, G and H are forced back with relation to the holder, remaining stationary so far as endwise movement is concerned with relation to

the work. The thrust between Q and the end of H is taken by a hardened ball pivot bearing as shown so that the friction is inappreciable. The extended lip on the bushing O is simply for the purpose of providing the long keyway shown, which engages a pin in the body P to prevent O from turning. When the tool is not in contact with the wo screw R limits the outward movement of G, H, and O produced by spring plunger Q.

Cutting the Teeth

Consider now that we have a gear blank in the machine with the teeth all cut, but not yet severed from the bar, and suppose the cutter N to be meshed with it as shown at D in Fig. 13. Suppose further that the spindle of the machine has been stopped. If now the turret slide be moved forward or back from the position shown, so that tool P is pushing forward or back over the work, centre G and gear H remain stationary with reference to the work, but move back and forth with relation to the tool holder. This axial movement of gear H will evidently rotate helical gear J, which, through the train of gears K, L and M will in turn rotate the cutter N. The ratio of this train of gearing is such that the rotary movement given to N by the longitudinal movement of the tooth-holder in either direction keeps it exactly in step with the teeth of the work. Thus the movement of the turret slide rolls the cutter on the work ju as if the latter were mounted perfectly free on its axis and as rolled by the teeth of the work itself, instead of through the train of gearing described.

Consider further, with the cutter and work set in the relation shown in Fig. 13, that the turret slide of the machine is fixed in position, but that the spindle and the work is rotated. The rotation of the gear revolves the three-cornered driving centre G, which, in turn, transmits its motion to gear H, and thence to gears J, K, L, M, and cutter N. The ratio of this train of gearing is again such that the rotary movement thus given the cutter is in the proper ratio to keep the latter in step with the teeth cut in the work, so that the work and cutter revolve together as if they were a pair of helical gears driving each other, with no connection through the train of gearing.

It has thus been shown that the cutter will be kept in step with the work if the tool is moved axially back and forth over the work while the latter is stationary. It has also been shown that the cutter will keep in mesh with the work, while the latter is revolving and the turret slide and tool are stationary. Since the cutter and work are kept in step under these two conditions separately, they are still in step when the two movements are combined. This tool and its arrangement of gearing can thus be moved back and forth over the revolving work without throwing the teeth in the cutter and the teeth in the work out of step with each other. This always supposes, of course, that the tool is not moved back so far that driving centre G loses its contact with the work, as the proper meshing of the cutter depends on the driving connection between G and the blank. If G is ever moved back out of contact with the blank, this connection is broken and when the cutter is again moved forward on to the work, it will probably be found out of step.

The action of cutter N will be readily understood now that the method of driving it has been explained. The face, as shown in the end view of Fig. 12, is the cutting edge. As the tool is forced on to the work, this revolving cutting edge, having the exact shape of the helical gear which is to engage with the work, cuts teeth of that exact shape on the blank as it is gradually forced over it. In other words, the operation is an ex-

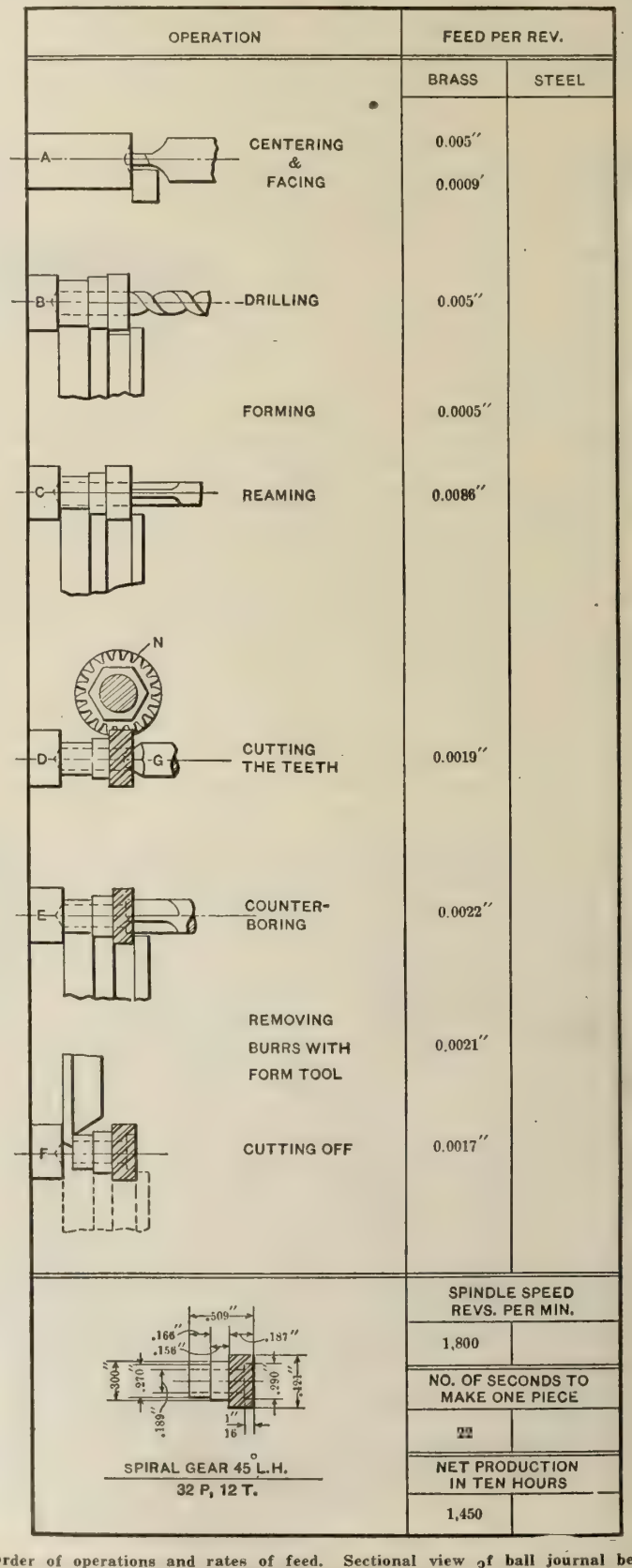


Fig. 13.—Order of operations and rates of feed. Sectional view of ball journal bearing, and a single ball thrust bearing.

ample of the molding-generating principle, the cutter N molding the proper surface to mesh with its own teeth.

The various adjustments of the tool may be understood by reference to Figures 10, 11, and 12. The shank of the tool is made very long, as may be seen also in Fig. 9. This permits the use of a spring for plunger Q long enough so that its pressure will not be materially greater when the cutter is pushed clear over the work at the completion of the cut, than when centre G first enters the hole in the work. If the pressure should materially increase, there would be danger that G might be pressed further into the edge of the hole, thus disturbing the axial relation of G and the blank, and consequently throwing the cutter and the work out of step with each other by that amount. The use of the long spring avoids the possibility of trouble on this score.

The cutter spindle S is mounted in bronze bushed bearings in front and back plates T and U, which are clamped together and to the body P of the tool by studs and nuts V. These studs, as is most plainly shown in the sectional view in Fig. 12, pass through elongated slots in the body so that the cutter spindle may be adjusted for a larger or smaller diameter of work by means of set-screws W, the adjustment being locked by nuts V. This adjustment would of course, disturb somewhat the correct meshing of gears L and M. Gear L is therefore mounted on a stud X which floats in an enlarged hole in the body and so may be adjusted by means of suitable set-screws which bring it into proper mesh with both M and K. The shaft on which the latter is mounted is also carried in a sliding block Y, by means of which gears J and H can be moved into closer or freer mesh After the cutter has been set to the proper diameter for the work, the whole system of gearing may thus be adjusted to mesh without discoverable back lash and without binding. It is advisable to have as little back lash as posible between the cutter and the driving centre to prevent the former from jumping or chattering when first commencing the cut. When there is much back lash the ends of the teeth where the cut commences are not formed to quite the proper shapes. While there is no great harm in this in the case of a helical gear, in which the contact takes place in the centre of the face, it gives a poor appearance to the work, and so should be avoided.

The thrust of the revolving work, pressing down on the cutter when the tool is in action, is taken by a ball bearing at Z. This is the only point where there would be any great danger of excessive friction so that the probability of G slipping in the work, due to too great a resistance in the mechanism it has to drive, is obviated. For the desired action, the cutting edge of the cutter must be in the plane of the centre line of work. In the tool shown, no special provision is made for maintaining this condition. As the face of the cutter is sharpened it is necessary to pack it out with filing washers. In later designs, adjustments will be provided for bringing the cutting point on a line with the centre.

The order of operations followed is shown in Fig. 13. The part to be made is shown with dimensions at the bottom of the engraving. The first operation after feeding the stock is centreing and facing, as shown at A. This is done with a tool held in the turret, and shown pointing upward to the right in Fig. 9. The turret is next revolved two holes, and the drill is brought into action. Then the turret is revolved again and the hole is reamed. The reamer is mounted in a "floating holder" seen pointing downward to the left in Fig. 9 (the turret revolves in a counter clock-wise direction.) This form of holder enables the reamer to be centred accurately, so that it will cut to size and take off an equal amount with all its teeth. While the drilling and reaming are going on, the blank is being formed by a circular form tool mounted in the front cross slide, as shown at B and C. The operation of cutting the teeth at D has already been sufficiently described. At E the hole is being counter-bored.

This counter-boring incidentally removes the marks made by the sharp corners of driving centre G. At F the completed piece is being severed from the bar. While the counter-boring is in progress, and during the first part of the cutting-off operation, the front form tool as shown at E and F is again brought down to clean off the burrs produced by the gear cutting tool.

A pair of finished brass gears made by this process mesh smoothly with each other, and appear to be finished, on the whole, rather better than would be the case had they been shaped by a formed cutter as usual. There appears to be almost no limit to the possibilities of the automatic screw machine in the hands of a resourceful designer, and this production of a set of gears serves very well as a reminder of that fact.

Steel helical gears of the same dimensions have been made at the following rate: Number of seconds to make one piece, 80; net production in ten hours, 400; also others 25/32 inch diameter 12 teeth, equal ratio, have been produced in 4½ minutes per piece giving a net production of 120 in ten hours.

ERRATA

In the Nov. 3rd. issue of Canadian Machinery, there appeared an advertisement of the J. T. Hepburn, Ltd., on Page 27. In this copy the size of the planer illustrated was given as 92 in. x 92 in. x 10 ft. This of course is the incorrect figure, for the size of the planer shown is 42 in. x 42 in. x 10 ft.

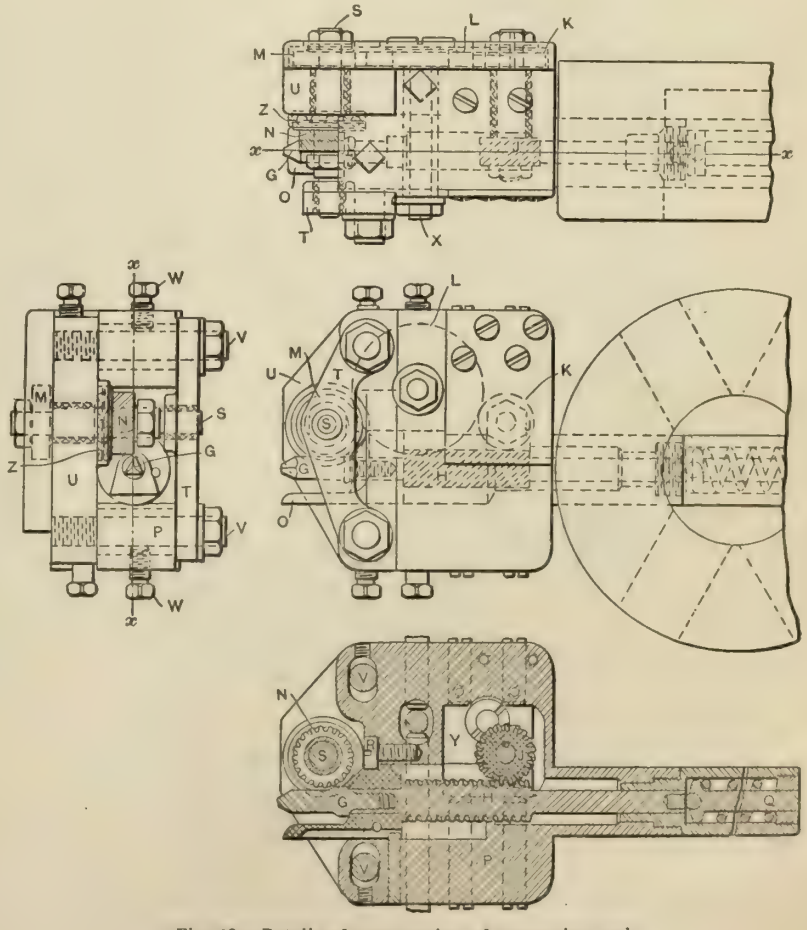


Fig. 12.—Details of construction of generating tool.

Forming Tools Require Careful Calculation

Forming Tools Especially Useful for Repetition Work — On Straight Forming Tools It Is Best to Reproduce Form by Mechanical Means—Complicated Shapes Should Be Calculated Carefully

By J. DAVIES

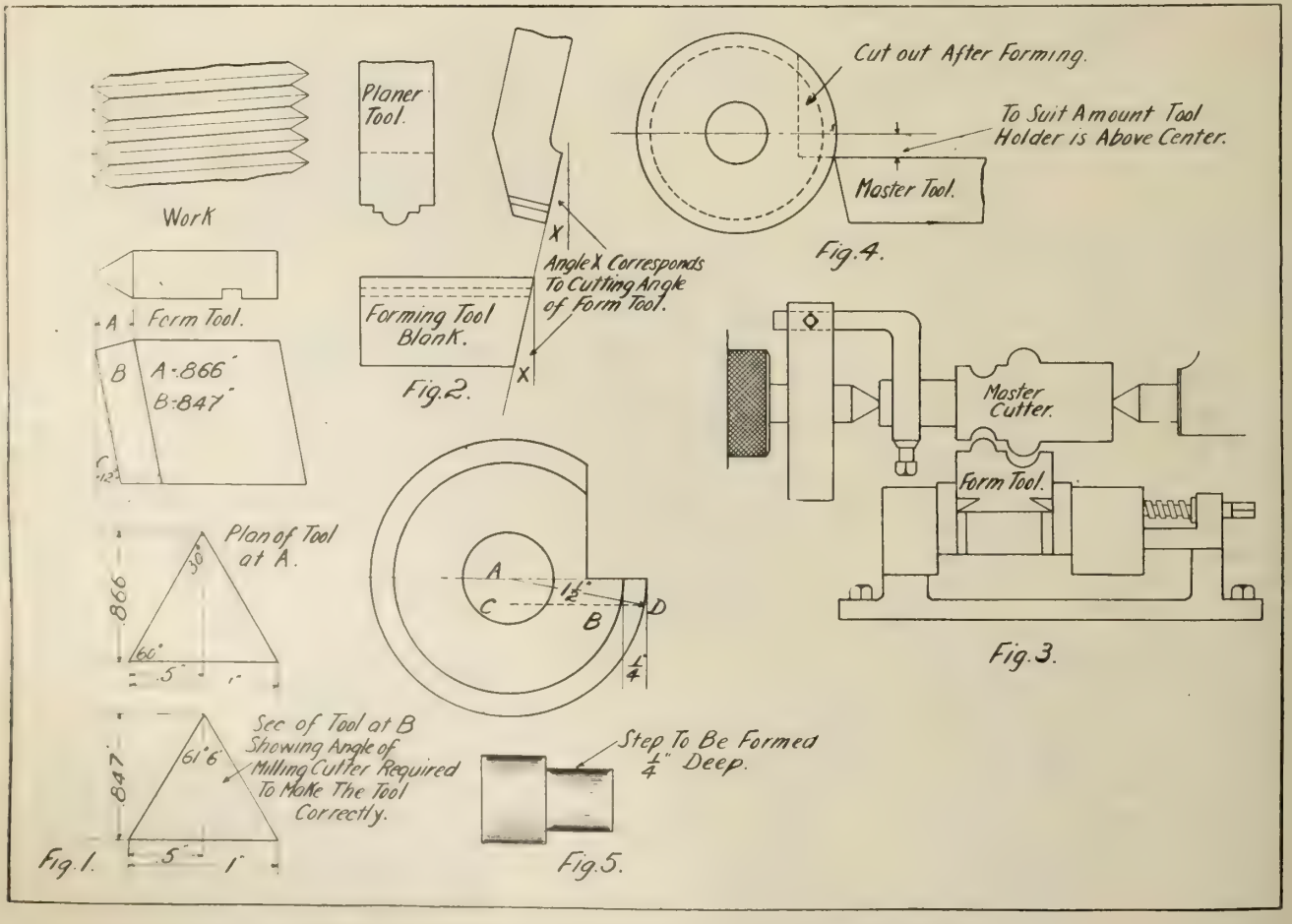
DURING the war, forming tools of various kinds played a very prominent part in the production of 18 pound shrapnel shells. There was the simple straight tool made to some form; the dovetailed vertical; and circular tools for copper bands, and brass nose sockets. One characteristic of the circular forming tool is that it will not reproduce its own profile, owing to the fact that in order to get cutting clearance, a piece must be cut out below the centre, then the tool raised up to the centre. This means therefore that to make a circular tool to produce work of a given size and shape, requires careful calculation.

The fact that different positions of the tool alter the size is not altogether a disadvantage because in one case we used a circular tool for cutting the wave ring which had to be turned to pretty close limits, and when the tool setter or operator would grind his tool, or perhaps a new tool was supplied, the shells would sometimes come high or low in diameter. This would generally be remedied by raising or lowering the tool. Of course in doing so we altered the form, but the difference was so slight that it did not matter. The most obvious advantage of the form tool is that the most complicated shape can be produced at once without any special skill by the operator, for if one part measures correctly, the whole form will be correct, assuming of course, that the tool is correct.

The disadvantage is that they are difficult to make and would not be economical except for repetition work. Generally, when using form tools the entire edge is cutting at once. This has a tendency to cause chatter. Forming tools are made which operate tangentially, that is instead of moving in towards the center of the work, they move in a line tangent to the outside of the surface being formed, often by means of a vertical slide and a hand lever.

Forming tools are made in many ways, the majority have no top rake. That is, they are flat on the top. This simplifies the calculations for obtaining a true form. Suppose we are to make a forming tool to produce the form shown. Fig. 1. This is a common 60 threading tool with a 12 degree clearance cutting angle. When milling the tool and measuring at right angles to the front of the tool, the depth B will be found to be slightly less than the required depth A. The difference between A and B will depend upon the angle C. The depth B will equal A multiplied by cosine of angle C. To simplify our calculations let us call the width of the tool 1., which equals the pitch of the thread and could be taken to any unit of measurement. If the tool is 60 degrees and the width at the base is one, then the depth or length A will equal .866 calculated as follows:

Bisect angle 60 making two right angle triangles with a base .5" wide and angles 30 and 60 and 90, tan of angle 60 times the width of base equals height equals 1.732 x 5=.8660 or tan x side adjacent=side opposite. Now the depth B measured from the front of the tool will equal .866 x 97815 or A times co-



Figs. 1 to 5.—Showing the author's ideas. Text matter explains each view.

sine C=8470 so that the depth of the tool measured from the front equals .847. Now it will be noticed the width remains constant so that it is quite evident that we have altered the angle when measured at right angles from the front face. This angle represents the angle of the milling cutter required to mill the tool correctly and would be:

$$\text{Co tan} = \frac{\text{Side adjacent}}{\text{Side opposite}} = \frac{.847}{5} = .1694$$

The angle whose co tan is 1694=30° 33′ The complete angle=30° 33′ x 2 = 61° 6′.

If any slight inaccuracies developed in making the tool, these could be compensated for by altering the 12 deg. cutting angle to suit as this angle could be changed slightly without any detriment to the tool.

When a straight forming tool is to be made of a complicated shape it is best to reproduce the form by mechanical means rather than enter into any very elaborate calculations. This can be done in two ways at least. One method consists of filing a template to the required form and from this making a shaping or planing tool and fixing this tool in the shaper or planer at the same angle with the forming cutter as the latter will be afterward applied to the work. See Fig 2 Another method is to turn a piece of tool steel to the form required leaving a plain piece on each end to act as an arbor.

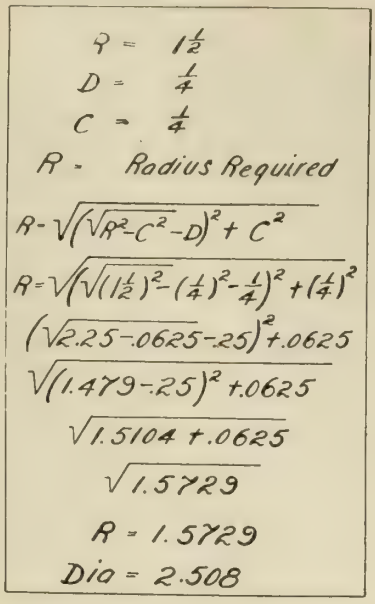
In making the cutter shown at Fig. 3 here is the plan adopted. The dovetailed form tool is roughed out as near as possible, then machine is stopped and the master former set at the same angle with the vertical as the form tool will stand when in operation. The master cutter is secured by any convenient means, after which a light scrape or two by hand is taken, this being accomplished by running the table backwards and forwards.

Circular Forming Tools

Circular forming tools are probably the best when conditions will allow of them being used, owing to the large amount that can be ground away before the tool is all used up. Here again if a difficult form is required it can be reproduced by mechanical means as shown in Fig. 4. Make a master lathe tool of required form and drop it as much below the centre as will correspond with the piece to be cut out of the circular forming tool. This gives the correct shape at all points.

It has already been stated that a circular form will not reproduce its own profile, neither will the steps in the tool be the same depth in the work as they are in the tool. Suppose we want to make a circular forming tool to make a piece of dimensions shown in sketch. The largest dia. of forming tool to be 3″ with a piece cut away ¼ below the centre for clearance. It is required to calculate the small dia. of the forming tool. Fig. 5 is a sketch of the forming tool with all known dimensions. The problem is to find the length of the line A B which is the radius of the small dia. of the tool. The first step is to find the angle at D in order to find the angle at D in order to find length length C D.

$$\frac{\text{Side opposite}}{\text{Hypotenuse}} = \text{sine} = \frac{.25}{1.5} = 1.666$$



Important Note: The above is not quite correct. Reading from the third line from the bottom, here is how it should be reproduced—R equals the square root of 1.5729, therefore R= 1.254. The last line on cut is correct.

The angle whose sine is 1.666 is 9° 34′ and the co sine of this angle is .9869.

The side adjacent to this angle which is the length C D = hypotenuse x co-sine. Hypot. x co sine. = length C D= 1.5 x 9860=1.470. The depth of the cut B D subtracted from length C D = C B = 1.479—.250=C B=1.229. Side adjacent which is length C B divided by side opposite which is ¼ equals co-tangent of angle B. 1.229 ÷ 25 co tan of B 4.9916. The angle whose Co tan is 4.916 is 11° 30′ and the sine of this angle is .19937. Divide side opposite or ¼ by sine of angle B length of A B which is the radius of dimension required

$$= \frac{.25}{19937} = 1.254 \text{ Rad.} = 2.508 \text{ Dia.}$$

A formula given by machinery for the same work is: H R=largest radius of tool; D=Difference in radii of steps on work; C=Amount cutting edge is below center; R=Radius required, which worked out on our example gives the same results.

The Winnipeg Motor Car, Ltd., of Winnipeg, Manitoba, have acquired three acres of land in this city for a three story building large enough to turn out 55 cars per day. The company have been working all summer getting it into shape and they expect to be producing by the first of the new year.

BALL AND ROLLER BEARINGS

(Continued from Page 28)

this bearing should be concentric with the bore and of the housing carrying the adjacent journal bearing. The faces of the recess must also be perfectly square with this bore. This type of thrust bearing being mounted on a sleeve in a unit makes it very desirable to use and easy to install.

Fig. 8 shows the application of ball bearings to loose pulleys, and it is on this work that they show to particular advantage. Their perfect reliability and suitability for grease lubrication mean that the bearings can be neglected for long periods without the slightest harm, provided they are properly fitted and lubricated in the first place. Where the belt is constantly thrown off and on the loose pulley, the use of ball bearings reduces considerably its wear and tear. The method of applying the bearings is very simple: The outer races being the revolving members should be a tight fit in the hub of the pulley, and should be clamped endways by means of the distance piece and spigotted end covers. The inner race of one bearing is fixed by means of an adaptor sleeve and nut. This bearing locates the pulley.

A thin sleeve or bushing should be tightly fitted to the shaft, and the parallel bore of the other bearing made a nice push fit on this sleeve. This inner race must not be clamped endways, and, while it must not be a slack fit, it must be able to align itself opposite its outer race. If this cannot happen, a permanent end thrust is put upon the bearing which will ultimately cause its destruction.

A SIMPLE TIPPING GEAR

The number of devices invented for raising the body of a wagon so that its contents may be tipped out on to a dump is legion. Most of the forms adopted are slow in action if they are simple, and if the action is rapid the mechanism is very heavy and complicated, especially where side tipping as well as rear tipping is required. Some interest therefore will be taken in a new solution patented by a British firm. It consists simply of an ordinary jack fixed on the chassis immediately beneath the centre of the body, and operating in a ball-and-socket joint which enables it to tilt in any direction as the jack is raised or lowered. The body rests on hinges which can be adjusted for side tipping—to either side—or for rear tipping. When the wagon has to be tipped all that is necessary is to arrange the hinges in a suitable way and operate the jack by means of the engine on the car. The jack in rising pushes the body over towards the side where the hinges remain fixed. The operation is quite rapid; and in the event of any breakdown of the power the mechanism can be operated by hand. The only additional weight which this invention involves is the weight of the jack and the girders fixing it to the chassis.

Proper Heat Treatment for High Speed Steel

Steel Being Raw Material Should Receive Careful Study—Danger of Improper Heat Treatment — Object of High Temperature Furnace—Quenching the Tool—Care is Big Essential

*By J. L. THORNE

THE ART of heat treating high speed steel is the most important branch of the cutting tool industry. It is even of more importance than good steel, careful designing, or of any other individual step in the process of manufacture, for the reason that heat treating is usually one of the last operations, and all the good qualities that a tool might have possessed are readily destroyed in a greater or less degree by improper heat treatment. Realizing the importance of this operation, close attention should be given to every detail which will enable the operator to insure reliable results.

Steel being the raw material from which all tools are made, should receive careful study and that grade which is best adapted for the particular purpose in mind selected. Many steels on the market today have adopted what is practically a standard chemical composition. This composition was selected because for standard work it has proven itself to be good. However, let us not make the mistake of being too conservative by refusing to try any new steel or alloy which may possess merit to a high degree. From the heat treating point of view, it does not matter by which process the steel is made, either the crucible or electric. Both methods make good and poor steel, depending entirely upon the skill and knowledge which are used in its manufacture. In a general way the chemical composition of high speed steel is as follows:

	Per cent.
Carbon	0.60-0.70
Silicon	0.20-0.30
Sulphur	0.025 maximum
Phosphorus	0.025 maximum
Manganese	0.25-0.35
Chromium	3.25-4.00
Vanadium	0.25-1.00
Tungsten	16.00-18.00

Before going further, it might be well to consider the effects of these different elements upon the steel. Silicon when too high, causes a brittleness by forming a silicon of iron which is not appreciably dissolved in the steel and acts in much the same manner as any foreign inclusion. Manganese is of great benefit to the steel, in that it readily combines with the sulphur and reduces to a minimum the damage this element would do if left to combine with the iron. Manganese, however, is nearly always in excess of that needed to combine with the sulphur and the remainder unites with the carbon to form manganese carbide, which is one of the compounds which in part hardens tool steel.

Sulphur, if left uncombined by the manganese, would form a compound with the iron which would be of a very brittle nature. As stated before, however, it is seldom in excess of the manganese and is injurious for the reason that manganese sulphide does not enter into the solid solution, but separates out as an inclusion in the steel. Sulphur causes steel to be brittle when hot, and if too high it is impossible to work the steel through the rolling mills, and necessarily scraps the ingot. Phosphorus unites with the iron to form a phosphide which often segregates and causes the other compounds, such as the carbides, to become segregated, and it is said to be one of the chief causes of ghost lines in steel. Phosphorous also causes the steel to be sensitive to shock.

Chromium does not materially alter critical range, although it has been claimed to slightly lower the upper critical points. This element in conjunction with the carbon, is mainly responsible for the extreme hardness of high speed steel. It is very influential in causing the steel to be hard on relatively slow cooling after being heated through the critical range, and it also imparts a secondary hardness on being reheated to a temperature under the critical range. Vanadium was originally used as a scavenger of the steel to remove the slag impurities and to reduce the amount of nitrogen held occulted in the steel. However, it is now proven that this element adds some very desirable qualities to the steel. It increases the elastic limit and greater resistance to wear and shock, allowing the steel to have a higher cutting rate when properly heat treated. Tungsten slightly raises the critical range and unites with the carbon to form a double carbide. This element increases the desirable effects of chromium and imparts the high degree of red hardness which makes our high speed steel so valuable.

While this does not begin to exhaust the effects due to these various elements on the steel, it, in a general way, gives some idea of what the steel is composed and why the various elements are added. It also explains why the tool manufacturer lays as much stress as he does on the importance of purchasing steel of a specified analysis. On the whole the chemical analysis of the steel has no direct bearing on the heat treatment it will receive, aside from the fact that these various elements cause a change in the position of the critical range. The critical range itself is of secondary importance. The main fact which the heat treater should know is the temperature necessary to cause the various elements to enter into the solid solution and form a homogeneous compound. The following treatment is for the usual high speed steel on the market, and as the composition varies with higher or lower percentages of alloys, the heat must be varied to meet the new conditions. With high speed tools which are cast to shape the heat treatment is altogether different in every way, from that described. It was because of our trying to heat-treat cast tools in the same manner as we had formerly heat-treated tools made of bar stock that we had encountered many failures and very uniform results. After a careful study of our cast tools, a new method for heat treating was worked out.

Improper Heat Treatment

To illustrate some remarkable instances of what improper heat treatment may cause even with a high-grade metal it may be well to give some of the results from the usual heat treatment given high-speed steel on cast tools and compare them with the results now obtained, using an altogether different method. In heat treating tools cast to shape as ordinary high speed steel we found, as did many others, that breakage was very high, due to hardening strains, and to the reason that cast tools do not have the fibrous structure that steel which has been hammered and rolled has, and, of course, if no corrective measures are taken, is of a brittle nature. This has been overcome by heat treating and in course of time, when some existing experiments have been completed showing the relation of cutting ability to results from impact tests, tensile strength and elastic limit in conjunction with the hardness of the tool, we hope to present this information for your consideration.

Even with our limited knowledge of the cast iron tool industry, we have obtained cutters which will uniformly do the following work: a 6x1 inch milling cutter was used and the material cut showed a shore hardness of 38, the speed was 83 revolutions per minute, or a cutting speed of over 130 feet per minute, depth of cut 1 inch feed, 16 inches per minute. This means we can remove 16 cubic inches per minutes, or one cubic foot in little over one hour and a half.

Heat treating of commercial high speed steel consists essentially of first preheating the tool; second, raising it to the high temperature; third, quenching, and fourth, reheating, drawing or tempering. To accomplish these four operations successfully the form of the fur-

*The author is metallurgist at the High Speed Tool Corp., New York, and presented this material before the Philadelphia convention of the American Society for Steel Treating.

nace should be carefully considered in its relations to the type of the tool to be hardened. For the purpose of this article, we will take into consideration such tools as are properly hardened in an oven-type furnace. This would include all milling cutters, blades, forming tools, etc., which are to be hardened all over.

The purpose of preheating is to raise the temperature to some point below the critical range, so that on its introduction into the high temperature furnace, it may acquire that temperature as quickly as possible. While it is necessary to leave the tools in the preheating furnace for some little time, care must be used that as small an amount of scale as possible is formed on the tool. The reason for this is that the scale when heated to a relatively high temperature is reduced again by the carbon of the steel and causes a decarbonized surface. There are many cases where the steel has been condemned for this soft or decarbonized surface, which was entirely due to an improper atmosphere within the furnace, this causing the scale. It has been found that smaller tools of delicate shape could be preheated to as high temperature as 1700 deg. Fahr. with good results, as it is not necessary to hold these pieces in the high temperature furnace for as long a time as would be necessary had the temperature been lower in the preheating furnace. In general, experience has proven that the higher preheating temperature gives better results than by following the older methods which use approximately 1500 degrees Fahr. for all preheating work.

The main points to be considered in the preheating furnace are: first, uniformity of heat; second, temperature to which the piece is to be raised; and third the atmosphere within the furnace to obtain the least possible amount of oxidation of the tool. In preheating the tool, it should be brought to the temperature slowly, as this will eliminate the danger of checking the steel due to the uneven expansion of the tool. This is especially true of tools which are not of uniform cross section. From the preheating furnace the tool is now transferred as quickly as possible to the high temperature furnace.

High Temperature Furnace

The object of the high temperature furnace is to cause the various elements in the steel to enter into a solid solution in the quickest possible time. The reason for haste is that as soon as the steel passes the critical range, grain growth sets in and the smaller we can keep the grain and at the same time acquire a homogeneous solution, the better service we may expect from the tools. Excessive grain growth causes brittleness in the tool and drawing even at high temperature cannot correct this, although it may mitigate the brittle nature to some extent. On acount of this grain growth, the preheating should be as high as possible but lower than the critical range and the temperature of the high heat furnace considerably higher than that to which the tool is to be brought. For ordinary high speed steel a furnace temperature of not less than 2350 degrees Fahr. and as soon as the operator is able, this should be raised to 2375 degrees Fahr. or even higher. At this temperature the steel would soon be destroyed if left for any considerable time, and must receive careful attention and removed the instant the fine cutting edges acquire the proper temperature. The usual method to determine the proper time to remove the tool is to watch for the metal to sweat or small bubbles to appear on the surface of the tool. This method is good, but a better way for the careful observer is to watch the thin section of the tool and when the tool is ready to be removed a faint but noticeable intensity of color is observable. This increased intensity lasts but a very short time, and if not observed, there is danger of the tool being overheated. It resembles in many respects the recalescence of plain carbon steel, and is no doubt due to some changes taking place in the steel. The Tungsten carbide will go into solution at a temperature much lower than has been recommended in this paper, but it is sluggish and to get it in solution takes time, allowing grain growth, although for the heat treater who has had little experience with high speed steel it is no doubt safer even if it is at the expense of the cutting ability of the tool.

Heat Cutting Edges

It is of prime importance to heat cutting edges to get even uniformity, etc. To accomplish this, it is necessary to resort to many little tricks. All tools should be moved so that both sides shall attain the same temperature and for milling cutters, the writer has found that a block of pure nickel upon which they may be placed so that the cutting edges extend over the edges of the block assists in bringing the tool to a uniform heat. Tools which have a large and small cross section may be brought to heat evenly by protecting the thinner sections with asbestos for a portion of the time and removed so that all parts acquire the temperature necessary at the same instant. Angular cutters may be placed with the thin section next to the hearth bottom and are thus protected by their own mass and the thin sections are the last to acquire the necessary temperature.

Where many pieces are treated daily, the scale from the tools falls to the hearth and in the high temperature soon fluxes with the hearth to form a thick slag which does not help in heat treating and more often damages the fine cutting edges by promoting fusing of the steel. This slag often adheres to the tool after quenching and when it is sand blasted enough to remove this slag the cutting edges often suffer. When the hearth gets bad a sheet of asbestos covering the hearth will help considerably, although it requires renewing almost daily. In connection with the hearth, it has been found that carborundum is much better than the ordinary fire clay. The cost is two to three times as much, but gives nearly ten times as much service. In one heat-treating room the bottoms made of fire clay lasted on an average ten days. Carborundum hearths were tried, and they gave better than three months' service. This, when the time lost in renewing the hearth is taken into consideration, more than paid.

Another source of trouble in the high temperature furnace is protection tubes to withstand a temperature of 2300 degrees Fahr. or higher. Most of the alloys on the market fail to stand up for any time at all and the refractory tubes have numerous faults. In the first place, it is hard to introduce a new protection tube into a hot furnace without first preheating on account of breakage, due to the expansion of the tube. Even when put in a cold furnace and brought up to heat with the furnaces, they sometimes break for this reason. Another bad feature is that they are easily broken by being struck by the work in the furnace. As a substitute for the various protection tubes on the market using pure nickel tubes made from nickel bars with the holes drilled or bored is suggested. Cast nickel tubes were tried and while they were far superior to any that had been used before, they gave less than half the service the bar tubes gave and were more or less porous. The bar tubes have given service for three to nine months where the temperature used was from 2350 to 2385 degrees Fahr.

Quenching the Tool

The tool having been brought to the desired temperature and the steel being in a solid homogeneous solution, it is necessary to quench the tool so that it is cooled quickly, thus the complexed hardenites do not have time to separate out an acquire that form in which the steel would be soft. Fortunately for the heat treater this occurs in high speed steel at a comparatively slow rate and even cooling air is rapid enough to retain these hardenites in the form that will render the steel hard. However, to follow the practice a large amount of scale forms which reduces the size of the tool, causes pitting and in many ways impedes subsequent operations, however, it is still sometimes used, more especially in Europe. To overcome these objections the tools formerly were immersed in oil when removed from the high temperature which cooled fast enough to keep the steel hard. There are many objections against the use of oil, however. Some of these are: Fist, the oil often takes fire when large quantities of hot metal are quenched and unless expensive cooling devices are installed is dangerous. Second, the oil cools the tools too quickly and often causes the tools to check, especially when of uneven cross area. This is especially true if the oil contains moisture and water often gets into the oil from the water jackets usually employed to keep the oil cool. Third, the oil becomes spilled or drips off the tools when they are removed and in this respect is dirty and causes the floor to become slippery, which is dangerous to the workmen.

(Continued on Page 53)



WHAT OUR READERS THINK AND DO

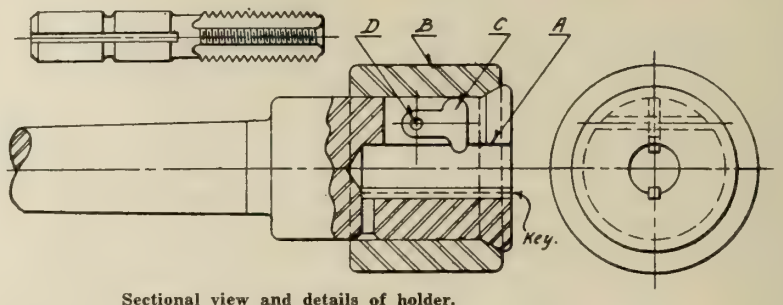


RELEASING DIE HOLDER

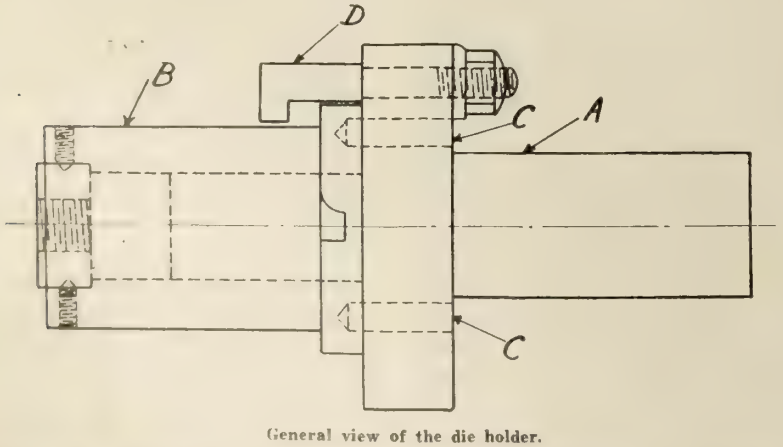
By Harry Moore

A solid shank for this type of tool, is to my mind well worth while. As a general rule the "home made" variety die holder has a weak shank, due to the fact that it is bored clear through to receive the shank of the revolving holder. This, in many cases, causes trouble when the holder is tightened up in the turret hole. If it should be tightened too much, the holder will not revolve easily as the hollow shank has a certain amount of spring, or on the other hand if it is not tightened sufficiently the holder will come out of the turret hole badly when backing out the die.

An easily made die or tap holder of the solid shank type is shown in the sketch. The die holder B, is made in the form of a sleeve running on the front portion of A. When the die is cutting, the thrust is taken by two pins CC, (driven tight into the shoulder of A) engaging with two holes in B. A hook bolt D, tightened securely to the shoulder of A, and running into the slot cut in B, serves to back the die off the work when the machine is reversed. The end of the hook bolt D, is rounded off to facilitate its slipping into the slot in B, without knocking.



Sectional view and details of holder.



General view of the die holder.

COLLET FOR HOLDING TAPS AND OTHER SMALL TOOLS

By F. S.

The accompanying illustration shows a simple arrangement which may be used for holding such parts as have a round shank, and which may be held in a drill press. Its object is to permit of quick removal of the tool from the collet. The shank of a tap would have, for instance, a keyway and round groove cut into it as shown in the sketch, and this is slipped into the hole A of the collet.

While this is being done the bushing B is held up by hand so that the small hinge piece C will be allowed to swing out of the way when the tap is being put in position. The collar B is then forced down over the hinged piece C, which is carried in a slot in the body of the holder hinged on a pin D. This hinged piece enters the groove on the tap and prevents it from falling out; the keyway driving the tap efficiently. Collets of this type may be used for drilling and other purposes.

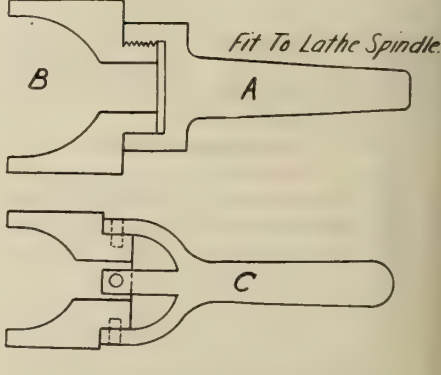
TREATMENT OF STEELS

According to directions supplied by the Consolidated Steel Corporation, American producers of tool and alloy steels, for the treatment of their high-speed material, in cutting tool lengths from bars of high-speed steel the bar should always be heated at the cutting point to a yellow color corresponding to a temperature of about 1750° to 1850° F. The bars should never be cut cold. For forging, the material should be slowly and uniformly heated in a clean fire, or furnace, to 1750° or 1850° F. (a yellow color), allowing sufficient time for the heat to penetrate to the centre of the piece. The tool should be reheated when the temperature falls below 1750° Fahr.

MACHINING A BALL

By G. Russell

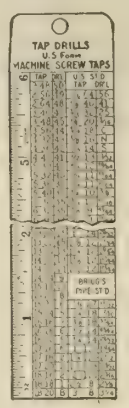
The accompanying drawing shows the tools used to finish some steel balls in the lathe. First a piece of steel is turned as round as possible by the ordinary method, taking care to remove the usual tit. Next the tool A is placed in the lathe spindle, and the ball placed in B. Next bring the hand tool into operation; it is placed over the ball. The lathe is started and by using a little pressure, and an oscillating motion, the ball is soon finished. The pressure should be released occasionally, in order to let the ball take a slightly different position. If proper care is taken, such a ball can be made within .001 inch. of being perfect.



The tool used to turn ball.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

While many contestants had 11 answers correct in the Oct. 20th contest, not one had the list of 12 correct. Question No. 12 was the puzzle. It read "A Pretty Strong Statement." Read page 3, Oct. 20th issue, and glance over the first five words of the Nicholson File Co. advertisement. It's a mighty strong statement to our way of thinking.

CONTEST FOR NOVEMBER 10th ISSUE
Contestants are required to write us, stating to which advertisements we refer in this number.

1—A machine that is special.
2—Something which gives you both speed and balance.
3—A machine which performs seven distinct duties.
4—How to get something analyzed.
5—Something that is quiet in operation.
6—How to avoid useless waste of effort and time.
7—A process that reduces waste.
8—A development of 74 years.
9—Something that is specialized in.
10—How to secure pithy information.
11—Something used by large manufacturers.
12—How to keep up-to-date.

These are Correct Answers for List from October 20th Issue

1—L. S. Starrett Co.
2—The American Pulley Co.
3—John T. Hepburn Ltd.
4—Cleveland Pneumatic Tool Co.
5—The Heald Machine Co.
6—H. H. Robertson Co.
7—National Acme Co.
8—Murchey Machine & Tool Co.
9—H. W. Petrie, Limited.
10—Canadian Hart Products Co.
11—Aikenhead Hardware Limited.
12—Nicholson File Co.

Closing Date for This Contest is December 1st.



Development of Welding Methods

WELDING methods have been developed in a marvelous manner during the past few years. Many improvements to torches, equipment, etc., have been added, and now we have a new form of oxy-acetylene torch, which according to "La Nature," has been developed in the French Navy in the process of salving vessels lost during the war. A small bell-shaped vessel surrounds the oxy-acetylene flame and is kept supplied with compressed air. After the flame is alight and the stream of compressed air established, the torch may be plunged into water without being extinguished. If by accident the original form of blow-pipe was extinguished, it was necessary for the diver to ascend to the air to light it again. A tube containing an alkaline metal and an oxidiser is now attached to the torch, and can be moved to the mouth of the bell. On removing the cap from the end of the tube the chemical action of the water on the mixture produces a flame which re-lights the torch. The addition has greatly increased the number of underwater uses to which such a torch can be put.

Tests on Hollow Steel Casings

A PAPER issued by the Bureau of Standards at Washington gives an account of the tests on six hollow cylindrical steel castings manufactured by the centrifugal process. The castings were 6ft. long and of diameters up to 18ins., with holes of various diameters through them, and they were made with the mould revolving about the axis at a speed not specified in the report. Samples of the metal taken from different parts of the complete castings were tested for hardness, tensile strength, soundness, structure, and density, both in the condition as cast and after heat treatments of various kinds. It was found, says Engineer, that there was a slight segregation of carbon, phosphorous, sulphur, nickel, and copper in the radial direction, but none of manganese and silicon. Small blow-holes were evident in the inner 1/16in. of the castings. After heat treatment several of the castings showed mechanical strength equal to forged materials of the same composition, and satisfied the ordnance requirements for gun forgings. Microscopic examination showed no hard spots, flaws, or other defects outside the layer 1/16in. thick at the inner surface, and the process appears to be one of great promise.

The Annealing of Aluminum

ALUMINUM castings such as oil pans of motor cars are somewhat difficult to weld when broken, owing to the liability of the part drawing out of shape while cooling or cracking owing to the locked-up stresses. If the part changes shape much it will be impossible to reassemble it, and if held rigidly to a steel frame while cooling off so as to maintain the original form there is danger of cracking.

One of the most effective materials for insulating aluminum castings and for insulating preheated aluminum castings and preventing cracks while cooling down is dry soft wood sawdust, says Autogeneous Welding. The sawdust should be used liberally, covering the welded casting to a depth of say two inches. If dry it is an excellent insulator, and if the casting is quite hot it is likely to take fire and smoulder slowly, thus extending the cooling period considerably. An aluminum casting so treated will be annealed so soft when cooled that it can be bent without fracture.

In this connection it is of interest to note a method employed by coppersmiths to anneal large copper and brass sheets and keep them flat. The same method is used for aluminum and monel sheets. After being heated the sheets are laid between dry pine boards and left to cool. The boards are excellent heat-insulators and as the wood chars and smolders for a time the slow combustion helps to maintain the heat. The sheets cool very slowly and when finally cool will be found soft and easily bent.

Lubrication of Railway Axle Boxes

AMONG various experiments with oil, a system of splash lubrication for railway axle-boxes is described in a recent issue of Railway Review. Near the bottom of the box, and hinged at the back end, is placed a plate or flat bar, its hinge permitting movement in a vertical arc and its outer end—near the front of the box—being seated on a coiled spring. Holes in this bar are fitted with hollow cones, the ⅛ in. apex openings of which are just above the top of the bar. A small roller or wheel having its axis parallel with that of the carriage axle is mounted in bearings on the bar and runs in an opening cut in the bar. To the end of the axle an eccentric disc or cam is attached by a tap bolt, the throw of the eccentric being ⅛ in. or ¼ in. This eccentric rides in contact with the wheel on the spring bar, so that at each revolution the end of the bar is depressed, and the oil which fills the lower part of the box is thus squirted up through the cones to strike the journal. To provide for lateral movement of the axle within the axle-box, the bar roller has a travel of about 1¾ in. along its shaft.

Another mechanical lubricating system employs loose waste to distribute oil which is pumped to it from a reservoir at the bottom of the axle-box. No change in box, brasses or journals is required. In this design the pumping is effected by the lateral movement of the journal and axle, a stud bearing against the end of the axle transmitting this movement to the short upper arm of a vertical lever. The lower end of this lever gives a corresponding but longer movement to a plunger in the oil reservoir, thus forcing the oil up into the packing. An advantage of this latter arrangement is that in case of the mechanism becoming inoperative, the oily waste would still continue to lubricate the journal. In tests held it was found that this lubrication was sufficient for about 150 miles, after which the journal began to heat.



DEVELOPMENTS IN SHOP EQUIPMENT



CONSTANT SPEED MILLING MACHINES

The Oesterlein Machine Company, of Cincinnati, Ohio, have introduced a complete line of milling machines of the constant speed, or "all geared" type. The new line consists of No. 1, No. 2, No. 2 heavy, No. 3, No. 3 heavy and No. 4 sizes, each size being made in plain and universal. The fundamental idea underlying the design has been to produce a machine with all of the features essential to modern milling and to secure these features by reducing the number of parts of the minimum and increasing the strength of the necessary parts to the maximum.

The speed mechanism consists of 15 gears from which 16 geometric speeds are obtained. Only one shaft is employed in addition to the spindle and the pulley shaft. In obtaining 8 of the 16 spindle speeds, power is transmitted through a three or four gear train. It has been found unnecessary to secure any of the 16 speeds by means of quadrants, or similar mechanisms. This simplification of speed mechanism shows its results in the low power consumption of the machine. The no-load power loss of a No. 2 machine varies from 124 watts (.18 h.p.) to 226 watts (.30 h.p.) between the extreme spindle speeds of 16 to 384 revolutions per minute. This power loss included the feed box at the highest rate of feed and feed mechanism within the knee and may therefore be regarded as practically the entire no-load power loss of the entire machine.

The speed changes are secured by means of "two position" levers and a "four position" knob. The "four position" knob controls the selection of four adjacent spindle speeds. All speed changes may be made without stopping the machine. Every gear is made from low carbon forgings that are put through an annealing, carburizing and hardening process. All gears are sandblasted to remove furnace scale and the wire edge of machining operations is removed in order to protect the bearings. The automatic lubrication of the machine is effected without pumps or any extra moving parts. This is accomplished by a system of three reservoirs. The first reservoir is cast in the top of the column, aside the overarm. Into this reservoir clear, fresh oil is poured. This oil seeps through felt down tubing to cavities cast under the main spindle bearings, from there to the intermediate shaft bearings and driving pulley.

Wicks dip into the cavities under the spindle and carry oil to the spindle bearings proper.

The driving pulleys are 14 inches in diameter, and run at 400 revolutions per minute. Practical use is made if the high belt velocity by controlling the operation of the machine by tight and loose pulley. A brake for quick stopping of the spindle is designed into the belt shifter in such a way that the belt is partially carried to the loose pulley and the brake applied to the tight pulley by a spring plunger release. The feed box is driven off of the pulley shaft, producing feeds in inches per minute. A phosphor bronze of from 28 to 32 points scleroscope hardness, is used for all bearings and feed nuts throughout the machine. Cumberland ground steel of 45 to 50 point carbon is used for table, cross and vertical screws. The feed box, knee and table are similar to the design developed by the company and used in their cone type milling machines.

IMPROVED SCLEROSCOPE

The Shore Instrument & Mfg. Co., New York, have marketed an improved Scleroscope model C1. The refinements made so increase the flexibility of the operating mechanism that it will give more uniform service even though the adjustments are comparatively approximate, and the works conditions, including the skill of the operator, are less favorable. Among the features are a special fine screen for eliminating dust from the operating mechanism. The leather operating piston formerly used, has been replaced by one of tungsten steel, which is practically indestructible The former rigid adjustments of the hammer hook mechanism has been replaced by a flexible adjustment which also greatly prolongs the life of the glass tube. The hammer hooks have been provided with shock shoulders, which eliminate breakage of disalignment of these parts. In addition, more highly perfected glass tubing is being employed.

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Canadian Machinery Weekly Contest 39

The Fact That Our Prizes Are Useful and Permanent Seems to be Attracting Many New Contestants. We Had a Very Large Number Try Last Week, and We Expect a Still Larger Number for the Contest Contained in the Present Number. Be Sure and Try Your Powers of Perception.

CANADIAN MACHINERY
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Ball and Roller Bearings

ON another page of the present issue appears an article on ball and roller bearings. This will appear in two parts and will show various applications to machine tools, and should interest not only the mechanic and designer, but the manufacturer as well.

In a large manufacturing plant, where considerable hand trucking was done, it was decided to equip a few trucks with ball bearings as an experiment. Certain heads grumbled at this move, stating that the cost of such bearings was too much in comparison to the total cost of building an ordinary truck with plain axle. After a week's trial with the ball bearing trucks, the grumblers turned to boosters, because results showed that first cost was a very small item compared wi the saving in time and energy effected. The amount of material moved increased, the men operating the trucks did not tire so easily, and the wear and tear was less. Everyone was satisfied, and all other trucks were similarly equipped.

What is true of trucks is likewise true of other plant equipment. Where friction has to be overcome, ball or roller bearings are a good medium to employ. Many machine tools of the present day would not have reached their existing state of perfection, were it not for some type of friction-reducing medium. It is a well known fact that friction is the start of many troubles, therefore by using ball or roller bearings we eliminate the cause of these troubles. Wherever a shaft revolves, it pays to make the task of turning that shaft as light as possible.

Designers of machine tools, and kindred mechanical equipment should make it a point to become thoroughly conversant with the uses and application of ball and roller bearings. They should seek information from all possible sources, and there is no better way to get this than from men who have made a study of the subject. Never be ashamed to ask for information. The writer of the present editorial sought light on a ball bearing application on one occasion, and in a very short time a manufacturer had pointed out a large saving, both in manufacturing cost, and the type which should be used. Men engaged in this class of business do not view the matter simply from the standpoint of selling the most expensive type of bearing, but they are out to give real engineering service. It behooves designers therefore to co-operate wherever possible, and by so doing they will not only save money for the firm they work for, but add to their own knowledge at the same time.

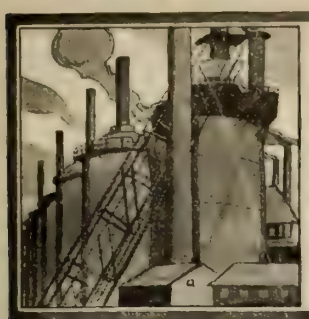
Is It A Question Of Price?

CAN YOU imagine a manufacturer offering machine tools and internal combustion engines at bargain prices? Yet this is actually occurring at the present time. Several American technical publications are carrying advertisements which state that for a limited time. certain tools can be purchased for lower prices. One concern calls the venture a "no-profit" sale, and frankly admits that they are making this novel move in order to give employment to their machinists. The fact that the machines thus advertised are of high quality makes the movement all the more significant. If some mediocre type of machine were placed on the market at bargain prices, one would not be surprised, but to see tools of international reputation offered under such conditions causes one to look at the matter seriously.

We admire the aggressiveness of these firms, but feel that their effort to increase sales is being misdirected. Much better results would be obtained if they were to increase the efficiency of their selling staffs, rather than adopt a temporary reduction in price. Unconsciously, they are whittling for themselves a boomerang, for later on when things become stabilized, the confidence of their customers may be gone. A machine of good reputation does not need to offer bargain prices. Let such firms quote a fair price and stick to it. Shading of prices never helped anyone yet. For a while business may increase, but when conditions reach normal the cry is likely to go up that just because the market is firm, advantage is being taken of the buyer.

Without doubt, manufacturers should take advantage of the present lull, and go over their plant with the view of improving the present equipment, so that when things become normal again, and this condition is not so far off as some would have us believe, they would be ready to meet the situation. By all means let these manufacturers purchase their equipment at as good a price as they can, but it is doubtful if bargain prices will induce a man who has made up his mind that he does not desire further tools to buy.

A METHOD of preventing scale in boilers is recommended by a Russian engineer, and consists of adding a small quantity of linseed to the boiler water. The linseed is put in the upper part of a copper tank divided by a horizontal sieve of fine mesh and connected with the hot water supply. The resultant decoction, says "Practical Engineer," filters through the close meshed double copper sieve to the lower part, and is fed to the boiler through the injector. The slimy substance of the solution attacks every particle of the forming scale, which does not adhere to the walls of the boiler, and is readily ejected when the boiler is blown out. The necessary amount of linseed is stated to be about half a pound for every 100 horse-power. Taking 30 lb. of steam as corresponding to 1 horse-power, the quantity of linseed required would be about half a pound for every 270 gals. of feed water.



MARKET DEVELOPMENTS



Trading is Very Light on Market This Week

October Does Not Appear to Have Been As Good a Month As September—Reports from Various Markets, While Somewhat Conflicting In Character, Emphasize that Business is Quieter

THE REPORTS from the different markets are rather conflicting in character this week. Take for example, Toronto. The feeling in this district is that the past week has witnessed a considerable improvement. Expanded metal has advanced in price; sheets are expected to increase in price shortly, and machine tools are selling better than they were a week ago. Of course, business in these various lines is far from normal, but still considerable improvement since the first six months of the present year has occurred. Travellers say that they see a movement among manufacturers to roll up their sleeves and get ready for the real drive for business. This feeling is reflected in the percentage of enquiries which actually develop into orders.

In Montreal, however, they have a different tale to tell. Conditions are quieter in that district, and are not quite so good as they were during the month of September, or in the first half of October. Even in view of existing conditions, things are not nearly as quiet as they were during the first six months of 1921. Production in the various lines about equals the consumption. This in itself is a healthy condition from an economic standpoint. Second hand tools are in fairly good demand in this market, and in fact are moving much faster than new machines. The scrap metal is very dull, but this is general in all markets.

Pittsburg claims that what the steel industry needs for its business to get better is not for business in general to get better so much as to secure some extensive construction work where large quantities of steel are used. Pig iron production shows an increase for October, but after the middle of last month the general iron and steel market turned distinctly quieter. Producers fear that this will cause a softening in prices, and as the prices of steel products are already relatively low, it is felt that lower prices are not needed for the purpose of broadening demand.

The recent attempt to advance the price of sheets in the Pittsburg district has failed. The Toronto market talks this week about a possible advance in sheet prices, but it looks as if the Pittsburg failure will stop any such movement here.

Pig iron is extremely dull, and coke shows a tendency to soften. Bars, shapes and plates do not show any stability, with the result that the price varies considerably.

PIG IRON PRODUCTION SHOWS INCREASE; CONSTRUCTION WORK MUCH NEEDED

PITTSBURGH, November 10—Production of pig iron in October was at the rate of about 14,600,000 gross tons a year, or 22 per cent higher than in September. If steel ingot production increased in the same ratio it was at close to 40 per cent of capacity in October, against 32 per cent in September and 21 per cent in July.

Unfortunately the fact is not altogether as good as it looks. Increased production is excellent when it proves there is increased demand, but production without demand is not good. Of course there was demand in October, but in not a few quarters it is doubted whether the demand was sufficient to justify so large an increase in production over September. After the middle of October the general iron and steel market turned distinctly quieter, and producers fear that in consequence the softening in prices will be accentuated. As prices of steel products are already relatively low it does not seem that lower prices are needed for the purpose of broadening demand. Pig iron does not present altogether the same case, as pig iron is relatively higher than steel, by reason of the greatly increased freight rates having more effect on pig iron costs than on steel making costs.

General Situation

For many months the matter of demand upon the steel mills has been complicated, the relationship between steel demand and what is called "general business" being complicated. Ordinarily, steel activity is considered an index to general activity, and indeed the adage that "iron is the barometer of trade" goes farther than that, for it counts upon iron and steel activity coming somewhat before general business activity. There was a divergence between steel activity and general activity last July, of one sort, and now there is a divergence of another sort. Last July the case was that there were stocks of steel and manufactured wares that had to be liquidated, and the demand upon the steel mills was far below a relation to actual consumption. For a week or two the mills operated at less than 20 per cent of capacity, but the actual consumption of steel and steel products was not as low as that. As stocks were liquidated demand upon the mills increased, until in the fore part of October it was 35 to 40 per cent of mill capacity.

Now there is a divergence of a different sort to be noticed. The sum total of business or commercial activity in the United States is fairly large. Measured by the total amount of work done and the total volume of goods transferred it is not far from normal. One may ask how this can be the case when there is so much talk of "unemployment", but the explanation of that is that the number reported unemployed is really no large percentage of the population, while those who are in employment are working harder and more efficiently than in 1920, i.e., producing or handling more goods per hour they are paid for than a year ago.

The divergence is that the commercial activity is of such a character that it does not absorb its usual proportion of steel. There is very active work in building garages and dwelling houses, but that takes little steel. The same amount of money spent on power stations, factories and hotel and office skyscrapers

would mean much more steel. There is much activity in road-building, but that consumes very little steel. The same amount of money spent on railroad track, freight cars and locomotives would mean a great deal of steel.

What the steel industry needs for its business to get better is not for business in general to get better, but for it to run more to construction work and the various kinds of activity that involve steel consumption. Perhaps general business is not getting better. Perhaps it is getting worse, and quite possibly that will be a good thing for steel. The secretary of the treasury, who was Pittsburg's leading banker before he was called into President Harding's cabinet, is quoted in the daily press as saying he favors the secretary of war giving Pittsburg an extension of time in raising the bridges here, ruled by the previous war secretary to constitute an obstruction to navigation, on the basis that construction costs are likely to come down still more in the future.

Steel Prices

For a fortnight, the American Steel and Wire Company (Steel Corporation) has been soliciting its customers for contracts at present prices, as advanced September 12th, on the ground that prices are going to be advanced. The first report had it that nails were to go up 15 cents a keg, but it is understood now the contemplated advance is $2 a ton all around, which would make plain wire $2.70 and wire nails $3. Usually when a wire advance is undertaken the date for the advance is set. This time no date is named, the fact suggesting that it takes more time than usual to round up the contracts. The Youngstown Sheet & Tube Company, which did not make the September 12th advance at the time, announced its advance November 1st.

In sheets our report of a week ago noted that the $5 a ton advance attempted by independents had failed, the market being easier in tone instead of stronger. Now not a few independents are cutting the old price, commonly by $2 a ton, but there are cases in which a cut price of $5 a ton has been quoted, which means the old price, the minimum before the September advance. Regular prices, shaded in some cases as indicated, are $2.25 for blue annealed, $3.00 for black and $4.00 for galvanized.

On the afternoon of November 3rd, the American Sheet and Tin Plate Company announced a reduction in its tin plate price from $5.25 to $4.75. Independents had been doing $5.00 and less for some time past, and the remarkable thing is that the Steel Corporation did not act on this cutting several weeks ago, for the corporation's general policy for months past has been to meet competition when important.

In tubular goods the shading of the lists of September 16th is slightly more pronounced, but the amount of the shading is small, except in line pipe. Bars shapes and plates show approximately as much irregularity as formerly, which means that there is no set price. Each mill has various prices according to the nature of the inquiry and the circumstances and every order of importance is competed for separately. The general average in bars, shapes and plates is about $1.60.

POINTS IN WEEK'S MARKETING NOTES

Trade conditions during the past week have not been very encouraging. However, although trading is light, conditions are not so bad when compared with the first six months of 1921.

The recent rail orders secured in Canada are being rushed out, and in all probability will be completed before the end of the year.

Foundrymen are evidently looking for freight reductions in the near future, because they are asking to be protected against falling freight rates when enquiring regarding prices. This would tend to show that the material thus enquired after was for stock purposes only. Foundry stocks however, are as a general rule, very light.

Montreal reports that second hand tools are more in demand than new tools. Luckily the Toronto market has been selling more "new" tools than second hand machines lately. Machine tool manufacturers are getting their costs down, this being reflected in lower prices to the consumer.

Sheets are very brisk on the Toronto market, and an early advance in price is expected. Expanded metal went up 10 per cent. during the past week. No surprise is evidenced at this increase because it is claimed that production costs warranted the advance.

The scrap market remains very quiet in all quarters and is likely to remain so until foundries get more business.

Pittsburgh reports an increase in the production of pig iron. Construction work would help steel trade considerably. While there is a good amount of money being spent, the work being performed does not call for much steel work, hence the demand is light.

The market for sheets in Pittsburgh is easier in tone, the recent attempt at an increase in price having failed. This is the very opposite to conditions on the Toronto market. The fact that the advance did not materialize in Pittsburgh will perhaps mean no increase will be attempted here. However our Toronto letter mentions a possible advance as this is how things stand locally at present.

Pig Iron and Coke

The pig iron market has been extremely dull, and it looks as if consumers do not expect to need as much pig iron in the next couple months as was expected. That buying is being postponed on account of expected freight rate reductions is not altogether likely, since the buying has been of hand-to-mouth character in the past, and such buying could not well be postponed for such a problematical event as freight rate reductions. Prices are not quotably changed, but might be shaded if important inquiry arose. We still quote $20 for Bessemer, $19 for basic and $21 for foundry, f.o.b. valley furnaces, freight to Pittsburg being $1.96.

Connellsville coke is quotable a shade lower and is softer in general tone. We quote spot furnace at $3.25 to $3.35, contract furnace at $3.35 to $3.40 and spot foundry at $4.25 to $4.75.

SHEETS ARE BRISK CUTTERS DROP IN PRICE

TORONTO:—Nov. 10. There is a decided change for the better in the market this week. A few claim that the election is the only stumbling block to increased business, while others again state that the election has nothing whatever to do with the lull, and that from now on they expect things to develop steadily. One thing sure however, and that is, everybody feels optimistic as to the future. Take for example the steel market. During the past week, expended metal has gone up 10 per cent. in price, and warehouse prices generally have stiffened. All lines are fairly active, and sheets are decidedly brisk. One dealer said that about three quarters of his business during the past weeks was in sheets. The good weather is largely responsible for this activity, for it is giving builders a chance to work on the various structures which are now receiving the finishing touches. Speaking on the advance in price of expanded metal one dealer said that it was not surprising that this advance had taken place because for some time past, the existing price had hardly covered the cost of production. This same dealer said that he expects sheets to advance in price during the next few days.

Machine Tool Market

The general feeling in this market is that business is going to be much better. Dealers and machine tool salesmen say that they have noticed while on the road, that many manufacturers are getting ready for the come back of business. They are beginning to loosen up, with the result that more orders are coming in. The percentage

of enquiries and orders seems to be better balanced. For some time past, enquiries were frequent, but orders few. Now when an enquiry comes in dealers are beginning to have more faith in its possibilities. This increase in interest applies to the wood working trade as well as the metal working machines.

Small Tools

The small tool market goes on in steady fashion. The activity is good, and yet one cannot truthfully say that any improvement has taken place during the past week. It would seem as if this product has hit its proper stride, for the present at least, because the past three months has witnessed no change of any importance. Milling cutters have taken a drop, with the result that the 1½ increment has been taken off on high speed cutters, and standard list prices are again being quoted. On carbon steel cutters the reduction amounts to approximately 10 per cent.

The orders which keep coming in to this market clearly show that manufacturers are still adhering to their hand to mouth policy of buying. Dealers of course are not complaining, for the activity existent seems to be very general. "It goes to prove that when business really opens up we will be rushed with orders," said one dealer, and as he pointed out, the stocks of small tools throughout the country must be very low.

Scrap Metal Market

Things are still very quiet in the scrap market. One misses the old time hustle in this section, and it is very unliely that we shall see any improvement until plants generally commence to order castings. Instead of purchasing by car loads, the foundry owners are ordering only sufficient to cover the orders on their books. They refuse to stock up, for any scrap metal in the foundry yards is considered as so much dead money these days.

Everybody spoken to this week had their eye on the same period, namely, Spring. "Watch things pick up then," seemed to be the chief thought in the mind of dealers and manufacturers alike, and it is not expected that we will see any definite developments before that time. There may be an occasional spurt or two, but the real drive for business seems to be due about the turn of the new year.

TRADE CONDITIONS QUIET THIS WEEK NO CHANGE IN PRICES HAS OCCURRED

GENERAL trade conditions for the past week have not been very encouraging, although the amount of business moving is still a distinct improvement over that which averaged over the first six months of the calendar year. Still the trade cannot refrain from comparing the present volume with that of the somewhat better conditions existing during the month of September and the first half of October. Taking all matters into consideration, conditions are far from being in bad shape. After practically a year of quiet business conditions, the country has gradually liquidated its stocks of iron and steel and, it is the exception rather than the rule, to find the manufacturer or jobber with any large stock of materials, either raw or manufactured, on hand. Production in the various lines is about equal to the consumption, which is a rather healthy condition from an economic standpoint, although it works out as a hardship to many who must necessarily be among the unemployed. Some rumors have been present that there was a general shortage of galvanized sheets. This condition is not significant as stocks were short all along the line from mill to consumer and the seasonable autumn demand has been a heavy drain upon these small stocks. The condition will automatically adjust itself in a short time. The seasonable autumn demand has about spent itself. Building operations, generally speaking, are slowing down and everything points to a settling down for winter conditions.

Production of Steel

Production of steel continues to fluctuate between two limiting points, not far separated from one another. The total production and total consumption are, roughly speaking, about the same. Prices are not changing to any great extent. The present quotations leave only a small margin for the producer and are not likely to be cut to any extent. For some time past there has been a tendency toward stiffening in price, but practically no changes of any moment have been made. Present low prices have been made to stimulate business that might be slow in closing, and thus represent the point, beyond which the steel producer will not go, as it would be a losing proposition.

The recent rail orders are being rushed out and will be completed, in all probability, before the end of the year. Bars continue to be very quiet. Structural shapes are also rather quieter than they have been. Plates are only moving slowly. Sheets are moving in fair quantities. The week just past has not produced any individually large orders and the general volume of business is much the same as last week.

Pig Iron

The foundries have not come into the market for pig, to any great extent, this last week. Prices have not changed. If any increased demand for pig iron becomes evident the present limited supply will soon become exhausted and cause an increase in quotations. It is not likely that additional furnaces will "blow in" until there is more attraction in the margin of profit. This condition apparently was understood by the local foundries and the increase in business in September was, to a certain extent, speculative. To-day the small supply carried by foundries is considered ample. Of late the foundrymen making enquiries for quotations, which are made "f.o.b. furnaces, freight allowed to destination" seems to be of the opinion that freight rates are to be reduced, hence are asking to be protected against falling rates. This plainly shows that these inquiries are for stock and not likely to be used immediately. Some time ago several steel plants in the United States broke into the pig iron market and upset the prices. Following this the price was raised on two or three occasions to the present level and nothing further in this connection is expected as these furnaces have evidently disposed of their surplus pig at the low level and are not looking for further business in this line.

Machine Tools

Business is very quiet in new tools, but there continues a fairly large list of inquiries for second hand tools. Most shops throughout the country have not enough work to keep all their machine tools busy and thus are not in the market. Then again, the prices of machine tools appear rather high especially in view of the unsettled labor conditions which are reflected in the cost of all supplies and other materials, and tend to make machine shop profits uncertain. Thus there is presented a combination of circumstances that present a poor outlook for the sale of machine tools. In fact the country has a larger number of lathes, planers and general run of standard tools than would be required to take care of the needs even if times were normal. These tools will likely never be worn out, but will be discarded and replaced by more modern tools, highly developed, to continue the battle against high production costs. The machine tool manufacturers are getting their costs down, which is reflected in lower prices to the consumer. This together with advanced design and the addition of labor saving jigs and fixtures will create a little better volume of business, but it will take time to produce results. Meanwhile only an occasional sale of a new tool here and there, is reported.

Small Tools And Supplies

Small tools and supplies continue to move much the same as they have done for some time past. In fact, all things being considered, this department of the machine shop business is in a very satisfactory condition. It must be admitted that the volume is not large, but is satisfactory. Price lists have been established again and manufactures and jobbers are doing business along the old accepted lines. Prevailing prices are somewhat higher than pre-war levels due to the higher labor costs principally.

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SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 50
Steel bars, base, Toronto	3 50
Iron bars, base, Montreal	3 00
Steel bars, base, Montreal	3 00
Reinforcing bars, base	3 00
Steel hoops	5 00
Tire steel	3 50
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 50
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	35 00	37 00
Spelter	7 25	7 50
Lead	6 50	7 50
Antimony	7 00	8 25
Aluminum	28 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 25	$3 90
Plates, ¼ up	3 75	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 48	14 71	17 77
.....	6 50	8 03	7 95	9 48
.....	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 25	4 25
Canada plates, dull, 52 sheets	6 00	6 00
Can. plates, all bright	8.50	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	8.00	
Fleur-de-Lis, 28 B. W. G.	7.50	
Gorbal's Best, No 28		
Colbornes Crown. No. 28.		
Premier, No. 28, U.S.	6 45	6 35
Premier, 10¾ oz.	6 85	6 75
Zinc sheets	8 50	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$
1¼ in.	27 25	
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.		34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.21
Peerless	.22
Grand	.21½
Superior	.21½
X L C R	.16½
Atlas	.19
X Empire	.15
Ideal	.18
X Press	.13½

Colored

Lion	.13½
Standard	.12
No. 1	.14
Popular	.10½
Keen	9

Wool Packing

Arrow	.35
Axle	.28
Anvil	.22
Anchor	.17

Washed Wipers

Select White	.17
Mixed colored	.14
Dark colored	.13

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

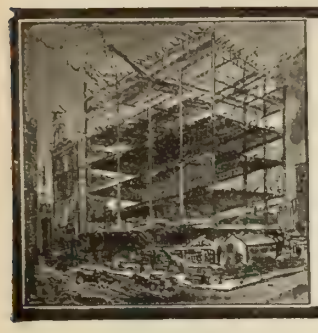
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Canadian Concrete Steel Co., Montreal, Que., has been incorporated with $200,000 capital stock.

T. A. Hollinrake, president of the A. R. Williams Machinery Co., was in Atlantic City last week on business.

Nineteen million feet of lumber was exported from the Province of New Brunswick in the month of September.

The Dryden Paper Company's plant recently resumed operation. They are now operating up to capacity.

The Molson Brewery, 906 Notre Dame St., E. Montreal, Que., is building a boiler house at an estimated cost of $80,000.

A. B. Salyerds of Preston, Ont., plans to rebuild his wood specialty plant which was recently destroyed by fire. The estimated cost is $50,000.

It is officially announced that the Peninsular Sugar Company recently organized with $2,000,000 capital stock will erect a sugar plant at Chatham, Ont.

Canadian Austin Machinery, Ltd., has been incorporated with a Dominion charter to manufacture excavating and cement-mixing equipment in Woodstock.

The Gurney Foundry Co., Toronto, Ont., took out a permit for alterations to their factory, 510 Queen St., W., totaling $18,000.

The Triumph Motor Equipment Co., has been incorporated with $250,000 capital stock to manufacture motor trucks, accessories, etc., at Hamilton, Ont.

Another new industry for Winnipeg, Manitoba, is the Home Appliance Co., who are to manufacture electric washing machines.

Spring & Auto Parts, Ltd., has been incorporated to manufacture springs, motors, engines, machines, carbureters, Automobile accessories, etc., with $50,000 capital stock in Toronto, Ont.

The Dominion Sheet Metal Corporation of Hamilton state that they are now filled up with orders for sheets which will run them until after Christmas.

Fire loses in Canada during the week ending October 19, are estimated by the Monetary Times at $509,750, compared with $184,900 the previous week.

The International Wheel and Rim Co., Ltd., intend to locate in Toronto and make that point their headquarters for their export business. This concern manufactures double disc steel wheels for automobiles.

The Hamilton Gas Mantle Co., Hamilton have added to their plant an up-to-date electro-plant for nickel, copper, silver, galvanizing, oxodizing and lacquering, having installed also a mechanical plating apparatus.

Some products, which in the past have been imported from France and the United States, namely french ivory and ebony articles are now being made at Port Elgin, Ontario, by the Stevens-Hepner, Ltd.

The Sommerset Tool Works have been established at St. John, N. B., to manufacture axes, hatchets, etc. It is their intention to make certain tools which have had to be imported from the United States heretofore.

The Alliance Brass Manufacturing Co., has been established at Peterborough, Ont. Machinery is being installed and production is expected to start about February 1922.

The Contract for the Electric Pumping Station to be erected at Point St. Charles, Montreal, has been awarded to the Atlas Construction Co., Limited, 37 Delmont St., Montreal.

The city of Verdun, Que., is having plans prepared for the installation of two electric pumps with 5,000,000 gallons capacity each to replace steam system.

The Anglo American Motors of Trenton, Ont., plan for a factory composed of 10 buildings, each to be an independent unit. The plant is to be equipped with modern machinery. The site at Trenton comprises 32 acres and they have been allowed a very favorable contract by the town council.

It is understood that the Fortes Vibration Company of St. Louis, Mo., are anxious to establish a factory for the manufacture of toys in Canada. From information received here, we understand that this firm wishes to locate near some suitable timber area.

The Prince Rupert Pulp & Paper Co., 602 Pacific Building, Vancouver, B. C., plans to construct the first unit of pulp mills at Prince Rupert, B. C., which will have a forty ton daily capacity. The estimated cost will be $1,000,000.

It has been decided to proceed at once with the erection of a new $500,000 home in connection with the Western University, London, Ont. It is also reported that the early construction of St. Peter's seminary is in view.

The Hull Electric Co., has ordered two One-man safety car bodies, 32 feet long over bumpers 8¼ ft. wide to replace single truck car bodies now in use. These have been secured from the Ottawa Car Mfg. Co.

Building records for the ten months ending October 31, in Sudbury were $426,910, an increase of $22,000 over the same period last year. The housing commission in that city are building very extensively.

The proposed new Imhoff Sewage disposal system for the city of Peterboro, Ont., will cost, it is estimated by city engineer Parsons, $320,100. This system will handle 6,000,000 gallons of sewage per day.

The Worcester Fire Extinguisher Co., Ltd., have opened Montreal offices at 137 McGill St., under the management of Mr. S. Skigmore. This firm will act as the sole Canadian Agent for the Rockwood Sprinkler Co., of Boston, Mass.

The McArthur Irwin Co., paint manufacturers of Montreal, report that although from 1914 to 1920 the production of all their lines was increased, their three factories have been kept working at full capacity for the whole of this year.

Another new industry for Chatham. Silverwoods, Limited, of London, Ontario will shortly commence in this city the erection of a building, the estimated cost of which is $75,000 for the manufacture of artificial ice and also ice cream for distribution within the province.

Mr. D. B. Hanna, president of the Canadian National Railways has stated that the net earnings for the month of September of one half million dollars is more than 10 times the net earnings of four different railroad companies amalgamated into the one under the former heading. 17,000 miles of railway are included.

J. Birchall, formerly superintendent of McKinnon Columbus Chain Co., and McKinnon Industries Limited has formed a company to be known as the United Chain and Manufacturing Co., with offices at 114 Queenston St., St. Catharines, Ont. The new company will manufacture tires, chains, automobile parts, accessories, etc.

INDUSTRIAL NEWS

According to reports, the erection of a paper mill near Fort George, B. C., to cost approximately $6,000,000, will be undertaken immediately, provided negotiations with the British Columbia Government for leases on timber limits are successful. Robert Tyhurst, of the Fraser Timber Syndicate, is responsible for this announcement.

A statement from New York says that if Ottawa should definitely sanction the manufacture of Oleomargarine in Canada for a period somewhat longer than one year, two or three of these manufacturers will consider building a Canadian plant. These manufacturers state that there is a very real demand in Canada for their product.

"I have a patent sash support, which I have sold in the United States recently for $25,000," writes a reader of Canadian Machinery, "and I am now desirous of getting in touch with someone who would be interested in the Canadian rights." Anyone interested in this can write to A. W. Nelson, Crouses City Hotel, Williamsport, Pa.

According to information received, nine French freighters are on their way to Canada to join the fleet of the Matthews Steamship Co., Toronto. About $2,500,000 is approximately the amount expended, the deal was closed by A. E. Matthews, the president of the above mentioned concern. Other vessels will probably be added to the Matthews Co., in the near future.

Brant Foundries, Ltd., have started operations in Brantford. This company was established to produce high-grade castings for plants in the Brantford district. They are now specializing in the production of light grey iron, brass and aluminum castings.

W. P. Kellatt, manager Dominion Steel Products, Brantford, is in England on industrial business. It is reported of this plant that demand for certain of its products has been very encouraging during the present season. Enquiries have been such as to necessitate overtime in the estimating department.

Hall Brothers farm machinery manufacturers state that during the first part of the year their business was not only up to that of 1920, but showed a 20 per cent. increase. A similar increase has been maintained during the latter months and looks fair to continue for the remainder of the year.

Heintzman & Co., piano manufacturers of Toronto show figures that, with one exception in which there was a small decrease, their sales for every month of this year are thousands of dollars ahead of the corresponding months of 1920, with October the biggest month of all.

Mr. George F. Porter, chief engineer of the Canadian Bridge Co., Walkerville, Ont., has had conferred on him by McGill University the honorary degree of Doctor of Law. Mr. Porter is very well known having been connected with the above concern since its organization. He was appointed by the Dominion Government to design the bridge across the St. Lawrence river near Quebec replacing the one which failed in 1907.

A Canadian chamber of commerce has been formed in London, England, with the object of promoting trade between the Dominion and the Mother country. The council is composed of representatives from each of the provinces in the Dominion together with representatives of various Canadian business interests. The acting Secretary is Mr. R. B. Stewart, in care of Beatty Bros., 55 Holborn Viaduct, E. C. I, London, England.

A Pamphlet received from the office of the Association of Railway executives, New York, states that several reductions in freight rates have been made. Following are those which interest our readers:—Iron ore 28 per cent reduction:—Sand, Gravel, pebbles, etc., 18 per cent; export iron and steel 25 per cent. In addition to the above, reductions have been made on iron and steel articles, pig iron, scrap iron and billets.

A Made-in-Galt exhibition will be held in that city Nov. 12 to 19. Considering the number of thriving industries in this Manchester of Canada, the displays should be interesting. In fact, it is stated that there are people in Galt who will be considerably surprised by the industrial importance of the city as indicated by the display. The people there have not been slow to encourage enterprise whenever it had worthy appeal, and the exhibition will go far to demonstrate that their confidence has been by no means misplaced.

Mr. G. A. Kingsford, who has been for 18 months a resident of Hong Kong, states that Southern China, which has a population of 80,000,000 people did an annual trade equal to between 1/3 and ½ as large as that of Canada. He pointed out that one of the greatest difficulties facing the Canadian business men in entering the Chinese market was the fact that Hong Kong was not represented by a Canadian Bank.

The Kerr File and Tool Co., Toronto, have reopened their factory which was closed for some time on account of the dearth of orders.

F. F. Barber of the Barber Machinery Company, was visiting several of their United States principals last week.

A fire broke out in the Public Utilities water pump house at Napanee, Ontario, November 3. The commission had just completed installing a complete new set of machinery, and workmen were in the building at the time.

Rae Machine Tool Company's plant at Hamilton, is being reopened for the manufacture of a complete line of vises and other metal working tools. Previously a line of machine tools was manufactured but for several months past the plant has been idle.

The Montreal Harbor Commissioners have installed another floating grain elevator making four now in operation in the port which greatly help in speeding up the loading of grain. The last elevator is working about 15 hours a day and hauling about 7,000 bushels per hour.

The Matthews Gravity Carrier Co., Port Hope, Ont., announce that they have added to their line a portable belt conveyor for handling bulk materials. The conveyor is made in two standard lengths, 17 ft. 6 ins. long with a 12-inch belt, and 20 ft. long with a 16-inch belt.

The Davis-Bournville Co., Jersey City, N. J., have published a pamphlet on "Tube welding machinery and fabricating equipment." This covers slitters, forming machines, welding machines, straighteners, seam grinders, swagers, cutting off machines, benders, and drawbench

The Port Hope Veneer factory has enjoyed a most successful season's business, and over 400,000 baskets have been disposed of. Arrangements are now being made providing for the manufacture of berry boxes and plant boxes in order to keep the plant running all winter.

The Little River Coal Mining Co., Ltd., capitalized at $2,500,000 has been organized, with head offices at Sydney, Nova Scotia, to develop and mine the coal areas at Codroy, on the west coast of Newfoundland, in St George's bay district. It is planned to start operation at once.

Mr. J. J. Wilson pioneer foundryman in automobile work has severed his connection with the General Motors Corporation and has taken charge of the foundry division of the Hiram Walker & Sons Metal Products Ltd., Walkerville, Ont. This company makes a general line of motor castings.

The Sumbling Machinery Company, Toronto, are working to capacity on their line of laundry machinery. During 1920 they sold more than in any previous year and this year is to date ahead of of the whole of 1920. In addition to domestic business they have received some large orders from abroad.

Edward D. Wilmer president of the Goodyear Tire and Rubber Co., states that notwithstanding the fact that sales during the first six months of 1920 have exceeded those of any period in the company's history, more tires have been sold during the ten months up to October 1st. 1921 than in the some period a year ago. In September the company sold 69,000 more tires than in September 1920.

J. J. Westway, representing James Handley Wright, has made application to the city of Calgary with the intention of establishing a tannery. At the present time Alberta hides are hauled long distances to Eastern Canada or the United States, and the leather sent back to Alberta. The establishment of a tannery in Calgary would eliminate the transportation charges and give the plant an advantage in the Western field.

INDUSTRIAL NEWS

The Canada Furniture Manufacturers, Ltd., have opened their second factory at Wingham, Ontario, and are working 9 hours a day with sufficient orders on hand to keep them busy for some time. Conditions in the furniture trade have steadily improved since July last, company reports, and business is on the upgrade though yet below normal.

The Goldstein Mfg. Co., Toronto. is erecting a new plant at Nos. 12 and 18 Beverley St. This will give them additional space and enable them to take care of the new business into which they have gone quite recently, which is the manufacture of copper and brass tubes, seamless drawn. They state that at present this is the only Canadian mill in operation turning out this product.

Chappells, Ltd., Sydney, Nova Scotia, have taken over the property and plant of Rhodes Curry Ltd. The property contains extensive sheds, warehouses and a large electric power wood working plant. They have added to their equipment automatic turning machines the chief purpose of which is to manufacture Bowling Alley Pins.

The Pullen Company of Toronto report a steady increase in sales of waste and wipers for August, September and October. Each month showed an increase over the preceding month while October sales reached the highest point of any month this year. As the product referred to is sold largely to industrial plants this item should be encouraging to Canadian Machinery readers.

The well known Toronto machine house, The Garlock-Walker Co., Ltd., made an assignment this week for the benefit of their creditors. It is understood that an immediate reorganization is under way and an important announcement regarding this future organization will be made within a short time.

If Customs returns can be considered as indicating trade conditions, business is improving with industries in Guelph, Ont., as collections for October amounted to $88,697.65 an increase as compared with the same in 1920 of $36,881,-94. Building operations for 1921 to date show a big increase over the corresponding 10 months of last year.

Col. The Hon. F. A. Dudley, president of the United Hotel Co., with F. W. Rockwell, and Gen. Leslie Kincaid, also of the headquarters New York office, were at the King Edward Hotel this week on an informal inspection of Canadian interests that within a year will represent investments roughly estimating $2,000,000 There are three hotels already erected in Ontario, which are controlled by these interests which will soon be added to by the Royal at Montreal and the Prince Edward at Windsor, Ontario. The building of the two latter is now being rushed with night and day forces working 8 hour shifts.

Mr. G. T. Milne, O. B. E., who will replace Capt. Evan J. Edwards as His Majesty's senior trade commissioner for Canada, Newfoundland and the West Indies, arrived in Montreal a few days ago, and has assumed his new duties at the Trade Commissioner's offices on St. James street. It is understood that in future the activities of the Trade Commissioner's office here will be curtailed, following the decisions of the authorities in England, but it is hoped by Mr. Milne that future work will meet with sufficient support from the Canadian business community to meet the needs of expanding business during the reconstruction period.

Leslie H. Hall, sales manager of the Williams Tool Corporation, Brantford, Ont., with head offices at Erie, Pa., says that their firm is doing much better business than a year ago. On being asked how he could account for this condition he said, "We knew our machines were selling at a fair price, so we decided that more aggressive methods of salesmanship were required. We have spent considerable money on educational and advertising literature, and our salesmen have been on to their jobs. The result is our business this last month is practically double the previous one."

A. S. Capwell, manager Canadian Buffalo Forge Co., Kitchener, has returned from a business trip to the Maritime Provinces. He states that he has seen periods of greater business activity than at present down by the sea, but reports some improvement in the demand for lumber. The New England States is the best and most convenient market for this and the movement noted will benefit lumbermen to a greater extent than by mere reduction of stocks. So much money is tied up in lumber that banks have been reticent about advancements for next season's operations. A more active market should relieve the money situation. Coming westward, Mr. Capwell noted that building operations became increasingly evident—an encouraging sign to one hopefully observant of any conditions making for improved business.

R. H. Cunningham & Co., electrical engineers, Walkerville, are completing for a textile concern, a heat-treating furnace which is somewhat unique. The purpose of the furnace is to treat large quantities of small metal rings of about one inch diameter, used for some purpose in textile manufacturing. At present an oil furnace is used for the purpose, the rings being carried on rods, a more or less laborious process. By the electrical method, one man shovels the rings into a hopper and the machine does the rest. From the hopper the rings are fed into a cylinder the length of the furnace, which is of circular shape.

A worm gear which carries the rings through the cylinder, is timed so that when they reach the point of discharge into a quenching bath, they have been properly treated. The machine is designed to be a labor, time and money saver.

Annoucement is made of the resignation of Mr. F. J. Bell as President and General Manager of the Canadian Wire & Cable Company, Toronto, manufacturers of electrical wires and cables, with factories at Leaside, Ontario, and branch offices in different cities of the Dominion from Halifax to Vancouver.

Mr. Bell has also resigned as President and General Manager of Leaside Engineering Co., which corporation controls the Cable Company and other firms, including Leaside Munitions Co., manufacturers of shells during the war for the British and American Governments.

Prior to joining the Cable Company in 1913 Mr. Bell was General Manager and Secretary of British Canadian Power Co., supplying electric power and compressed air to the silver mines of Cobalt and South Lorain in the Northern Ontario Mining District.

Lead base babbitt metal is the title of a publication which is being distributed by the Westinghouse Electric & Manufacturing Co., announcing the placing on the market of lead base babbitt metal. This metal is the result of many years' use of this material by Westinghouse, approximately 1,000,000 lbs. of lead base babbitt metal being used during 1920. The subjects discussed in this publication are overheating, bearing design, preliminary machining of shells, cleaning of shells, care of tinning alloy, tinning of bronze shells tinning of pipe and malleable iron bearing shells, anchor holes in case iron bearing shells, care of the babbitted metal cleaning solutions and materials This is known as Folder 4474.

Some of the hosiery mills in Ontario are unable to accept further business for this season's delivery. The sharp increase in business during the last six weeks has brought in as much as they are able to handle. The selling of goods is proceeding. One mill representative remarked that business was booked for the first half of next year. A similar report comes from Woodstock, Ont., where one knitting company that is working night and day reports having orders on hand that ensure capacity production until next May providing that a sufficient quantity of raw material is on hand. Three other knitting firms report good business in the same city. Here is still another similar report from Clinton, Ont. where it is stated that a knitting company which experienced a very decided falling off in its trade the early part of the year has resumed operations on a considerable scale, and has increased the number of employees steadily. Another manufacturing plant whose head office is in Clinton reports an increasing business from all parts of the Dominion with the plant running full capacity in all its four branches. A piano manufacturer in the same town finds that their plant is one of the first industries to get back to normal conditions. The fact

GEO MET RIC

Right Rim the Lead

WHY BORROW TROUBLE?

If you have not reduced your tap breakage to the minimum, you are borrowing trouble.

Does it mean anything to you that there is a High Speed Tapping Device on the market which is

SUPERIOR

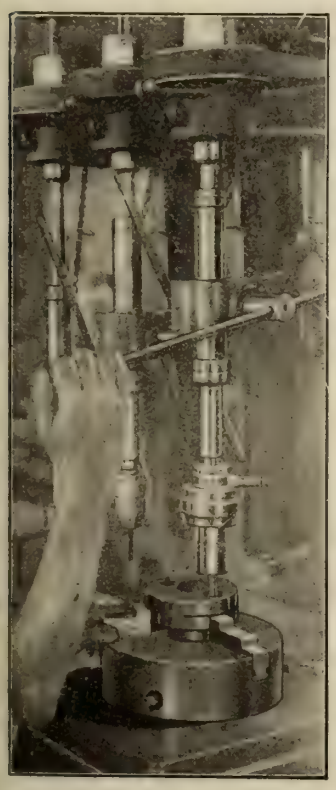
to any other known method.

Just get these few points now, and then send for the circular which will give you the rest of the story:

There is a Ball Drive and Ball Reverse. You can see how easy this makes the action, with no clinching or binding.

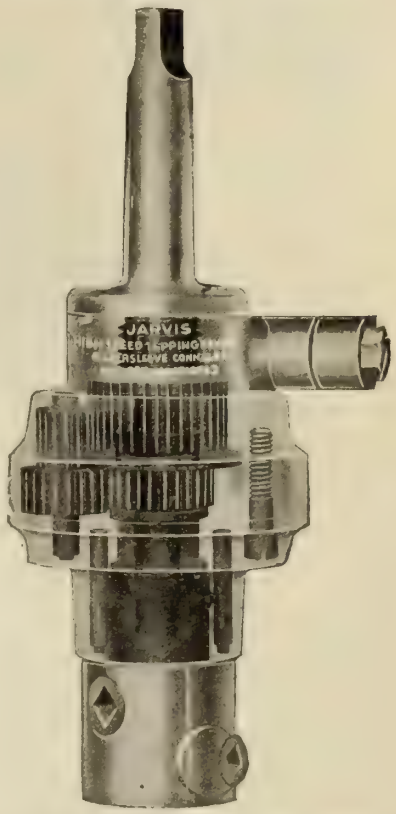
The Ball Drive gives direct drive from the spindle to the work. The gears operate only on the reverse.

Reverse motion is much faster than the drive.



Special Taps are not required.

It makes no difference whether the tap is forced against the work in a Drill Press, or the piece is pushed towards the tap in a Speed Lathe.



There are two styles of this Tapping Device. The Positive Style M and the Friction Style N. Where the tapping is in tool steel or any tough metal, or when a blind hole is tapped, the Cone Friction Chuck, Style N, is better.

Seven sizes of this Jarvis High Speed Tapping Device accommodate a range from zero up to 2 in.

And the PRICE—that, too, is reduced to the minimum.

One more important fact attaches to this Tapping Device. It is recommended and furnished by the Geometric Tool Company as a fitting adjunct to their line of Threading Tools.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N. B., Halifax, N. S.

is now running with a full force and 12 hours a day turning out more pianos than at any time in its fifty years' experience in business.

Darling Bros. of Montreal report very good business for the year, largely owing to two or three contracts they have had, so much so that by the end of the year they expect to be very little behind last year's business.

Tenders for the extension of the Timiskaming and Northern Ontario Railway from Cochrane to Tin Can Falls, a distance of about 70 miles, will, it is expected, be called for some time during the first two weeks of next month, according to Lieutenant-Colonel L. T. Martin, of Ottawa and Renfrew, one of the commissioners of the railway, who has just returned to the city from Northern Ontario. Colonel Martin says that the extension will undoubtedly prove a success, due to the traffic that will follow the development. Everything he said, is being done to get contractors on the work as quickly as possible in order to relieve the unemployment situaton.

In order to assist desirable new industries without tieing up to much local capital, the Board of Commerce of Manistee, Michigan, is working out a new plan of co-operation with prospective industrial concerns. It is proposed to organize a local company to put up factory buildings in accordance with desired specifications and to sell those buildings at cost on a time payment plan and at a low rate of interest. The initial investment of an industry in buildings would be small and the industry could use practically all of its funds as working capital. It would not be the policy of the Board under this plan to encourage mere promotions, but sound, solid, substantial industries backed by men of experience and financial responsibility would be assisted.

The plant of the Hiram Walker & Sons, Metal Products, at Windsor, is being overhauled and somewhat reorganized. This concern is a large producer of special wires for electrical elements, and this particular department is being moved to a separate building.

Stimulus to all of the basic industries, and a marked feeling of optimism with new production and creative energy all along the line in the United States, is said to be the results of the recent advance in cotton prices due to low crop forecast. It is estimated that a continuation of the present improvement will bring the end of the period of depression about February and that by Spring a new and long-looked for normalcy will have become fairly well established. The National Automobile Chamber of Commerce notes the following indications of improvements: Larger output of iron, steel and coal; continued activity in textile and shoe industries heavy shipments of grain; gradual increase in railway earnings; increased activity in building construction; substantial gain in export trade, and continued increase in employment. Over the whole country the wholesale and jobbing trade has improved, and though the retail trade drags, it is not losing ground. Collections are reported to be slow in the South and East but better in the Middle West.

PERSONAL

On the first reading page of the present issue we have an article on "Ball and Roller Bearings" by O. H. Willison. A word about the author himself would not be amiss. Mr. Willison received his education in England, and later served his apprenticeship with the Lacey Hulbert Co., pneumatic and hydraulic engineers. From there he went to Peter Brotherhood, Peterboro, England, being engaged with this concern on some marine work of varied nature.

About 1911 he decided to come to Canada, and after arriving here, became connected with the machine tool department of the Canadian Fairbanks-Morse Co. Then came the war and Mr. Willison heard the call and answered it. After coming back from overseas he linked up his efforts with the S.K.F. Ball Bearing Co., later leaving them to join the staff of the Lyman Tube & Supply Co., Montreal, as bearings engineer, which position he still occupies. Mr. Willison knows whereof he speaks, and his article in the present issue should be read with interest.

Mr. E. A. Allcut, who is now associate professor in the department of thermodynamics, at the University of Toronto, is a man who should be well qualified for his new position. Professor Allcut graduated from Birmingham University with honors in chemical engineering. Later he took the M.Sc. degree, the Bowen Research Scholarship, and the Heslop Gold medal. He has done considerable research work on producer gas, and is a member of many engineering societies.

For 15 years he was engineering lecturer in the Smethwick Municipal Technical Institute and was also associated with the early experimental and testing work on the Humphrey internal combustion pump. Later on he was manager of the engineering and testing machine departments of W. & T. Avery, Ltd., of Birmingham. During the war Prof. Allcut designed a large number of special machines for testing materials used in the construction of aeroplanes, aeroplane engines, shells, etc. At the close of the war he became chief inspector of materials for the Austin Motor Company of Northfield, and was sent to France to reorganize the tractor plant of the company near Paris. On his return he set up in practice as a consulting engineer later coming to Toronto to occupy his new position.

STAINLESS IRON HAS WIDE USES

The advancement in the production methods and uses of stainless steel has been very rapid. The extent to which this style of steel has revolutionized the Sheffield cutlery trade is not so well known in this country as it might be. Stainless steel now shares honors with stainless iron, and as the London Times points out both these materials were discovered only eight years ago, yet the advancement in both products has been exceptionally rapid.

Stainless steel was the first to be manufactured, and soon afterward it was found that stainless iron could be produced by much the same process, with the exception that a smaller quantity of carbon-free ferro-chrome was required.

Stainless iron has been largely used for the production of golf clubs; it has attracted the attention of makers of stove grates and is being used for kitchen ranges, grates and fenders. An important and useful direction in which the material has been applied is in the fitting of motor cars; it is supplied in sheets for making hoods, and there is in contemplation its greater use for bodies and since it does not tarnish for replacing nickel-plated parts. It is made up into a wide variety of kitchen utensils and is used for shop signs and door plates. One British firm is producing the material in wire form, to be made up into door mats, and it is also being used for spring mattresses.

Another important development in contemplation is the use of stainless iron for the furnishing of railway carriages, engines and rolling stock generally. The proposal is that it should replace brass for door handles, brackets and many other fittings.

NEW TYPE OF VEHICLE

During the war the scarcity of rubber in Germany led to a feverish attempt to design vehicles which would give easy running in spite of being fitted with metal tires. None of the designs so produced appears to have been successful, and wagon constructors in that and other countries are tending to the exclusive use of solid rubber tires and even of giant pneumatic tires in order to reduce vibration and to prevent the goods carried in the wagon from being too severely shaken by irregularities in the road srrface. A British inventor has now made a vehicle which seems to have solved the problem. The body and frame of the new vehicle are carried on three vertical spiral springs, three to each axle, and each axle is anchored at both ends to brackets on the frames. The various parts are designed so that when wheels meet any road obstruction the axle can to some extent be displaced backwards as well as upwards. This horizontal movement is cleverly controlled by compensators which give considerable flexibility.

HEAT TREATMENT

(Continued from page 37)

For these reasons as well as others not mentioned, heat treaters have discarded oil for high speed steel to a large extent and have substituted various salt baths which have a relative low melting point and are soluble in water. This bath should be kept at a temperature of about 1100 to 1130 degrees Fahr. The merits of this method of quenching eliminate the danger of checking the steel as the change of temperature from the high temperature furnace to that of the bath is not as great as in the case of oil and the amount of contraction and strains set up in the steel is correspondingly less. The heat is conducted away from the tool more slowly in the salt bath than in oil, but fast enough to retain the hardenites in their proper form. As soon as the steel has acquired the temperature of the bath, it is removed and allowed to cool to some point below 650 degrees Fahr.

The tool is now hard but contains the strain set up in quenching and the full red hardness has not been brought out to the maximum. To get these results it is necessary to temper or draw the tool. This may be done in the same salt bath or one kept especially for the purpose. Experiments conducted to determine the proper drawing temperatures showed the following results as the temperature of the draw increased from 350 to around 700 degrees Fahr. the scleroscope showed a decrease in hardness. From this point up nearly 1200 degrees Fahr. the scleroscope showed an increase in hardness with the increase in temperature. Some metallurgists attribute this to the fact that is during this latter range of temperature that the red hardness of high speed steel is developed. While the scleroscope showed the steel to be harder at, say 1100 degrees Fahr. than at 700 degrees, a test made with a file show the tool to be softer. On actual cutting test the higher drawing temperatures always gave better results. This shows conclusively that neither scleroscope nor the file alone will give any indication of what a tool will do in actual cutting tests but if they are used together they will indicate to a large extent what may be expected of them. For general purpose a drawing temperature of 1130 degrees Fahr. is recommended, but if the operator is positive that his temperature recorders are correct, this drawing temperature may be carried up to 1175 degrees Fahr. Exceeding this temperature very much again causes the steel to become softer until the annealed condition is approached.

In conclusion it may be said that with care in handling and with a relable pyrometer equipment, anyone should be be able to heat high speed tools and obtain creditable results. The quenching and drawing in molten salts eliminate many of the dangers which formerly followed the old practice of using oil for these two operations. Lead baths have been used as a means of drawing, but on account of the lead adhering to the tool, particularly if there be scale on the steel, and the difficulty of its removal makes its value a doubtful one. Lead is also rather too good a conductor of heat to be the ideal bath for these operations. The exhausted cyanide bath will answer very nicely for both the quenching and drawing baths.

MONTREAL MARKETS

(Continued from page 45)

Practically no change in prices have occured during the past week in nonferrous metals. The small volume of business moving has continued throughout the week. Matters in New York and London markets are rather dull. It is difficult, jobbers staate, to predict the next move in prices, as no big business is in sight and it is reasonably safe to assume that no great activity will be evidenced for the next few days.

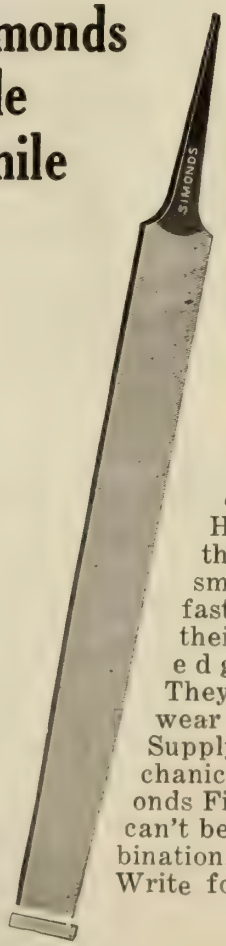
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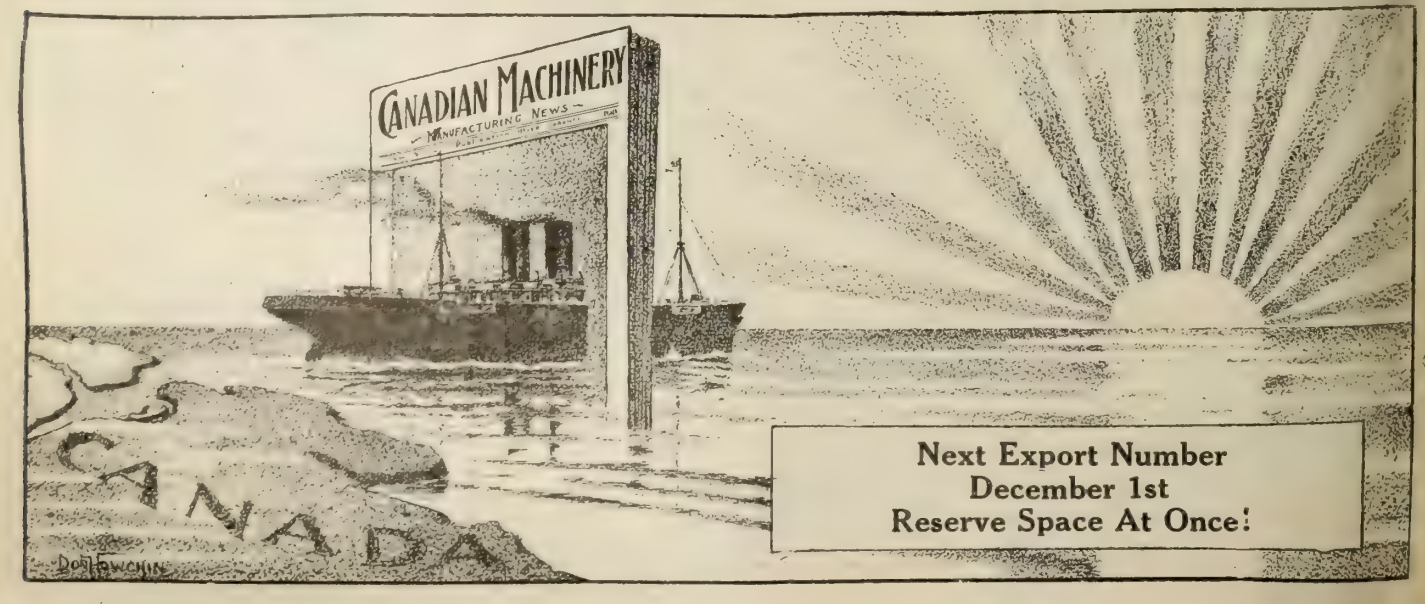
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Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Dickow, Fred C., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Cocks and Faucets
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Canada Machinery Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Carburizing, Case Hardening and Tempering
Cataract Refining Co., Toronto, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Cataract Refining Co., Toronto, Ont.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Conveyor Belt Joiners
Flexible Steel Lacing Co., Chicago, Ill.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.
Bernard Industrial Co., A., Fortierville, Que.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Etna Machine Co., Toledo, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Carter Welding Co., Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cutting, Oxy-Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Carbonado
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Pipe-Threading
Jones & Lamson Machine Co., Springfield, Vt.

Die Sinking Machines, Automatic
Jones & Lamson Machine Co., Springfield, Vt.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

field, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press
(See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Dickow, Fred. C., Machinery Co., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.
Hughes Owens Co., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Drilling Machine Heads
Hoefer Mfg. Co., Freeport, Ill.
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Automatic
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.
Holly, R. S., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Drilling Machines, Horizontal (See

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Hoefer Mfg. Co., Freeport, Ill.
National Acme Co., Cleveland, Ohio.
National Automatic Tool Co., Richmond, Ind.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Strelinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Sheffield Twist Drill & Steel Co., Sheffield, Eng.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.
Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Mathews Gravity Carrier Co., Port Hope, Ont.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto.
Perdue, W. B., San Francisco, Calif.

Expanders, Tube
Garlock-Walker Mchy. Co., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.
Willson Goggles, Inc., Reading, Pa.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis,

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Ingersoll File Co., Ltd., Ingersoll, Ont.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
L'Air Liquide Society, Toronto, Ont
National Electro Products Ltd., Toronto, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Volta Mfg. Co., Welland, Ont.
Walker & Sons Metal Products, Ltd Hiram, Walkerville, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Mechanical Engineering Co., Three Rivers, Que.
Rockwell Co., W. S., New York City.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Furniture, Machine Shop
Garlock-Walker Mchy. Co., Toronto, Ont.

Gages, Comparator
Jones & Lamson Machine Co., Spring-

BUYERS' DIRECTORY

Herbert Ltd., Alfred, Toronto, Ont.
field, Vt.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Perdue, W. B., San Francisco, Calif.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Ackworthie, Ltd., John, Birmingham, Eng.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
National Electro Products Ltd., Tortreal, Que.
Prest-O-Lite Co. of Can., Toronto Ont

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Philadelphia Gear Works, Philadelphia,
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.
Lyman Tube & Supply Co., Montreal, Que.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.
Philadelphia Gear Works, Philadelphia,

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto, Ontario.
Philadelphia Gear Works, Philadelphia, Pa.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Goggles, Safety
National Electro Products Ltd., Toronto, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont

Grab Buckets
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Holly, R. S., Toronto, Ont.
La Salle Tool Co., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.
Wilkinson & Kompass, Hamilton, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines Chaser
Jones & Lamson Machine Co., Springfield, Vt.

Grinding Machines, Cutter and Reamer
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Herbert Ltd., Alfred, Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Machines, Internal
Garlock-Walker Mchy. Co., Toronto, Ont.

Grinding Machines, Portable
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Power Oscillating Tool
Herbert Ltd., Alfred, Toronto, Ont.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Garlock-Walker Mchy. Co., Toronto, Ont.
La Salle Tool Co., Ltd., La Salle, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
La Salle Tool Co., Ltd., La Salle, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Waltham Grinding Wheel Co. of Canada, Brantford, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Abrasive Wheel Co., Ltd., Mimico, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Waltham Grinding Wheel Co. of Canada, Ltd., Brantford, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Guards, Electric Lamp
Flexible Steel Lacing Co., Chicago, Ill.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Ackworthie, Ltd., John, Birmingham, Eng.
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Clemson Bros., Hamilton, Canada.
Garlock-Walker Mchy. Co., Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Steel Foundries, Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Skinner Bros. Mfg. Co., Inc., St. Louis,
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardness Testing Apparatus
Hardening, Case-Hardening and Tempering
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hammers, Rivetting

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Shepard Electric Crane & Hoist Co., Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Hoists, Hand
Lyman Tube & Supply Co., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Hose, Industrial
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Index Centers
Dickow, Fred. C., Machinary Co., Chicago, Ill.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Insulation
Diamond State Fibre Co. of Can., Ltd Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Iron Valves
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Engineering Service, Ltd., Hamilton, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ort.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Garlock-Walker Mchy Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Acme Machine Tool Co., Cincinnati, Ohio.
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathes, Screw-Cutting
Jones & Lamson Machine Co., Springfield, Vt.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Garlock-Walker Mchy. Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Greenfield Tap & Die Corp., Galt, Ont.
Hendey Machine Co., Torrington, Conn
Lehmann Machine Co., St. Louis, Mo.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dodge Mfg. Co. of Can., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Atkins & Co., Inc., E. C., Indianapolis, I.
Cleveland Twist Drill Co., Cleveland, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Brown's Copper & Brass Rolling Mills, Ltd., Toronto, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Alkenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Garlock-Walker Mchy. Co., Toronto, Ont.

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and Planer Type
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Milling Machine Co., Rockford,

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hendey Machine Co., Torrington, Conn.
Holly, R. S., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Garlock-Walker Mchy. Co., Toronto, Ont
Herbert Ltd., Alfred, Toronto, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy Co., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
MacGovern & Co., Montreal, Que.
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nickel Plating Outfits
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Cocks and Burners
Puro Sanitary Drinking Fountain Co. Haydenville, Mass.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oils
Canadian Oil Companies, Ltd., Toronto Ont.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Imperial Oil Ltd., Toronto, Ont
Brantford Oven & Rack Co., Brantford, On

Oxygen
Carter Welding Co., Toronto, Ont.
Dominion Oxygen Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont
National Electro Products Ltd., Toronto, Ont.

Oxy-Acetylene Apparatus
L'Air Liquide Society, Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd. Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montre

BUYERS' DIRECTORY

Atlas Press Co., Kalamazoo, Mich.
Guildford & Sons, Ltd., Halifax, N.S.

Paper Mill Conveyers
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.
Marion & Marion, Montreal, Que.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Canada Machinery Corp., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Penstocks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Stainle Turret Machine Co., Madison, Wis.

Planers, Parallels
L. & P. Mfg. Co., Niagara Falls, Ont.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
L. & P. Mfg. Co., Niagara Falls, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Plumbers' Brass Goods
Puro Sanitary Drinking Fountain Co., Hawtenville, Mass.

Pneumatic Tools
Can Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Teol Co., Toronto, Ont
Garlock-Walker Mchy. Co., Toronto, Ont.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Polishing and Buffing Machines
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Ferri-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Terry & Co., John C., Birmingham, Eng.

Pots, Steel
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.

Pressed Steel Parts
Ackworthie, Ltd., John, Birmingham, Eng.
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
L. & P. Manufacturing Company, Ltd., Niagara Falls, Ont.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Streiinger Co. of Can., Ltd., Chas. A., Windsor, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Forcing

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Laurie Mfg. Co., Springfield, Ill.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Positive Clutch & Pulley Works, Toronto, Ont.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Barrel and Boiler-feed
Trahern Pump Co., Rockford, Ill.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Circulating and Coalant
Trahern Pump Co., Rockford, Ill.

Pumps, Geared and Hand
Trahern Pump Co., Rockford, Ill.

Pumps, Industrial
Trahern Pump Co., Rockford, Ill.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Trahern Pump Co., Rockford, Ill
Dominion Engineering Works, Limited, Montreal, Que.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal Q.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Hepburn Ltd., John T., Toronto, Ont.
Trahern Pump Co., Rockford, Ill.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Machinery Corp., Galt, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Garlock-Walker Mchy. Co., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Toledo Machine & Tool Co., Toledo, Ohio

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
General Combustion Co. of Can., Ltd., Montreal, Que.
Taylor Instrument Co., Toronto, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Racks, Cut
Ferri-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Rammers, Foundry
Holden Co., Ltd., Montreal, Que.

Reamer Holders
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Redford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Garlock-Walker Mchy. Co., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
International Business Machines Co., Toronto, Ont.

Regulators, Automatic (for electric furnaces)
Volta Mfg. Co., Welland, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Resistance Materials
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet Heaters
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que
General Combustion Co. of Can., Ltd., Montreal, Que.
Volta Mfg. Co., Welland, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
High Speed Hammer Co., Rochester, N.Y.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robuster Co., F. B., New Haven, Conn.
Stewart & Co., Duncan, Glasgow, Scot

Rolls (Rubber Covered)

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Goods, Mechanical
Quaker City Rubber Co., Philadelphia, Pa.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel
Chesterman & Co., Ltd., J., Sheffield, Eng.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto.
Keller Pneumatic Tool Co., Grand Haven, Mich.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Foss Machinery & Supply Co., Geo. F. Montreal, Que.
Herbert Ltd., Alfred, Toronto, Ont.
Lyman Tube & Supply Co., Montreal, Que

Sawing Machines, Power Hack
Ackworthie, Ltd., John, Birmingham, Eng.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Hamilton, Canada.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal, Power
Clemson Bros., Inc., Hamilton, Ont.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Lyman Tube & Supply Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton.

BUYERS' DIRECTORY

Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Driving Machine
Canada Machinery Corp., Galt, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Holden Co., Ltd., Montreal, Que.
Independent Pneumatic Tool, Chicago, Ill.

Screw Extractors
Cleveland Twist Drill Co., Cleveland, O.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.
Tallman Brass & Metal Co., Hamilton, Ont.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Greenfield Tap & Die Corp., Galt, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Warner & Swasey Co., Cleveland, Ohio.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Barnes Co., Wallace, Bristol, Conn.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Barnes Co., Wallace, Bristol, Conn.
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Canada Machinery Corp., Galt, Ont.
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Hendey Machine Co., Torrington, Conn.
Herbert Ltd., Alfred, Toronto, Ont.
Holly, R. S., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Smith & Mills Co., Cincinnati, Ohio
Walcott Lathe Co., Jackson, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Machinery Corp., Galt, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Toledo Machine & Tool Co., Toledo, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.
Terry & Co., John C., Birmingham, Eng.
Toledo Machine & Tool Co., Toledo, Ohio.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Herbert Ltd., Alfred, Toronto, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.

Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ont.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs
Barnes Co., Wallace, Bristol, Conn.
Cleveland Wire Spring Co., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Steele Ltd., James, Guelph, Ont.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Lyman Tube & Supply Co., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Co., Wallace, Bristol, Conn.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Keller Pneumatic Tool Co., Grand Haven, Mich.
Metal Stamping Co., Toronto, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Stairways, Wrought Iron
Can. Wire & Iron Goods Co., Hamilton, Ont.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Cold-Rolled Strip
Andrews Steel Co., Newport, Ky.
Barnes Co., Wallace, Bristol, Conn.
Can. Driver-Harris Co., Walkerville, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Barnes Co., Wallace, Bristol, Conn.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Andrews Steel Co., Newport, Ky.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Barnes Co., Wallace, Bristol, Conn.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Firth & Sons, Ltd., Thos., Montreal, Q.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Swedish Crucible Steel Co. of Canada, Ltd., Windsor, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Baines & David, Ltd., Toronto, Ont.
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.
Drury Ltd., H. A., Montreal, Que.
Firth & Sons, Ltd., Thos., Montreal, Q.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.
Vulcan Crucible Steel Co., Aliquippa, Pa.

Steel, Magnet
Can. Atlas Crucible Steel Co., Toronto, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Structural
MacKinnon Steel Co., Sherbrooke, Que.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Etna Machine Co., Toledo, Ohio.

Swaging Machine Parts
Etna Machine Co., Toledo, Ohio.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tablets, Bronze, Memorial
Tallman Brass & Metal, Ltd., Hamilton, Ont.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks, Steel
MacKinnon Steel Co., Sherbrooke, Que.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Toronto Iron Works, Toronto, Ont.

Taper Cutting Dies
Jones & Lamson Machine Co., Springfield, Vt.

Tap Holders
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Morrow Screw & Nut Co., Ltd., John, Ingersoll, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Chesterman & Co., Ltd., J., Sheffield, Eng.
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Archibald & Co., Chas. P., Montreal, Q.
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Testing Metals and Materials
Toronto Testing Laboratory, Toronto, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Victor Tool Co., Waynesboro, Pa.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Markers, Electric
Can. Ingersoll-Rand Co., Ltd., Sherbrooke Que.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tool Steels for all Purposes
Canadian Atlas Crucible Steel Co., Ltd., Toronto, Ont.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Greenfield T & Die Corp., Galt, Ont.
Hamilton ineering Service, Ltd., Hamilton, t.
Herbert Ltd., Alfred, Toronto, Ont.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Positive Clutch & Pulley Works, Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Transportation Systems (See Trucks)
Mathews Gravity Carrier Co., Port Hope, Ont.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tube, Products
Tube Co. of Canada, Toronto, Ont.

Tubing, Electric Welded or Oxy-Acetylene Welded
Tube Co. of Canada, Toronto, Ont.

Tubing, Flexible
Dunlop Tire & Rubber Goods Co., Ltd Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.

Tubing, Seamless Steel
Tube Co. of Canada, Toronto, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Crown Steel Products Co., Brantford, Ont.
Hyman Tube & Supply Co., Montreal, Que.
Ontario Metal Products Co., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Ackworthie, Ltd., John, Birmingham, Eng.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Herbert Ltd., Alfred, Toronto, Ont.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Vises, Drilling Machine
Hoosier Drilling Mach. Co., Goshen, Ind.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Greenfield Tap & Die Corp., Galt, Ont.
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal. Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal. Q.
Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Rubber
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.

Welding, Electric
Goodyear Tire & Rubber Co. of Can., Ltd., Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Perdue, W. B., San Francisco, Calif.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
L'Air Liquide Society, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Apparatus.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Toronto, Ont.
L' Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
National Electro Products Ltd., Toronto, Ont.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co., Toronto, Ont.
Davis-Bournonville Co., Jersey City, N.J.
L'Air Liquide Society, Toronto, Ont.
Lincoln Electric Co., Toronto, Ont.
National Electro Products, Toronto, Ont.
Prest-O-Lite Co. of Canada, Ltd., Toronto, Ont.

Wheels, Cast, Steel
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Electric
Shepard Electric Crane & Hoist Co Montour Falls, N.Y.
Volta Mfg. Co., Welland, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Co., Wallace, Hamilton, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Walker & Sons Metal Products, Ltd., Hiram, Walkerville, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garlock-Walker Mchy. Co., Toronto, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

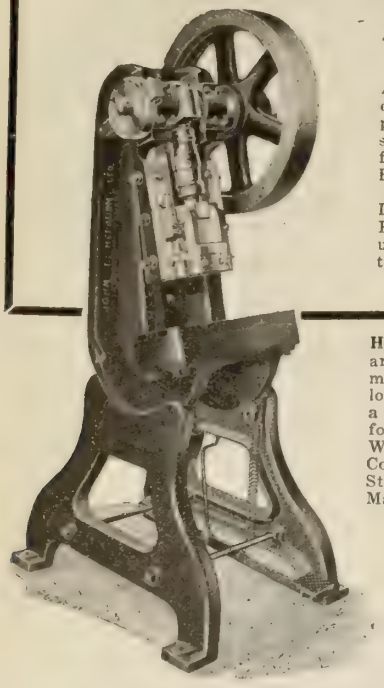
Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

CANADIAN MACHINERY AND MANUFACTURING NEWS

143 UNIVERSITY AVE., TORONTO, CANADA

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BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

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131 St. Paul St. West, Montreal.

AGENTS—D. Phillip, 138 Portage Ave., Winnipeg, Man.
A. T. Chambers, 505 Hastings St. West, Vancouver, B.C.

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BUTTERFIELD

CANADIAN MACHINERY AND MANUFACTURING NEWS

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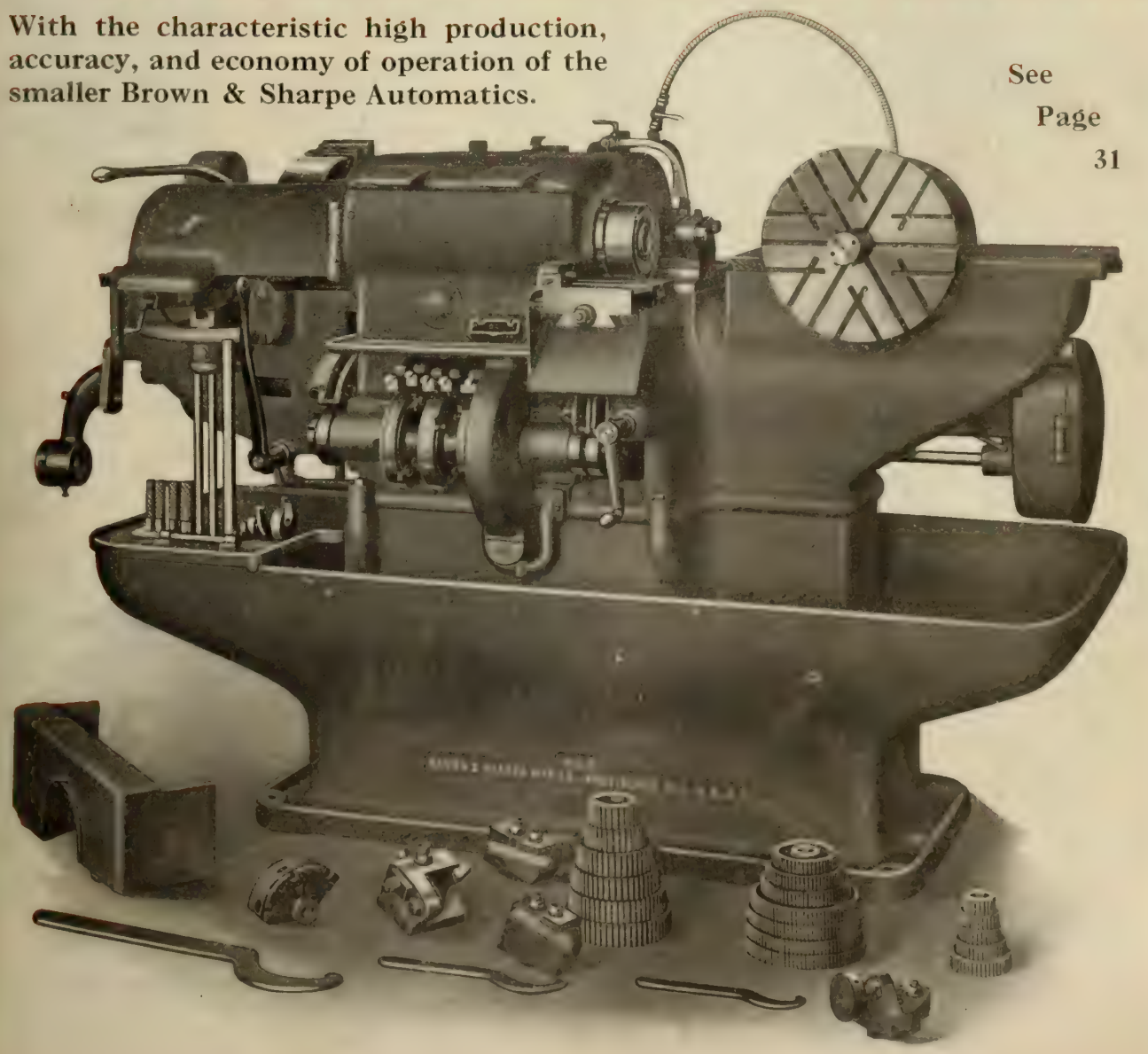
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See Page 31



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BETTER than most because of the interchangeable feature in their chasers. A broken chaser in a P. & W. Die doesn't mean a new set of chasers. You can get a new chaser to replace a breakage and the new one "fits in" perfectly in your old set. That's the 6th point, **"ECONOMY IN OPERATION."**

PRATT & WHITNEY COMPANY
OF CANADA, LIMITED

Works: Dundas, Ontario

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VANCOUVER	**WALKERVILLE**	**HALIFAX**
B. C. Equipment Co.	103½ Sandwich St.	Roy Building



PRATT & WHITNEY.

The BERTRAM Page

MACHINE TOOLS

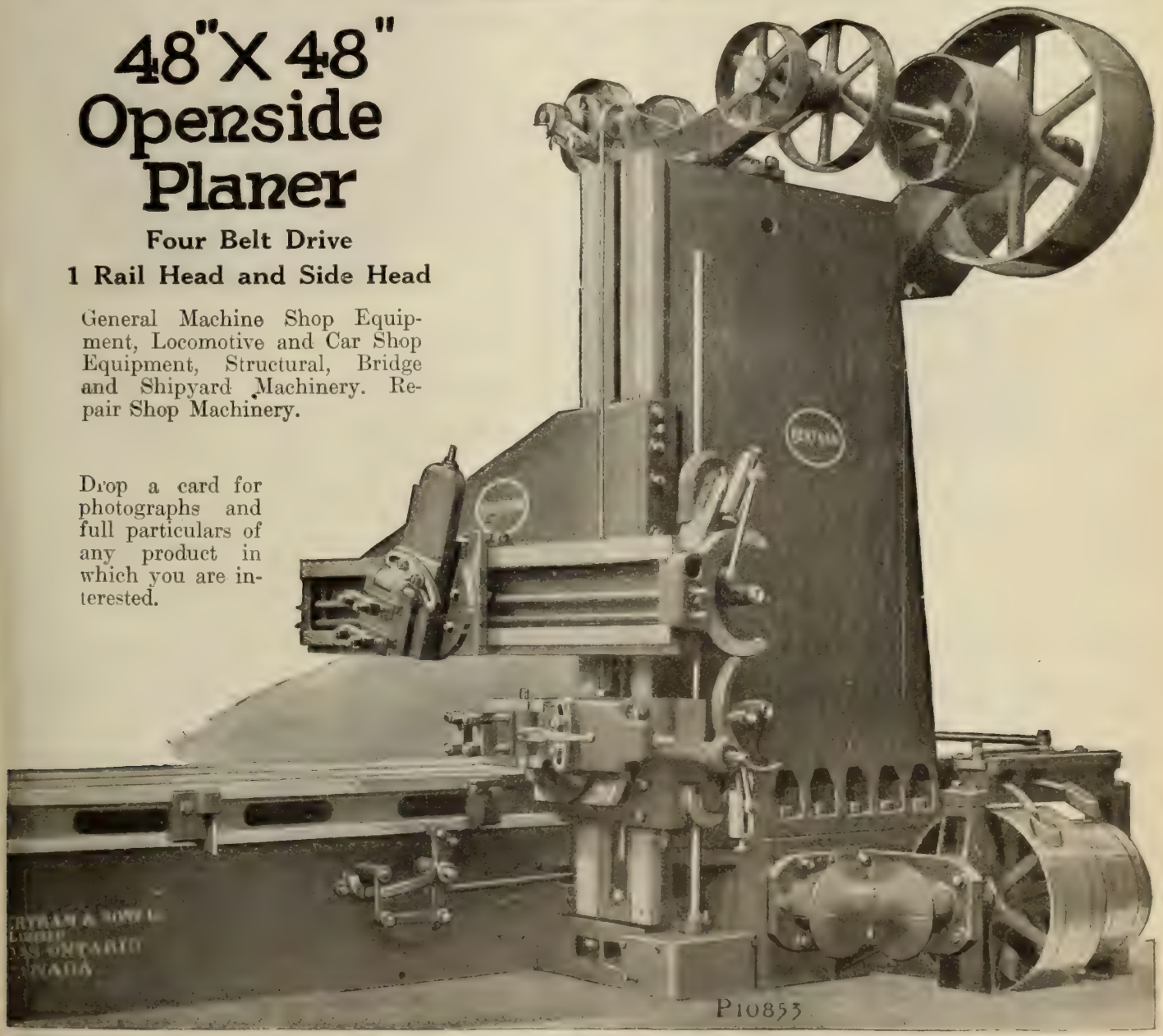
48"X 48" Openside Planer

Four Belt Drive

1 Rail Head and Side Head

General Machine Shop Equipment, Locomotive and Car Shop Equipment, Structural, Bridge and Shipyard Machinery. Repair Shop Machinery.

Drop a card for photographs and full particulars of any product in which you are interested.



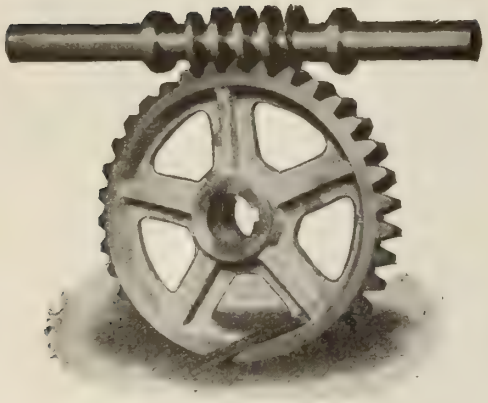
The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

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Let us help you to select sound designs for your gear drives.

Hamilton Gear & Machine Co.

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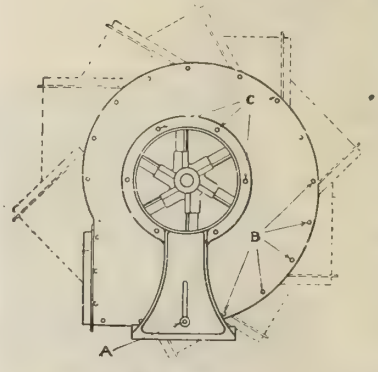
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

Insurance rates can be reduced; floors and machines covered with sawdust, chips or shavings, increase the fire risk.

Insurance companies reduce the premiums where adequate precautions have been taken to prevent fires.

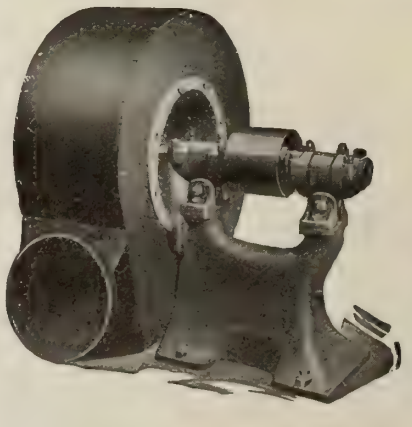
Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





The Canadian Standard Planing Mill Exhausters have reversible housings so that the outlet can be adjusted instantly to any angle desired.

This eliminates necessity of crossed belts. Simplifies changes on alterations in piping or building.



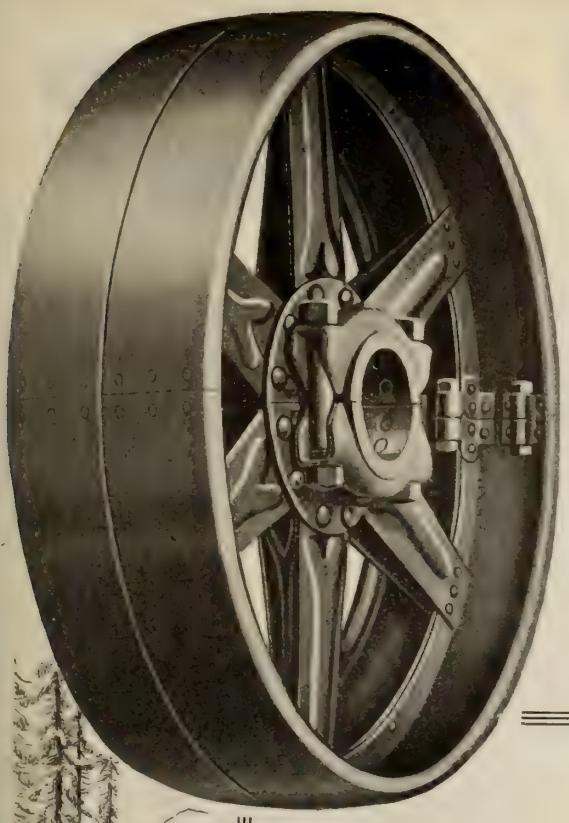
The housing is of heavy rolled steel plate securely bolted together with angle irons, round cast iron outlet bolted to the housing. Blast wheel mounted on heavy cast iron spider.

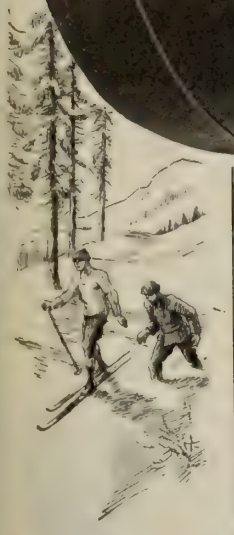
Every fan carefully tested by running test at speeds in excess of that required.

Write for Catalog No. 16.

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Where Resistance is Lowered More Power is Delivered

Just as skis aid the traveller by reducing resistance and lost motion, so "American" Pulleys transmit more power by reducing bearing friction, belt slip and weight on shafting.

How this is done is explained in detail in our book, "Getting Maximum Pulley Efficiency" Yours for the asking.

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A file ceases to be fully efficient as soon as it has begun to lose its keen-cutting edge. Replacing it costs only a trifle but means much in increased efficiency.

These brands, the standard for over fifty years, do not dull quickly:–

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WHEN bearing troubles crop up in your plant it is well to remember that problems just as difficult have been solved by SKF Engineers. It may have been in England, France, Japan or United States—but the knowledge and experience that solved them are at YOUR Service here in Canada—free of cost or obligation.

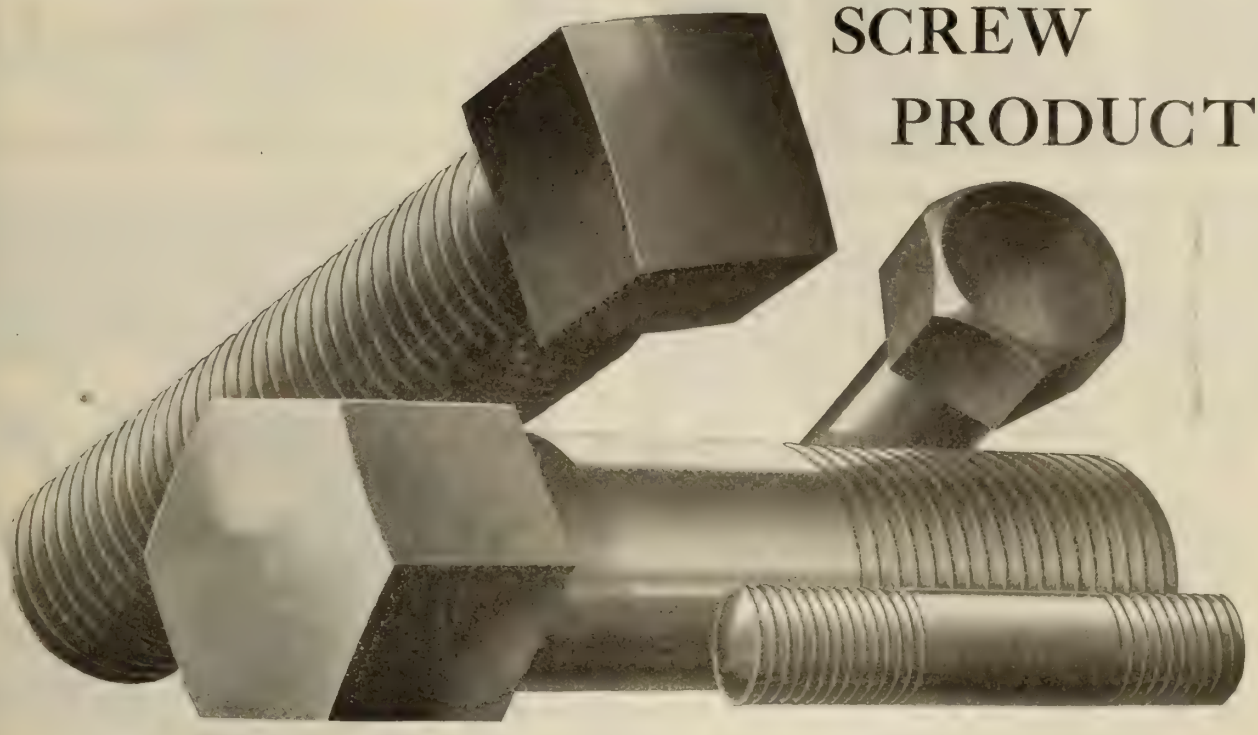
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"V," U.S.S., S.A.E. Cap Screws
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Semi-Finished "V," U.S.S. Nuts.

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Screw Machine Product up to 2¼" diam.—to specifications
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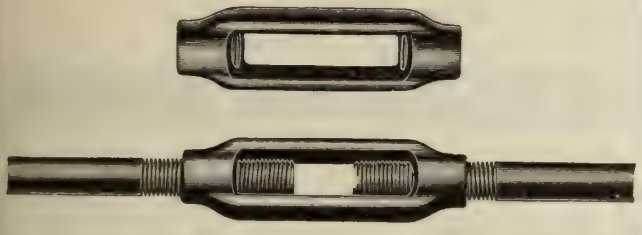


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May be obtained in short lengths Pointed and Tempered especially for use in STRUCTURAL IRON or for drilling the web of rails.
They are TOUGH TOOLS and stand right up to the work---Furnished in Carbon and High Speed Steel.

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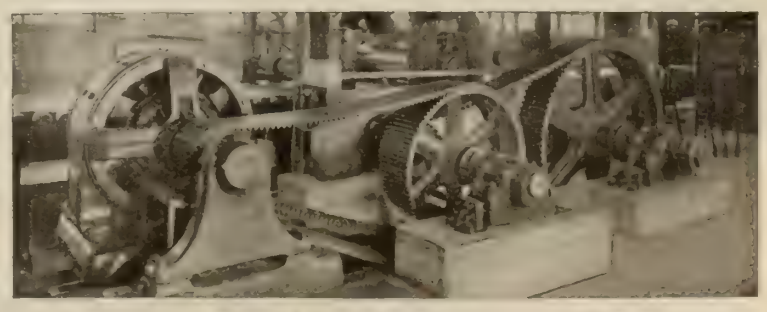
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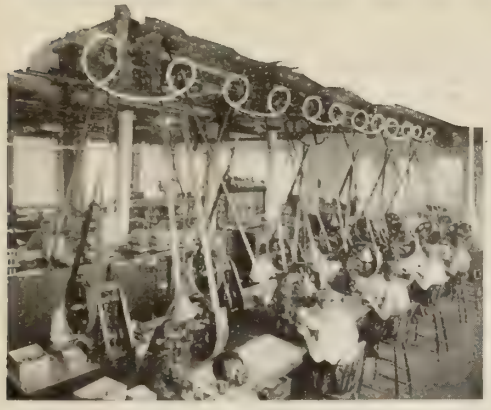
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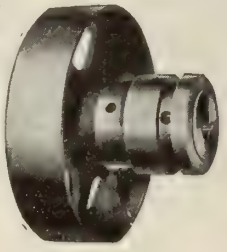
It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

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Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

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You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

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THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

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FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

Cleveland Sand Rammers are made in several sizes and weights, and are adapted for all kinds of Foundry Ramming.

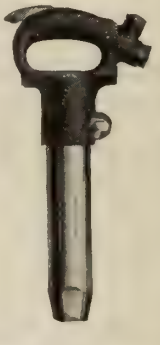
The Piston Rods are packed with a resilient packing which prevents any dirt from entering piston chamber and working parts—They are fitted with either Round or Flat Rod as required. Cleveland Rammers are light in weight, have high speed and practically no vibration, making them ideal foundry tools.





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For Foundry Work. Are furnished in any required size or weight for grey iron or steel castings; they have high speed, and are adapted for fast chipping now required by piece-workers.

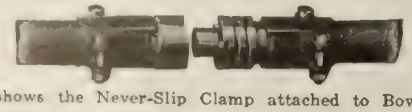


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Bowes Couplings are absolutely air tight under all pressures.

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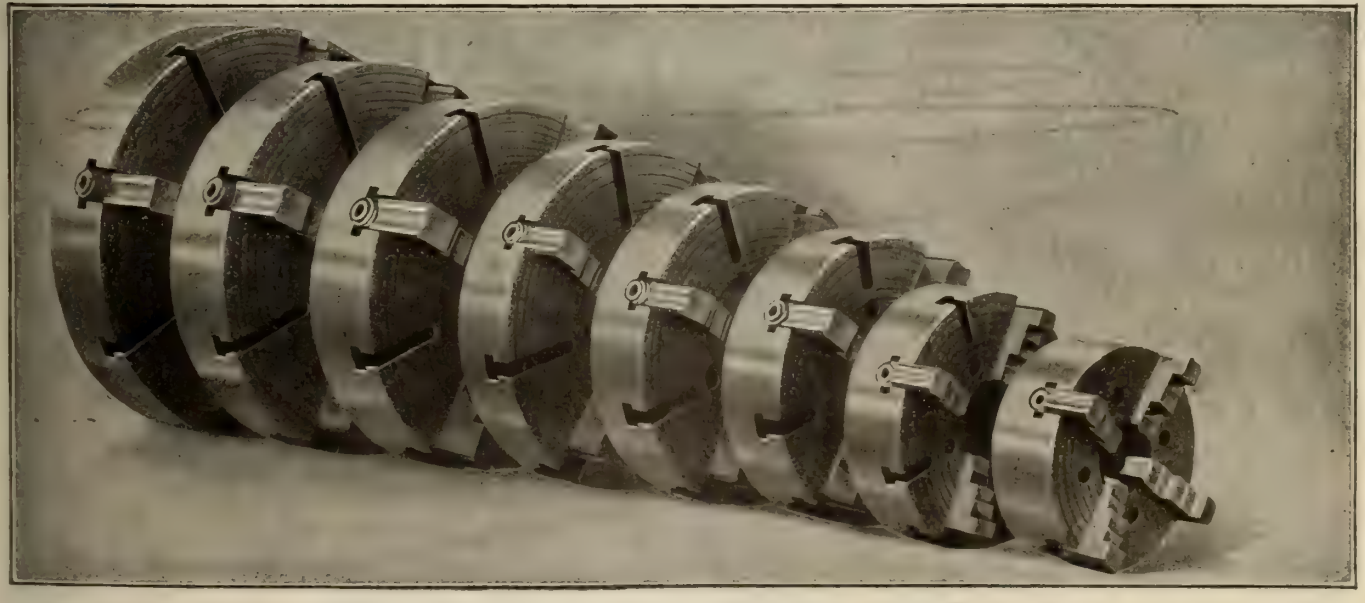
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DOMINION CHUCKS



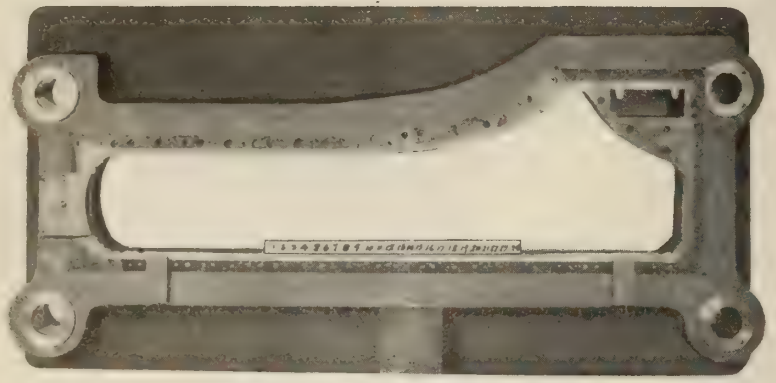
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Built for Long Life and to Stand Severe Service

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Engineers and Manufacturers BRANTFORD, Canada

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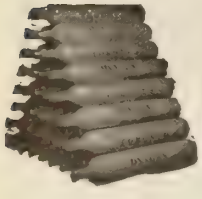
for every purpose —large or small— intricate or simple— are exactingly designed by

FORD-SMITH

Some say it is the fine quality of material used that accounts for the long life of our Dies and Special Machines. Others will tell you that the accurate following of specifications and close attention to details have a lot to do with it. But we believe it is a combination of both made possible by a complete tool plant and an expert engineering staff.

THE FORD-SMITH MACHINE COMPANY, LIMITED

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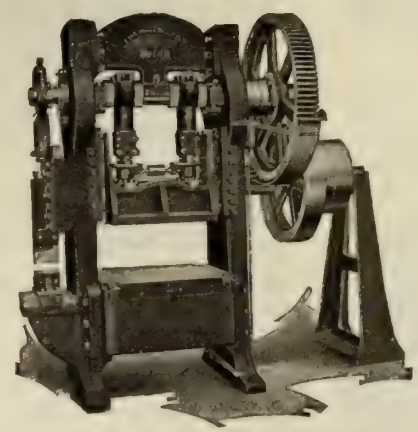
BROWN-BOGGS

B B

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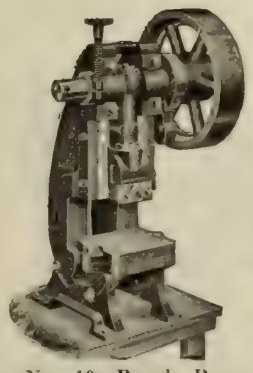
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Send us samples or drawings and we will quote you and guarantee satisfaction



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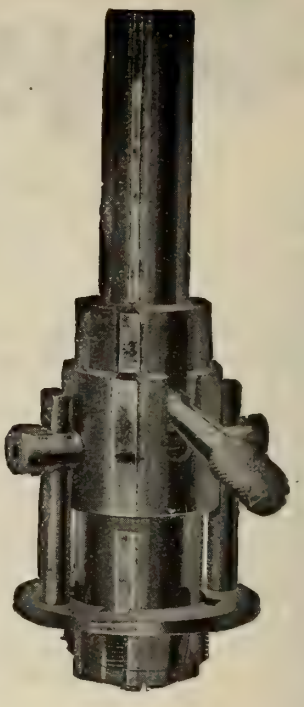
THE BROWN-BOGGS CO. LIMITED

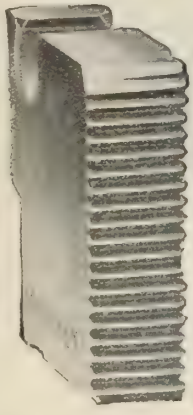
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Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



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And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

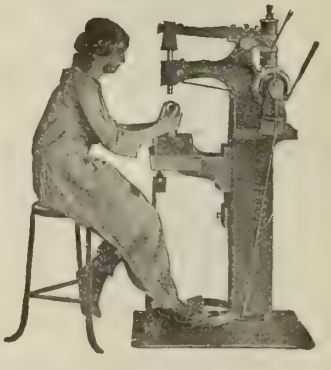
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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—
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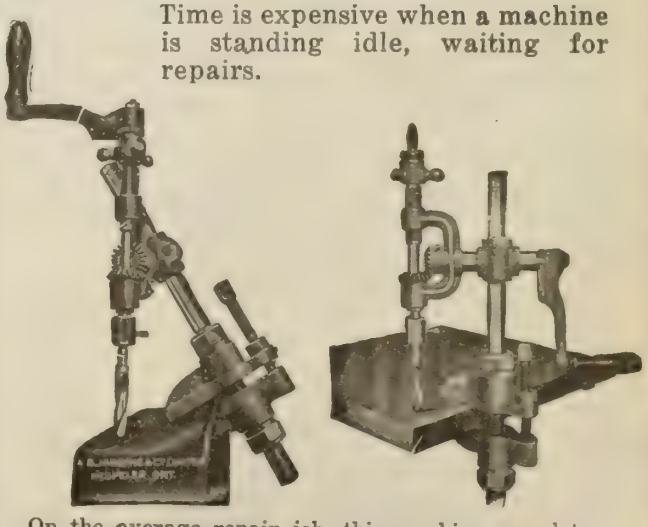
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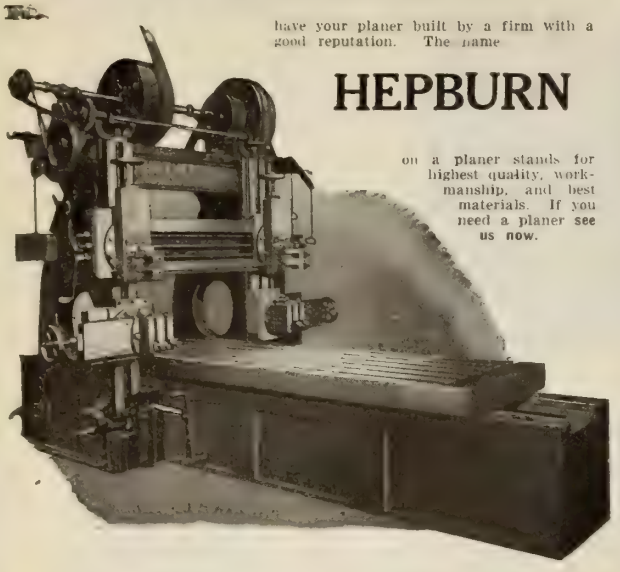
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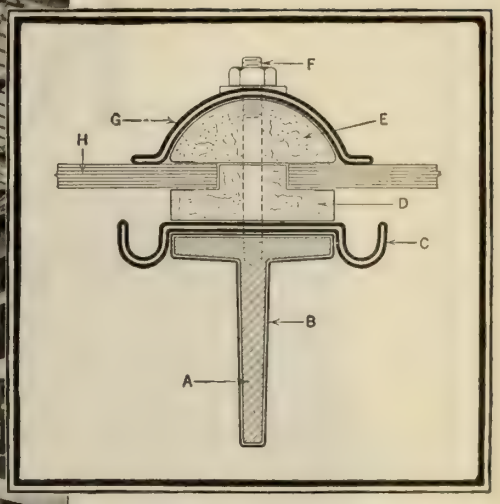
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One of the four large courts in the Cadillac plant. These courts and a large loading platform are covered with Robertson Process Skylights. 106,710 sq. ft. were used.



Study this Cross Section

Shows the important details of Robertson Skylight Construction.

A—Standard Rolled Steel Tee, Angle of Channel Bar-Beam. B—Robertson Process Protective Coating. C—Robertson Process Metal Condensation Gutter. D—Asphaltic Glass-Cushion and Separator. E—Asphaltic Cap-Filler. F—Cap Bolt and Nut. G—Robertson Process Metal Cap. H—Glass.

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Such was the aim of the Cadillac organization when plans were laid for the building of its new plant in Detroit. Everything that engineering skill and competent workmen could do to *realize* this ambition has been done. Plans, materials and equipment *of the best* have been here assembled, and the result is a noteworthy example of plant efficiency.

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106,710 sq. ft. were used in the new Cadillac plant. Seven large skylight courts are lighted and protected by this Robertson Product. Two large loading marquise contain nearly 10,000 sq. ft.

Correct design and *enduring materials* are the two important elements which give Robertson Skylights their exceptional advantages. The Robertson design meets all demands of the architect and engineer. It proves a supporting bar capable of carrying its load without deflection. It provides a perfect asphaltic bed for the glass—two elements that eliminate glass breakage and prolong the skylight life. Furthermore the Robertson design is equipped with efficient condensation gutters. It meets every requirement of endurance and appearance.

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Our engineers have issued a number of technical bulletins covering Robertson Process Metal and Robertson Process Gypsum (both reinforced gypsum slab and poured in place roof construction), as well as the Robertson Skylight Construction.

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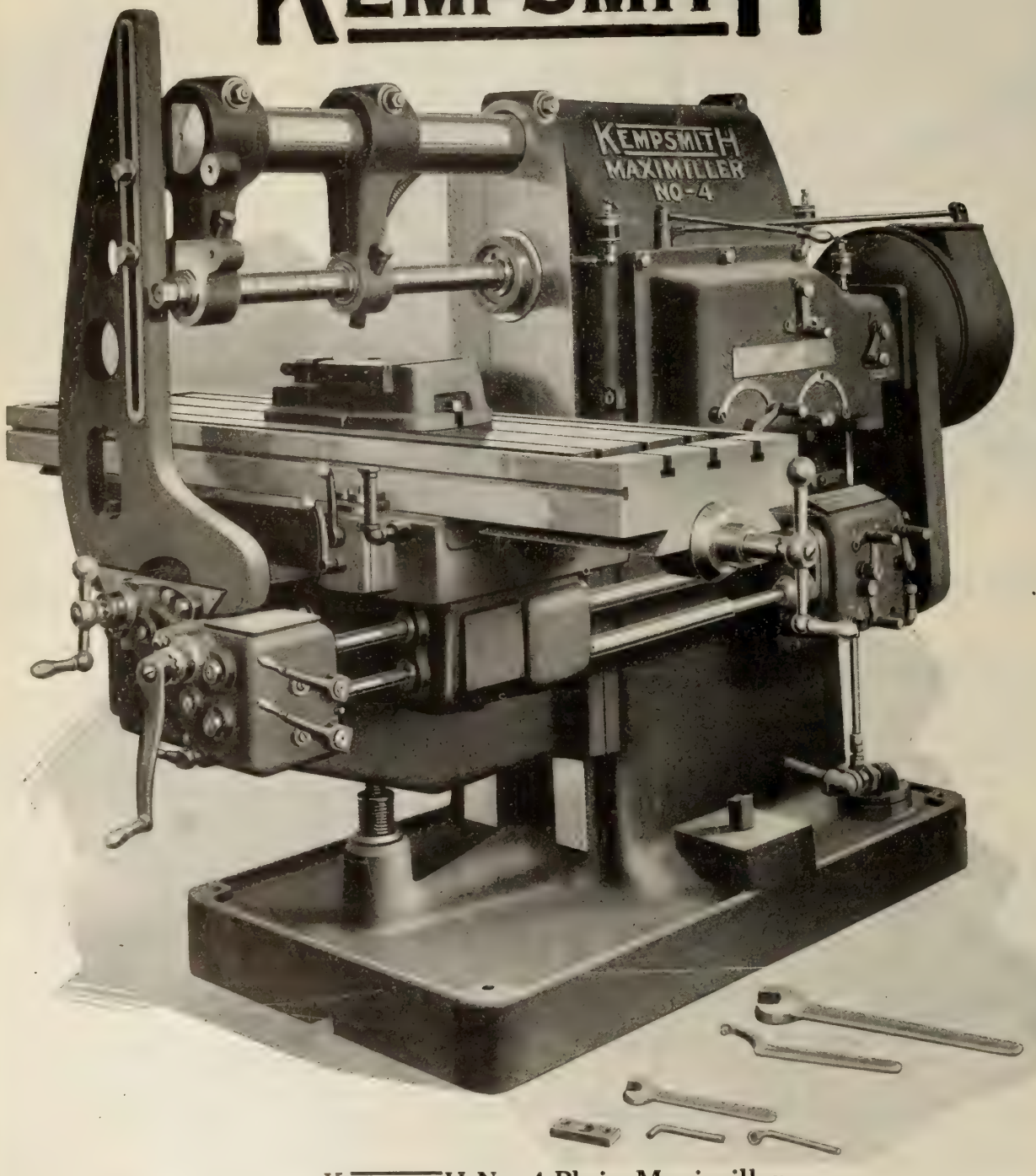
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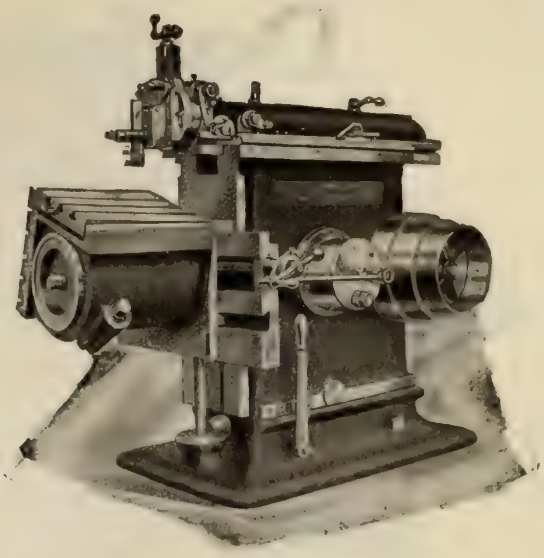
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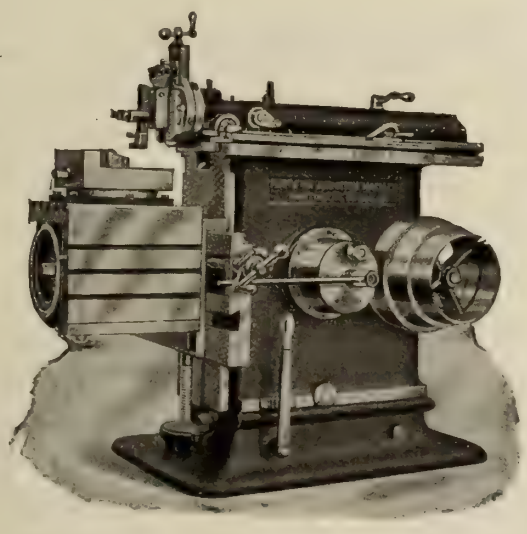
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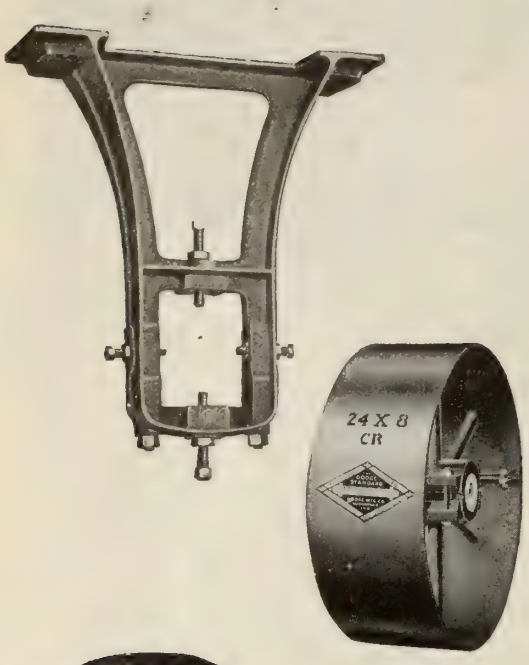
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Those who are wise enough today to drop standstill methods and by going ahead are causing others to follow, are those who at all times seek the best in factory equipment. They are guided by a true understanding of value as compared to cost, and are buying Dodge power transmission machinery now on a basis of quality, reliability and service in the face of greatly reduced prices on cheap lines.

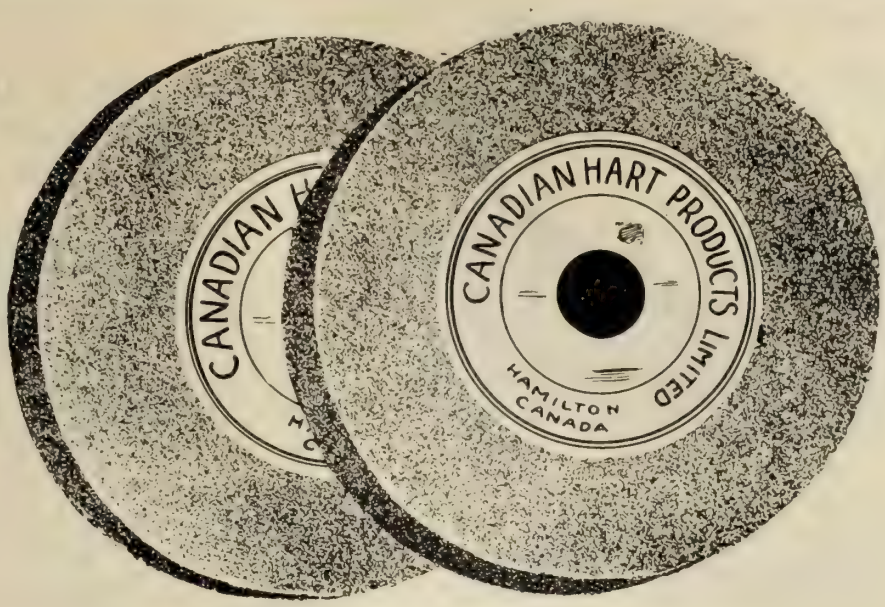
To those who are just coming back into their own, Dodge offers its every facility. Immediate delivery is possible on Dodge Standard Wood Split Pulleys, Dodge Standard Iron Split Pulleys, Dodge Steel Split Pulleys, Dodge 4-Point and Ball and Socket Hangers and all other products made by Dodge in Canada. You cannot better place your business and your confidence than with Dodge.

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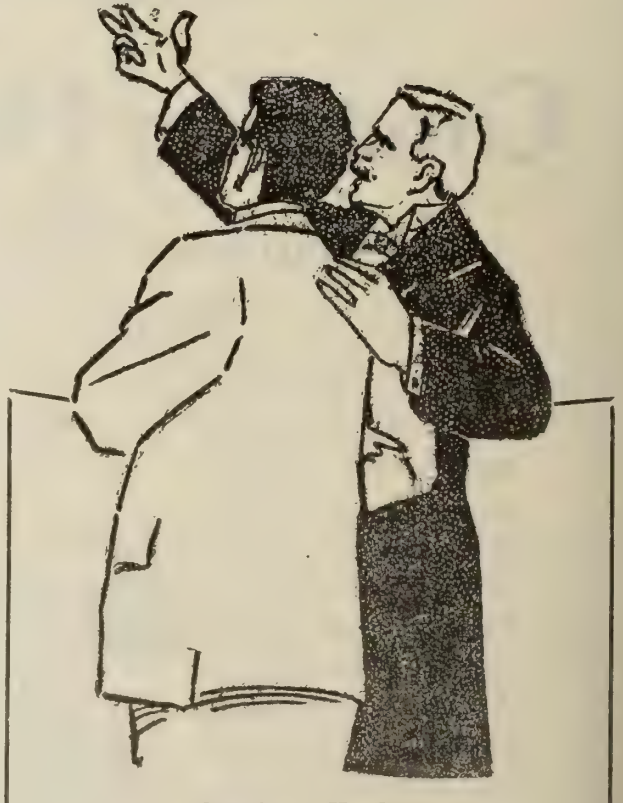
The president of a large industrial concern was speaking (if we told you the name of the firm you would immediately recognize it as one of the foremost of its kind in Canada).

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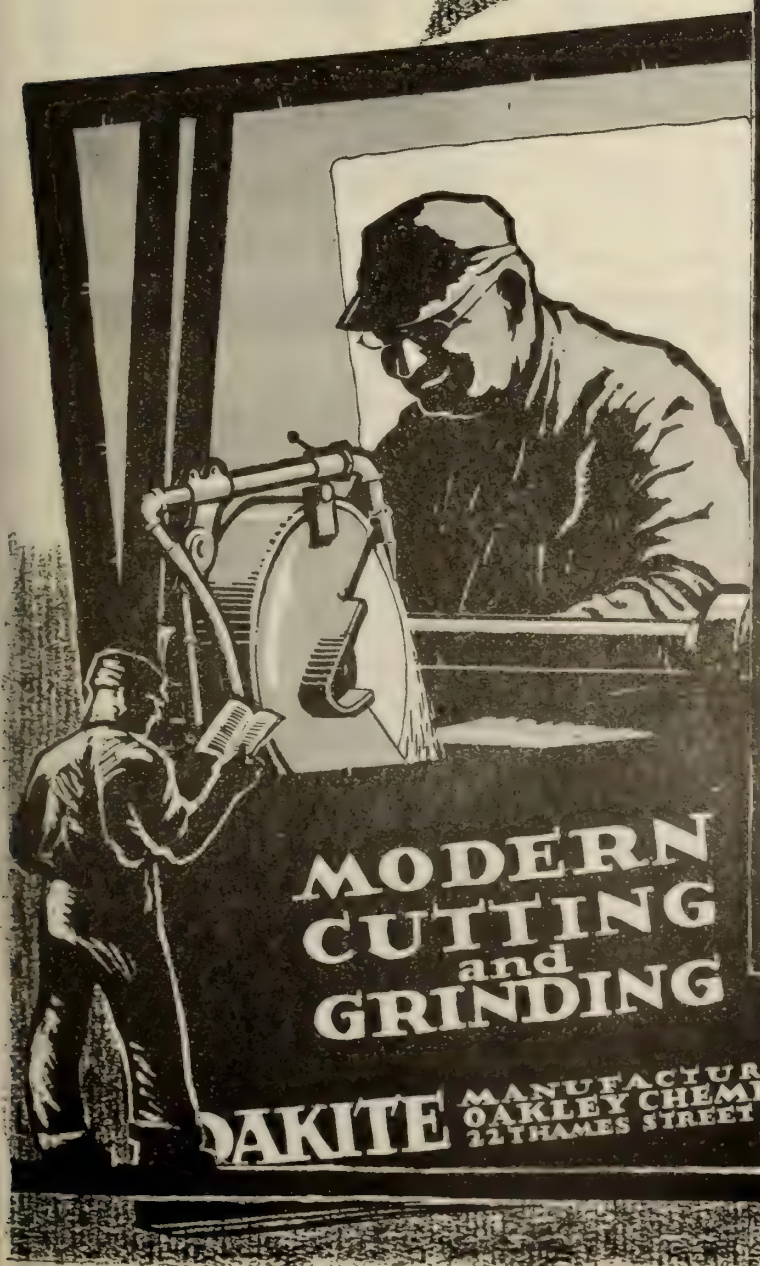


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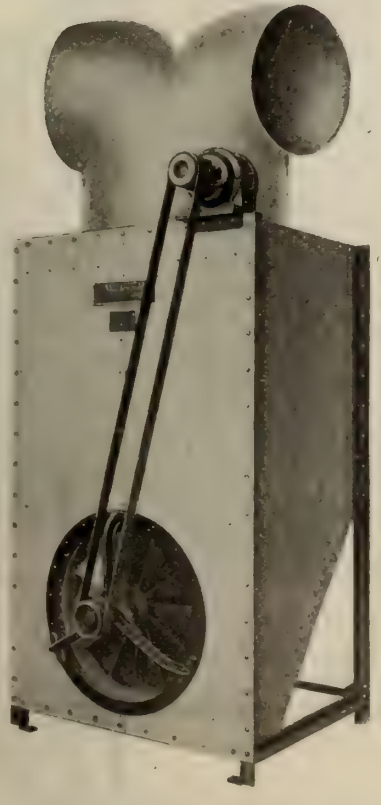


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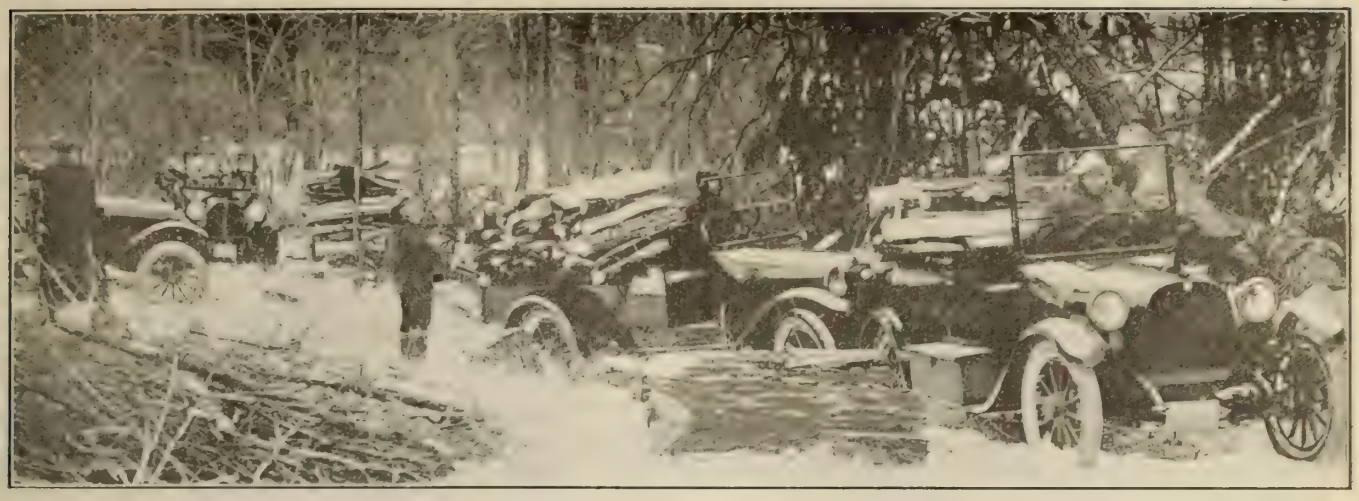
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You Can't Get Away From Regrinding Possibilities

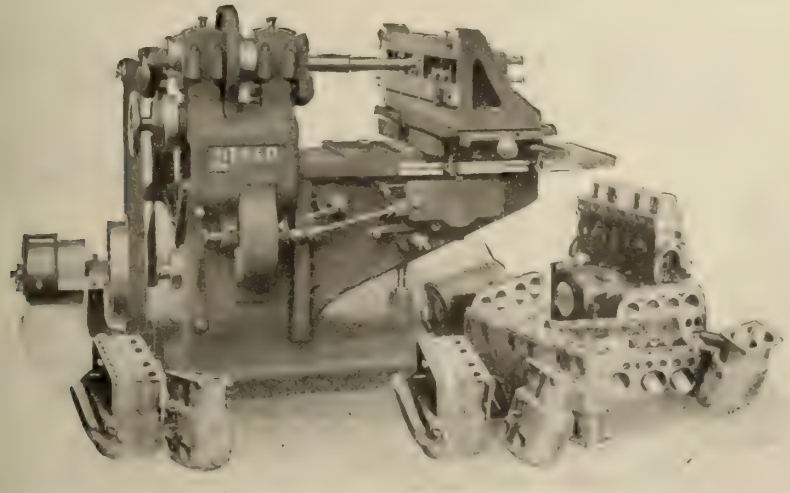
Location has nothing to do with cylinder regrinding possibilities. Motor driven vehicles are like the poor—you will find them everywhere, whether in the frozen North or in the torrid tropics.

There are over 400,000 registered cars in Canada and only 12 Heald-equipped shops to handle these possibilities, and remember—it only takes 3 four en bloc cylinders a day to make handsome profits on the investment required in a two-man shop.

There is not a single mechanical field in this Dominion today that has the chances that regrinding has. It is spreading like wild-fire in the States and still the demand is greater than the production. Once the motor owners are educated to its values, there will be a scramble to see who will get the trade, and if you want to be the lucky one, investigate the proposition today.

Remember one thing—that the heart of the regrinding shop is the grinding machine and that, while the possibilities are everywhere, there is but one grinder that is tried and true. For 16 years The Heald Machine Company has been building machines devoted exclusively to this class of work. They are used by every automobile manufacturer that grinds his cylinders. You can't go wrong when you purchase a Heald.

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"Canada's Next Premier"

No matter which he is—all three possibilities are pen-pictured in

November 15 MacLean's

"Scrutator," a writer of rare analytical power, holds the mirror up to Meighen, King and Crerar. Each of the three is "called up" in printers' ink as true to life as if they stood there separate and distinct in flesh and blood. It is one of the most searching, masterly articles ever written with public men as subjects. It is fair to each—and nothing more; a cold-blooded analysis of the virtues and weaknesses of the candidates in turn. It will surprise you, startle you, tantalize you with its subtleness and depth.

"Funny Thing That Tariff"—by J. K. Munro. This number of MACLEAN'S has four timely articles dealing with Big Politics, the whimsical observations of J. K. Munro are, as usual, full of amusement as well as information. Munro just can't help seeing the funny side of politicians and politics. Of Ottawa and Parliament Hill he makes a sort of continuous vaudeville performance. He gets some big laughs out of election activities.

Lt. Colonel John Bayne MacLean

has been a watcher from the hilltops longer than most of the present-day school of Canadian writing men. As usual, in his article on the Dominion political situation in November 15th, issue of MACLEAN'S MAGAZINE, he strictly maintains the detached attitude of the true journalist. But in his survey of the field and the political gladiators there is a warmth and an intimacy with both the men and the situations that could be imparted only by one who has long been a close and observant student of governments both Dominion and Imperial. This article appears under the caption—

"All Three Are Good Men."

"Our Election Enigma—Women!"—by Agnes C. Laut. How are they going to vote? Are they going to vote at all? Are they going to realize citizenship? These are some of the potent questions asked and answered by one of Canada's leading women authors—Agnes C. Laut. What influence will woman with her vote bear on Canadian politics? Will the woman wage-earner join the ranks of labor when it comes to the battle of the ballots? There is a fund of information for both men and women readers in this right-on-the-minute summary of Miss Laut's.

Other Gripping Features in This Issue:

If you like red-blooded fiction with the tang of the race track in it, W. A. Fraser's short story, **"The Thumb Print,"** is sure to satisfy. It's a case of a pair of sleek double-crossers being neatly double-crossed by what they deemed a rich doubble-crosser.

"Whose Bride Was Mary," is a delightful, fast-reading short story of perplexing situations from the pen of Ethel Penman Hoge.

The first of Rev. R. G. MacBeth's thrilling articles on old days with the Mounted Police, "Policing the Prairies," is given complete in this issue. Learn how the Mounties first invaded the prairies in the days of Indian scalp-takers and white "bad men," and in the face of tremendous difficulties.

Incidentally there are two generous instalments of the serials, "Mostly Sally," by Pelham Grenville Wodehouse, and "The Yellow Streak," by Valentine Williams.

What do you know about "Relativity" and the Einstein Theory?—An illuminating summary of Sir Oliver Lodge's explanation of it is one of the many interesting topics dealt with in MACLEAN'S "Review of Reviews."

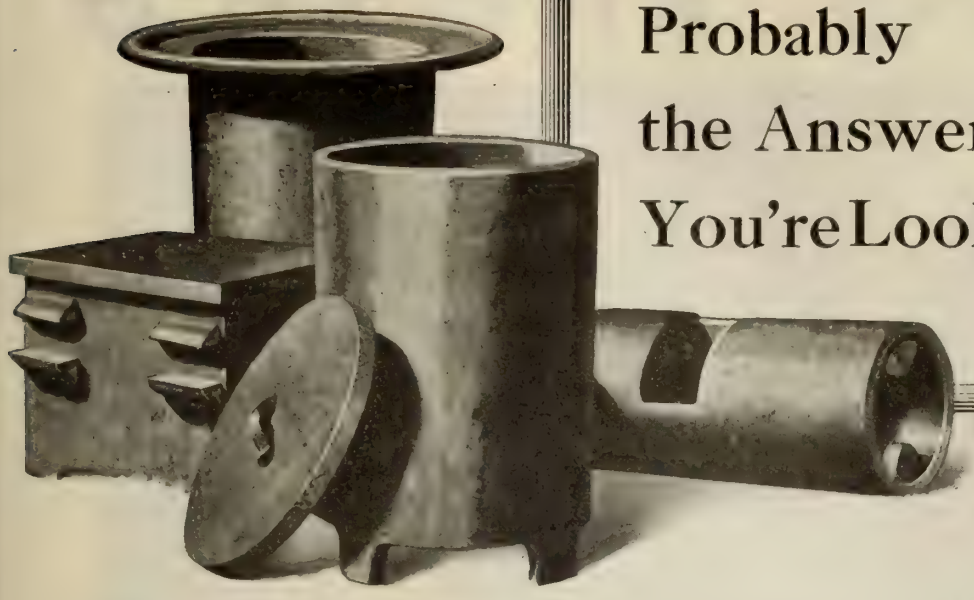
"Food Facts You Should Know," by William Fleming French, and the regular departments devoted to Finance, Current Humor and Women and Their Work, complete a number bristling with good things.

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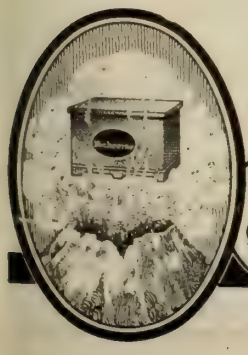
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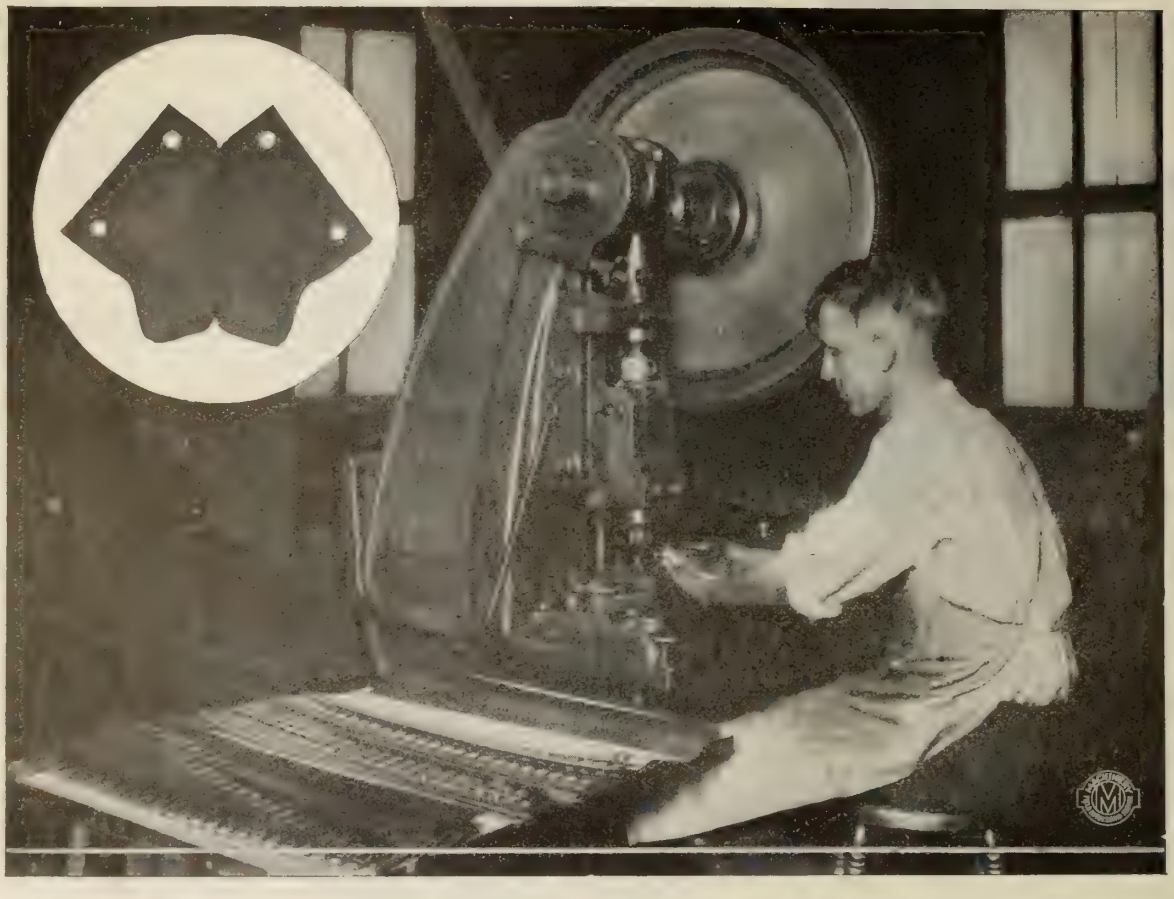


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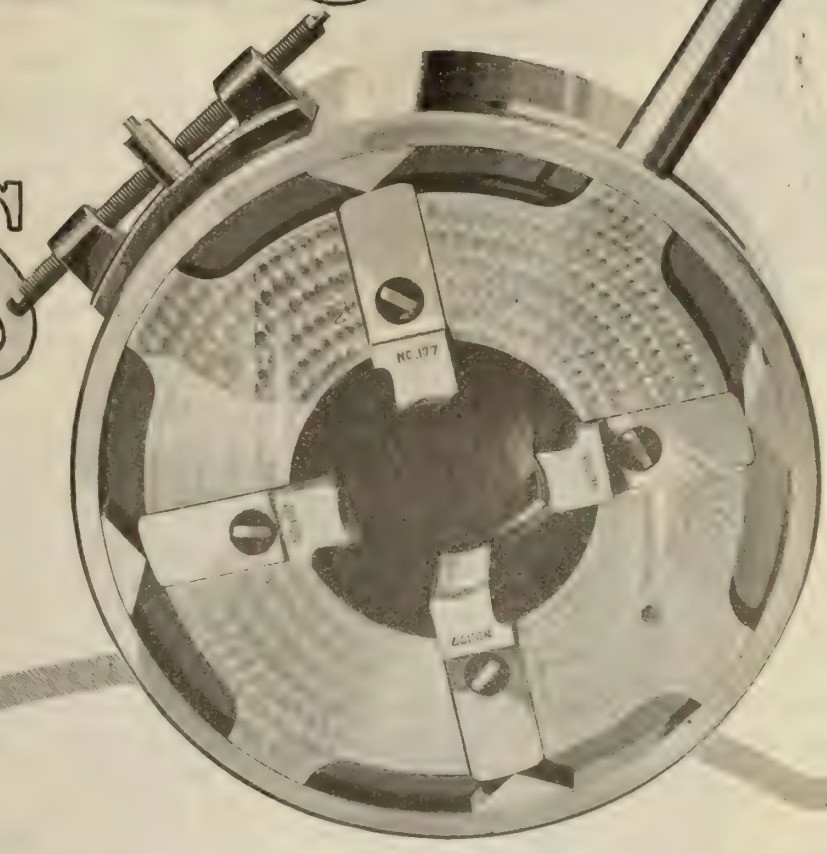
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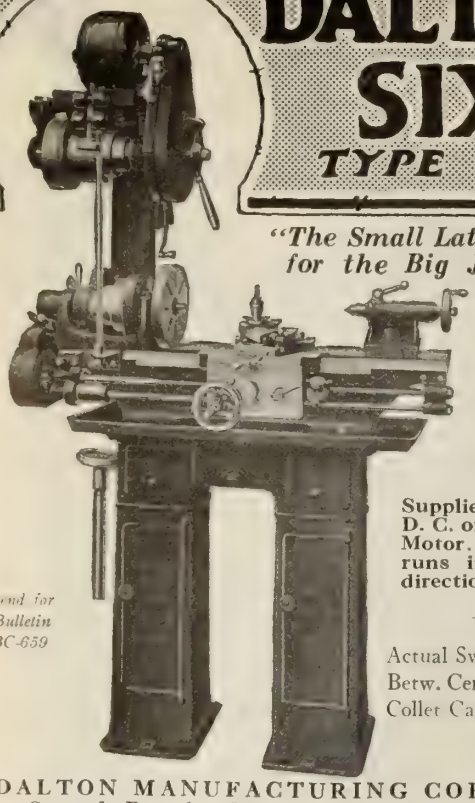
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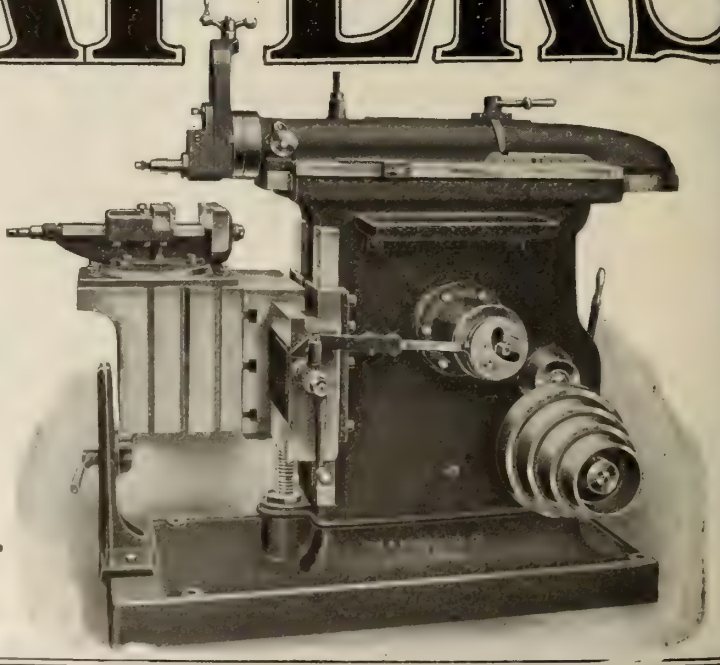
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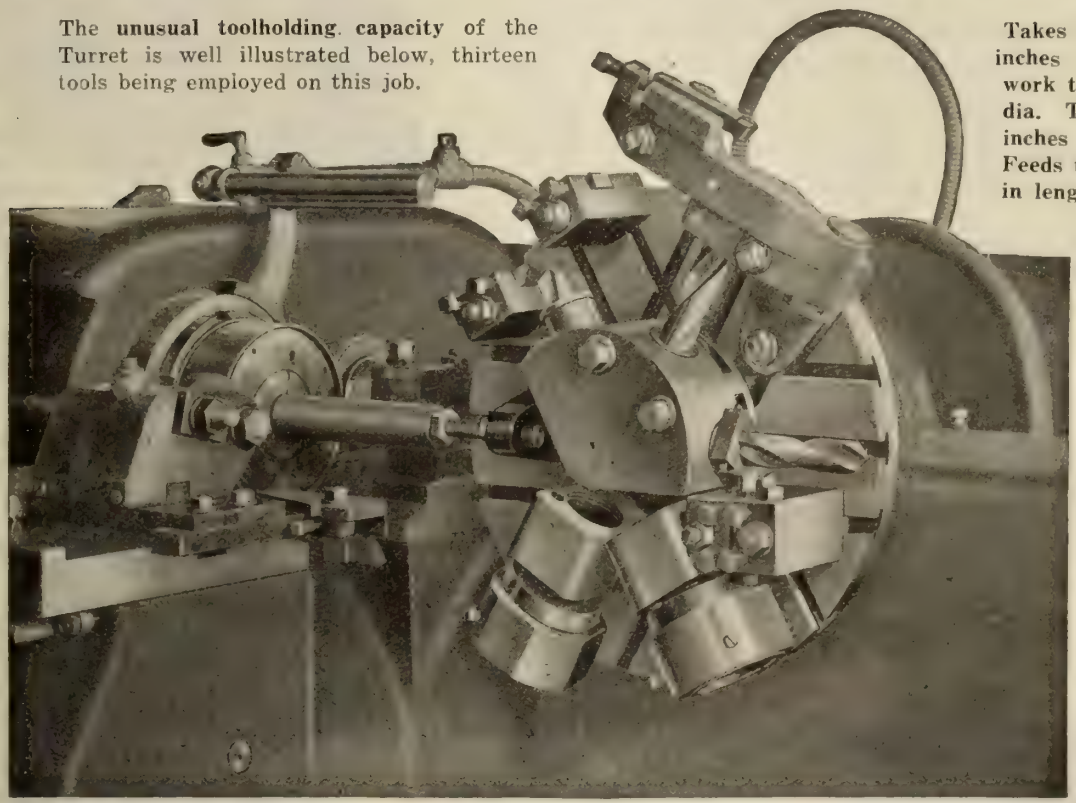
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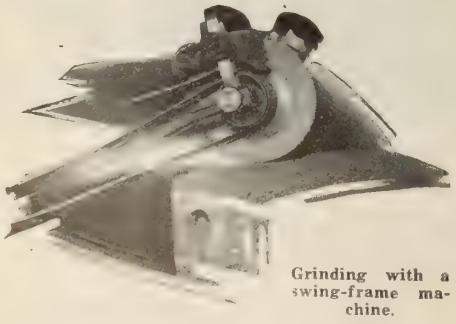


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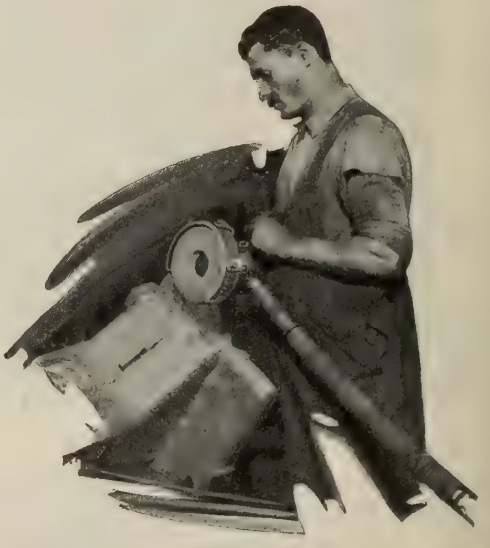
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI. No. 20 NOVEMBER 17, 1921

Some Miller Problems—How They Were Solved

Milling Machines are Very Versatile — Milling Steel Parts to Within Limits of .002 in. at the Rate of 600 Per Hour—Milling Four Tables At One Time—The Value of Gang Milling

*By H. A. WILSON

THE title "Miller Problems and how they were solved," is in itself interesting. The variety of work which can be completed on such machines is surprising, and in the examples to follow we have purposely varied the work being performed. For example Fig. 1:—

Here we see a straddle milling job. The steel pieces being milled are brought down to within limits of .002 in. at the rate of 600 per hour.

A shop job that is elementary in its simplicity often develops some interesting machines, devices, tools, jigs or fixtures when such simple problems call for work on a large production basis. Such is the case with this instance, and the steel pieces shown are .165 in. thick approximately.

An automatic milling machine is used, and two fixtures are placed on the table of machine, each fixture holding 36 pieces. The operations that are fully automatic, are the table feed; the constant fast travel; the spindle stop, start, and reverse, which latter operation is controlled through plungers actuated by trip dogs on the front of the table. In the photograph shown the pieces in the left hand fixture are being milled by a pair of left hand cutters. When this operation is completed the table motion will be automatically reversed at its constant fast travel of 210 in. per minute and the right hand fixture loaded with steel pieces will be brought up to the right hand cutters. At a proper point the table feed will be automatically engaged, the spindle will start on its right handed rotation and the milling operation on the pieces in the right hand fixture will commence.

While the pieces in the right hand fixture are being milled, the operator opens the left hand vise fixture by a half turn of the handle and removes the finished pieces. The fixture is then loaded with new pieces from a stack on the table, aligning the blanks by means of two hinged plates, one on each side of the vise. The near plates of each fixture can be seen in the cut. When the pieces are aligned, a half turn of handle tightens them in the fixture ready for milling. The operator has plenty of time to empty and load the fixtures, remove finished pieces to the boxes and stack blanks to replace those used in loading. The fixtures themselves are merely modified vises strapped to the table in three places.

Previous to adopting this method of milling the blanks, two fixtures, each holding one piece, were used. Three hundred and fifty pieces per hour were produced, but the work was very fatiguing to the operator. The method described above, increased the production to 600 pieces, and the work is much easier. Two Lincoln type machines were only able to produce together with one operator, two hundred pieces per hour. The summary of the operation as now being taken care of on the machine is roughly as follows: Thirty-six pieces in each of the two fixtures; spindle speed 56 r.p.m.; feed 1.37″ per minute; diameter of cutters 6″; limit demanded 0.002″; stock removed 1-32″ on each side.

Milling Tables

The next photograph, Fig. 2, shows four milling machine tables being machined at one time. It will be noted that the two tables placed in the front fixture are receiving the first cut. After this, they are placed in the rear fixture for the second cut. The tables in the rear fixture are located by the previously milled angle, and on account of the stock removed in the first milling oper-

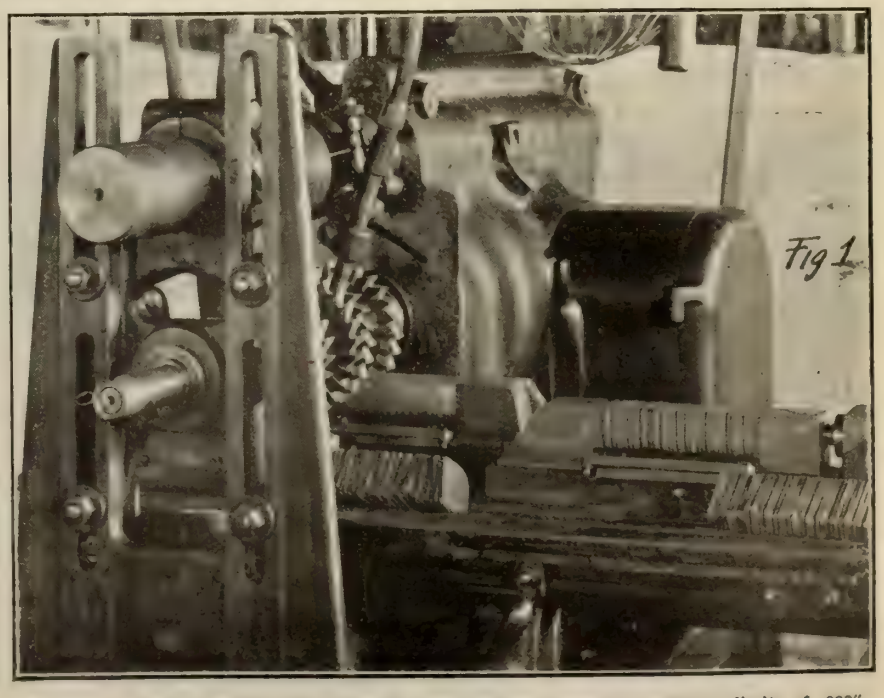


Fig. 1.—A straddle milling job, where the steel sections shown are milled to limits of .002″ at the rate of 600 per hour.

* Note:—The various millers shown in operation are Brown and Sharpe machines. This company is located in Providence, R. I., and we are indebted to them for the use of these illustrations.

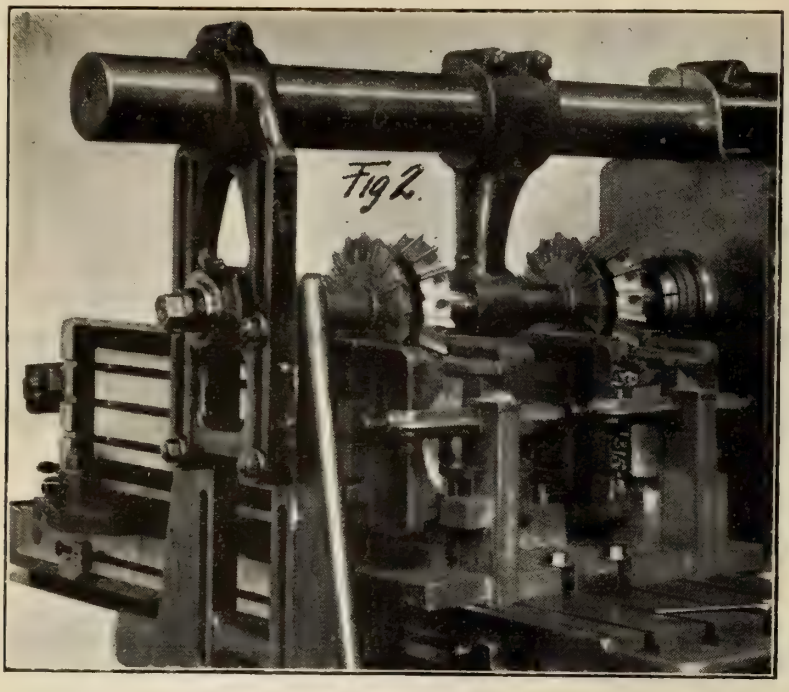


Fig. 2.—Four milling machine tables being completed at one time.

ation, the locating points are higher in this rear fixture than in the first, as the diameter of all four cutters is 9". Four cuts are taken at a time, until the usual lot of fifty is completed. The speed of the cutters is 26 r.p.m. and the feed is 4" per minute. The castings are cast iron, and approximately 1-16" of metal is removed. The length of cut is 54⅜." After the first set up, the changing time is eight minutes. The production time for fifty tables is 30½ hours. During the milling of fifty tables the cutters are not ground. All the angles of the tables are finish planed, after the rough milling operation.

Value of Gang Milling

Fig. 3 gives one a good idea of the value of gang milling, and shows the rough milling of top and bottom of milling machine tables. The set-up is self-explanatory and is of interest mainly from the careful ganging of the cutters, as it includes straddle milling, slab milling, and slotting in one operation. Fig. 4 shows an interesting operation, viz: taking two side milling cuts, the milling of three slots, and the slab-milling of the top surface of a milling machine table. This is a particularly heavy job, but these tables were milled very quickly and efficiently by this arrangement of cutters.

NEW STANDARD MACHINE SCREW LIST

The United States Bureau of Standards and the National Screw Thread Commission have been consulting with manufacturers of machine screws for several years with a view of standardizing the product of this industry and eliminating unnecessary sizes. At the suggestion of the Bureau of Standards, a temporary organization of machine screw manufacturers was formed for the purpose, which was joined by the manufacturers of more than 90 per cent. of the product of this industry, and at a meeting recently held the recommended list of the National Screw Thread Commission was unanimously adopted.

In the new list a considerable number of unnecessary sizes and pitches are done away with. There is a fixed pitch for each diameter in both the coarse and fine thread. The coarse thread pitches are the standard, and screws of these pitches will be carried in stock by manufacturers. The coarse pitches are substantially the same as have been in use for a great many years and no change in shop practice or tools is necessary. Fine thread screws will be made to order only. The most important change from the old list consists in the elimination of numbered sizes above No. 12. All machine screws above No. 12 in the new list will be in fractional sizes and confined to the coarse and fine thread pitches, which meet all manufacturing requirements.

NEW FORMULA

The Du Pont Company has developed and perfected a formula for the manufacture of straight dynamite which results in that explosive being proof against freezing even in zero temperatures. As a consequence of this development, they have determined to discontinue the manufacture of their former straight dynamite and hereafter all this kind of explosive will be made by the new low-freezing method.

ERRATA

In the November 3rd issue we stated that the H. B. Underwood Co., was in New York. This was incorrect, as the above firm is located in Philadelphia.

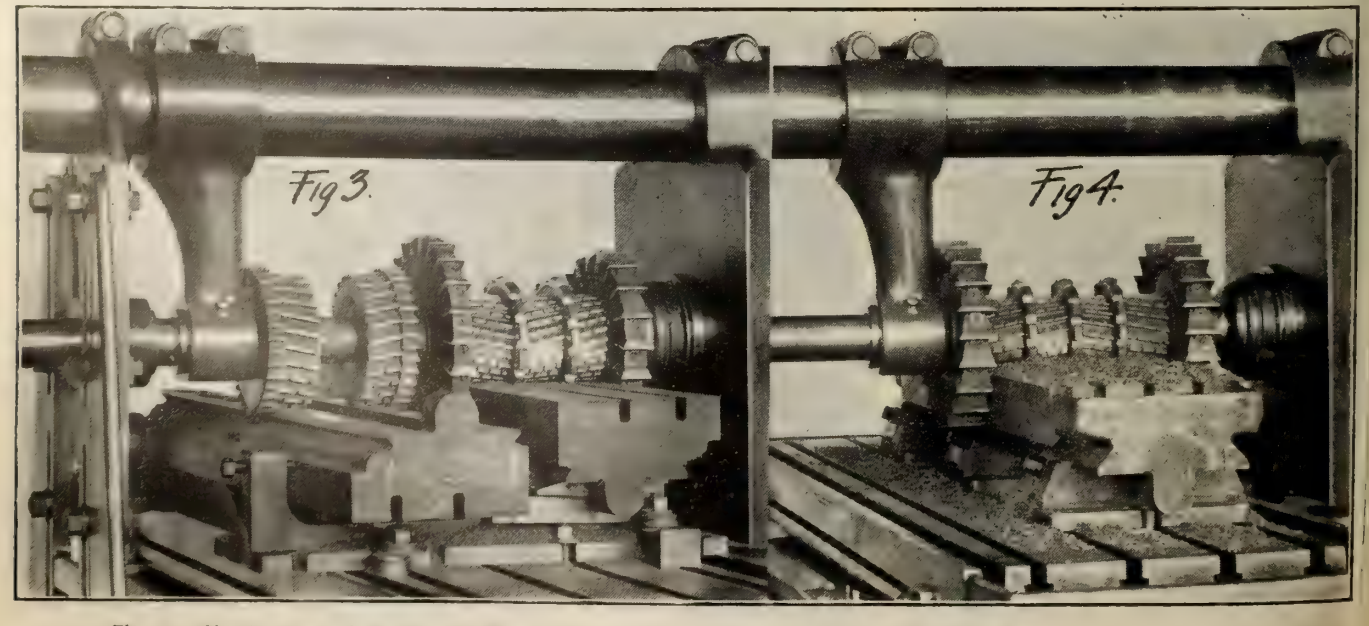


Fig. 3. — Showing the value of gang milling.

Fig. 4. — Milling tables, using a compact arrangement of cutters.

Milling Flats on 2000 Tappet Rods Every Hour

Value of Suitable Fixtures—Rotary Table—Vertical Attachment And Other Attachments Often Help to Boost Production—Special Fixtures Pay Where Large Quantities are Necessary

*By J. H. MOORE

IN THE previous article by Mr. Wilson, the value of gauging of cutters is shown. This having been clearly proven, we will taken up milling problems of a very different nature.

When large production is essential, its the old story of making a mutiple fixture, and producing the work with as little manual effort as possible. Take for example Fig. 1. Here we see a milling machine equipped with vertical milling attachment and rotary table. the work being the milling of flats on tappet rods for automobile engines. The special holding fixture is mounted directly on to the rotary table, and the fixture accommodates 58 pieces at one time, of course the operators are loading and unloading continuously, as the cutters are always working. A production of 2,000 per hour was obtained by this method, and four men were necessary to take out the finished pieces and replace with rough rods. Even with this production the machine does not go as fast as it might but it was impossible to speed up further, due to the fact that the men themselves could not handle the rods any faster.

* Note:—Figs. 1 to 4 show Kearney & Trecker milling machines in action, while the sectional view, and Fig. 5, depict Kempsmith millers in operation. We are indebted to both companies, who are located in Milwaukee, Wis., for the use of these photographs.

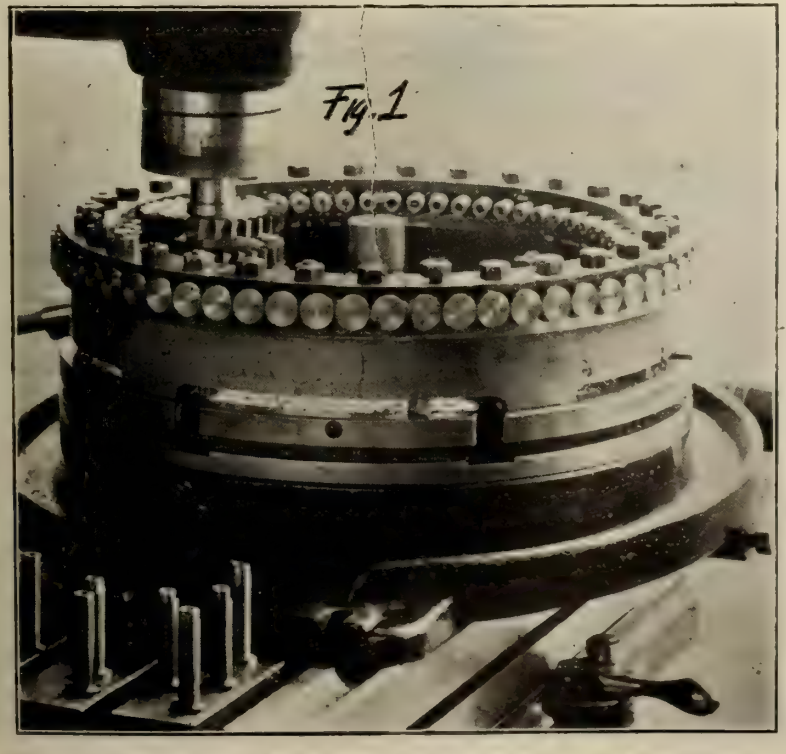


Fig. 1.—Milling flats on Tappet Rods, using rotary table and special holding fixture.

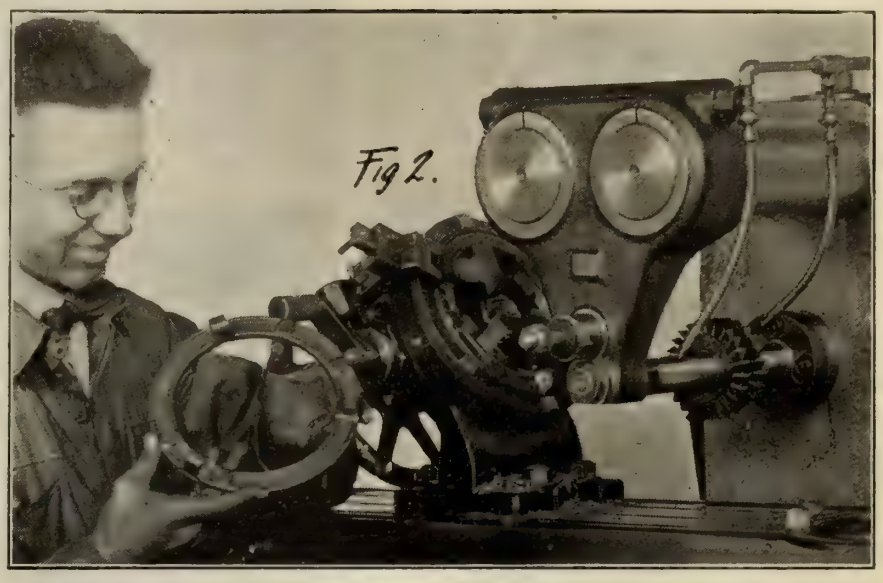


Fig. 2.—Milling a disc clutch for automobile clutch.

Disc Clutch

The next illustration, Fig. 2. shows a special fixture used to hold the ring shown on the table, also in the operators hand. The pieces are made from malleable iron and are part of the Borg and Beck automobile disc clutch. The rings are placed into a hardened tool steel die, and the gauge shown is used to locate the lug in proper location to the indexing mechanism. The ring is held by three clamps, these working automatically by means of the wheel shown at rear of fixture. With one turn of the crank, the plunger shown brings each lug to its position for milling. The actual time consumed in milling the three lugs on each piece is 35 seconds, this including picking up the ring, placing and tightening clamps, milling lugs, releasing piece and placing same on the floor.

The next view, Fig. 3. shows a special holding fixture for milling five steps on the three pads shown in the ring resting on the table. These steps are milled at the one setting, and the holding fixture is clamped to the rotary table, the power for this being furnished through the regular universal joint. which is in turn attached to the feed box of the machine.

The head holding the three auxiliary spindles is arranged to slide up and down, and is operated by means of the cam shown on the side of holding fixture. Each pad comes directly under one of the spindles and then machine is started. As the table and fixture revolve, the cam on the side automatically raises the head holding the spindles, and each step is milled automatically as the table revolves. After the roller in the cam reaches the end, it automatically raises the head, and the rotary table stops. A new piece is then inserted, and the same operation performed.

Drum Fixtures

The photograph at Fig. 4 shows how rotating drum fixtures can be used to

advantage. In this case the two special fixtures shown were mounted on the table, each drum holding two rows of rifle grenades, so arranged that four pieces are in the cutters at all times. The drums are rotated by means of a universal shaft from the feed box to a worm shaft which drives one drum, the other drum being geared up with the first, so that they revolve toward each other. Four inserted tooth, high speed steel cutters are used, and two operators, one at each drum, load and unload. A production average of 800 per hour over a three months period, was obtained, and this work had formerly been done on seventeen lathes, seventeen operators being necessary to obtain the same results. The photograph is so plain that we will leave readers to study the details at their leisure.

Mangle Shoe Job

Ironing machinery for household use requires a long plate or shoe, usually of cast iron, having a curved face which makes an ideal milling job, and one which, due to the good finish required, width of cut, etc., requires a fairly powerful, smooth cutting machine. The cutters and jigs must also be designed carefully, due to the comparatively frail section of the work. The equipment shown at Fig. 5 has given exceptionally good production and finish, on this class of work.

The section of these pieces is very thin and wide, and the length of the shoe varies according to the capacity of the ironing machine in which it is to be used, some being as much as four feet long. The clamping and supporting of such a piece represents some difficulties, but the jigs shown have worked very well in practice. They consist of a right and left end section and several centre sections, the number of which varies according to length of the work.

On one of the end sections there are two solid supports, and on the other only one. This forms a three point support on which to set the rough casting. All of the other various supporting points are of the spring plunger type, which are clamped after the work rests down on the three solid pins, thus adapting themselves to any irregularity in the work, and making a perfect support without the possibility of springing the work, if reasonable care is used.

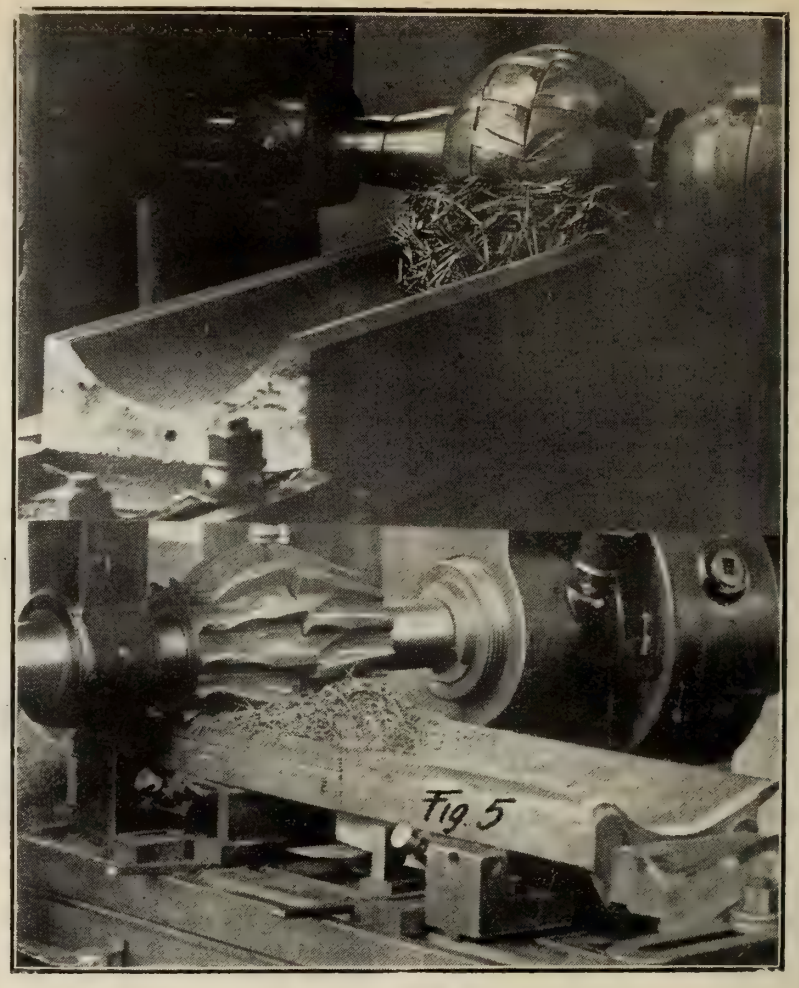


Fig. 5. — Showing the two styles of cutters, old and new.

An interesting point is that the centre of the long pieces must be pulled down about 1/16 inch in order that the piece shall come straight after the scale is removed by the milling cutter. The proper sequence for clamping the work is as follows:—

1.—Set the work on the jig. It then rests on the very solid supports. 2.—

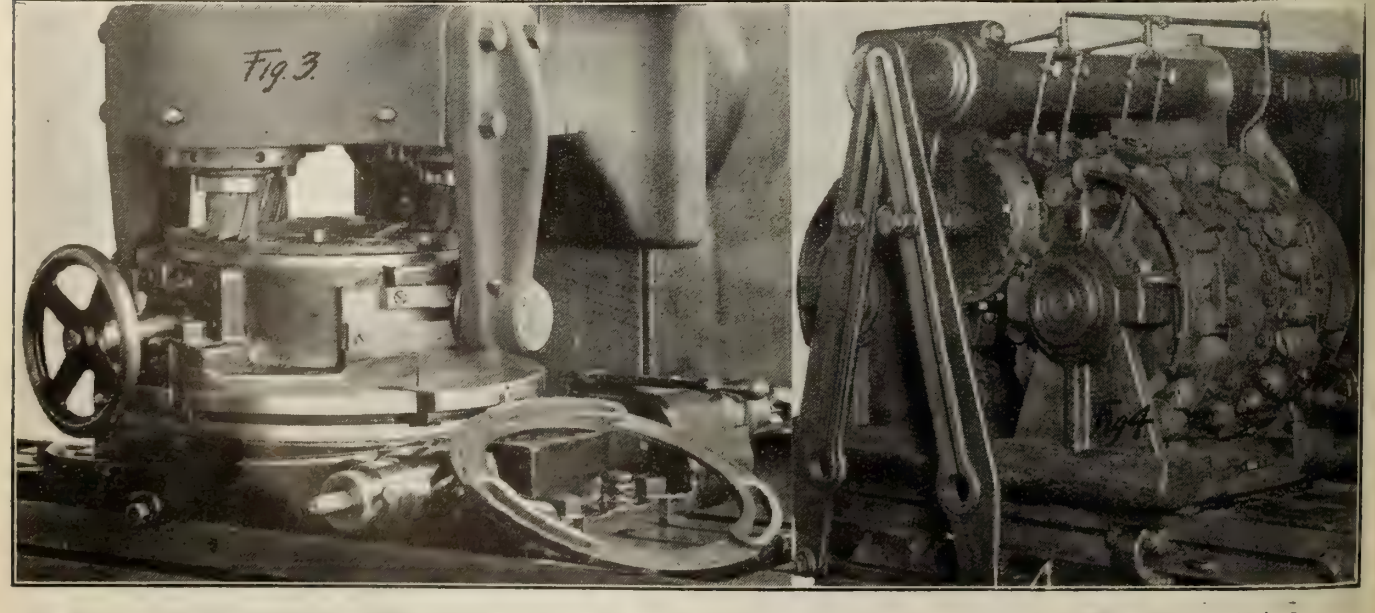


Fig. 3. — Special holding fixture for milling five steps on pads.

Fig. 4—Special rotating drum fixtures for milling rifle grenades.

Tighten the clamp screw on the 4th end support pin, thus giving four point support—two on each end. 3—Pull down the side clamps in the centre until the centre is sprung down about 1/16 inch. 4.—Set up end thrust screws and end clamps. 5—Tighten clamp screws on remaining supporting pins. 6.—Pull having too wide a face for best results.

The latest design is made in sections with the larger sections having blades inserted which show plainly in the drawing and photograph. This breaks up the cut giving a more continuous action and better finish. The cutter is kept as small as possible. A special type of arbor drive is used for heavy cuts of this nature, the arbor being flanged and centred on the nose of the spindle without the use of the ordinary taper end, which tends to crystalize and break off even though the driving is done by means of keys.

The photograph shows the old and new cutter set up for trial cuts, although both views show only temporary work fixtures, and are therefore not as satisfactory as they might be. In the one case it will be noted that the cutter is being tested on a cast iron block instead of the actual work.

The sectional view of the proper fixture used will be ample for description purposes.

Much of the success of this job is attributed to the rigidity and smoother powerful speed and feed drive obtained. In this machine used the cutter spindle and the feed screw are driven by worm and worm wheel located directly on the spindle and screw respectively. This forms an ideal drive for smooth action, as proven by the results obtained in finish, life of cutters and production. The production data is as follows:—Cutters= 6 inch diameter at 65 feet= 41 R. P. M. F=2-3/8 inches per minute= .058 per revolution.

VENTILATION RESEARCH

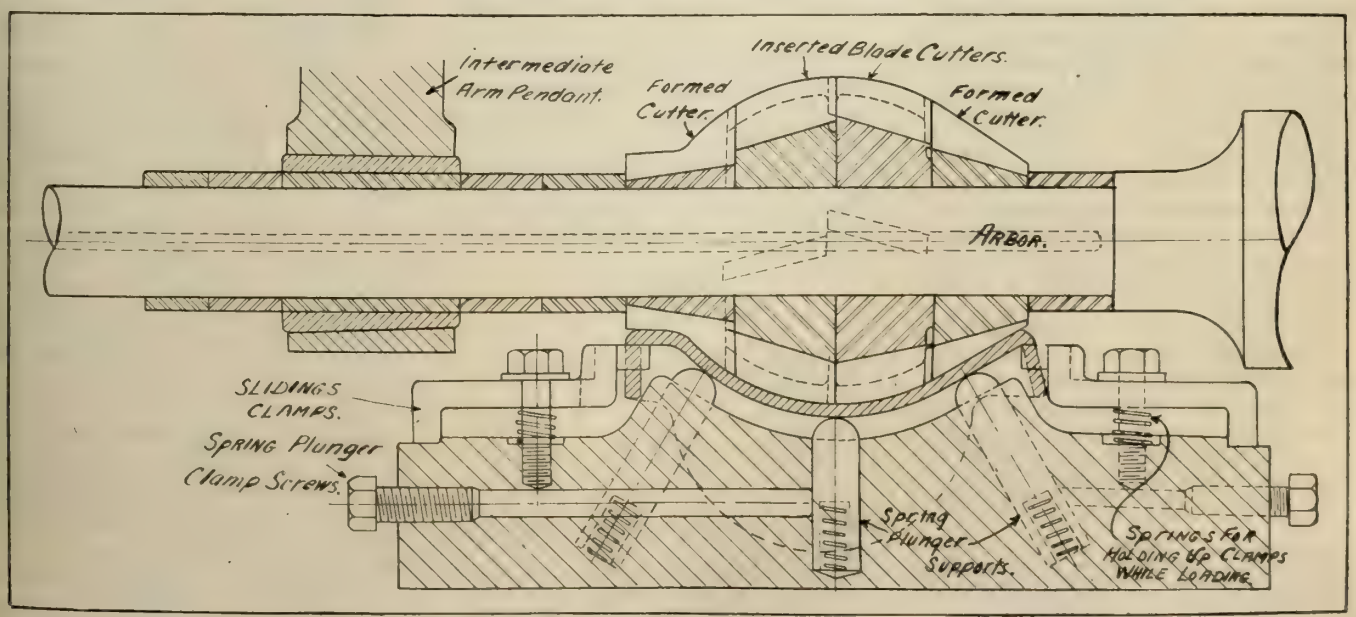
The Pittsburgh Experiment Station of the United States Bureau of Mines is working in co-operation with the Research Bureau of the American Society of Heating and Ventilating Engineers on a number of important problems which affect each individual in his home life, in his place of business, and especially in those places where many people congregate, as in churches, schoolrooms, and theaters. It is important to ventilate such places with sufficient fresh air to make everyone comfortable enough to be able to work at high efficiency. The circulation of excessive quantities of fresh air imposes a considerable cost on the heating system therefore an efficiently designed heating and ventilating system introduces the least amount of cooled air consistent with proper conditions for health. In this connection the use of ozone has frequently been proposed and actually tried in a number of places. The ozone is supposed to deodorize and purify the air by the oxidation of organic matter and possibly by killing bacteria.

It is however, a real question as to whether ozone can be introduced in quantities large enough to kill bacteria without producing very serious irritation of the throat and lung tissues. It is also a question as to whether harmful oxides of nitrogen are not produced simultaneously with ozone. Definite information is needed on this subject. The first step in obtaining such information is to work out methods for accurately determining the percentage of ozone and oxides of nitrogen produced for different types of ozone machines and to develop suitable methods for determining the very small quantities of ozone and oxide of nitrogen that may be in the air treated with such machines. Analytical work of the highest precision is required. The gas laboratory of the Bureau of Mines, Pittsburgh Station, is now engaged on this problem, working in co-operation with the Research Bureau of the American Society of Heating and Ventilating Engineers which is housed in the same building.

After the chemists have worked out the methods of detecting and analysing these small quantities of ozone and oxides of nitrogen, the next problem will be undertaken in a like co-operation of the two agencies just named working with the United States Public Health Service. Surgeons from this service are detailed to the Bureau of Mines for working on health and sanitation problems. The work is being carried on under the joint general direction of A. C. Fieldner supervising chemist and superintendent of the Pittsburgh station of the Bureau of Mines, and Dr. R. R. Sayers, chief surgeon, Bureau of Mines, by G. W. Jones, assistant gas chemist, Bureau of Mines; W. P. Yant, assistant analytical chemist, Bureau of Mines; and O. W. Armspach, engineer, American Society of Heating and Ventilating Engineers.

POWER FROM SEWAGE

It is often said that modern methods of sewage disposal are exceedingly wasteful, because they throw away material which might be utilised to great advantage. Many of the systems developed in Great Britain are free from this reproach, and experiments recently made in the utilisation of gas from sewage show that in an unexpected quarter British engineers are attempting to secure the highest economy. In one large British city a gas plant was installed to give 25 horse power for a working period of six hours per day. It is driven by gas generated from the dry solid matter produced in the process of sewage disposal. The experiment has been most promising, and it has revealed a useful source of power in a district where gas and electricity are not available. The power produced by the sewage gas is used to drive the plant which forms an essential part in the installation for purifying the sewage; thus it affords a most desirable form of economy.



Sectional view of the fixture used for milling mangle shoes.

Elements of Machine Design—Lesson No. 3

Theory of the Column — Stresses in Columns — Long and Short Columns—Radius of Gyration — Analysis of Stress—Rankine's Formula—Various Examples Explained in Detail

*By L. T. RUTLEDGE

THE word "column" suggests to the student unacquainted with the theories of structures but who has some ideas of architecture in general, a very high pillar, usually circular in section, of service in a building to support the roof or to adorn the front of the building. In this conection it is considered to be a member which rests on one of its ends and carries a load, transmitting it to some kind of a foundation beneath. It is admitted that this conception of a column is not far astray and quite satisfactory for ordinary cases but it is not broad enough and not complete enough for our purposes. The more general definition of a column is as follows:

When a prismatic piece or member in a structure has a length greater than about six times its least diameter and is subject to compressive stress, this member is designated as a column or strut. The word column applies when the compressive member is located vertically and carries a static load, whereas the word strut applies when the member subject to axial compression rests in an inclined or horizontal position.

When the length is less than six times the least diameter, we have, just simply, a compression block, the stress in which is determined by the simple formula, unit stress equals the load divided by the cross-sectional area. It is incorrect to call such a member a short column. As will be seen in one of the following paragraphs, the short column is quite a different thing altogether.

Columns are subject to a bending stress in addition to the ordinary compression stress. This additional bending stress is caused by eccentricity of loading and the deflection caused thereby. It is quite impossible to apply the load at the exact centre of the column. Besides the axis of the column will not be perfectly straight nor will the material in the column be absolutely uniform and homogenous throughout, owing perhaps to irregularities in casting in the case of cast iron columns or during rivetting or straightening if made of fabricated steel.

The yielding due to non-uniformity is a very serious matter since it brings about further yielding and bending. No two columns will act exactly alike under stress so it is impossible to anticipate most accurately the condition of stress. However, thousands of tests on loaded columns have been made under variation of every condition that could be imagined to affect the results and as a consequence certain formulae and constants have been established which when used intelligently give results that can be depended upon in design.

Long and Short Columns

For purposes of analysis of stress, columns have been divided into two main classes, namely, long columns and short columns, in both of which initial inequalities introduce serious bending. It is apparent that the amount of bending will increase with the length of the column. Ordinary experience confirms this assertion. Long columns fail by buckling or sudden collapse at a load which in a short compression block would cause a stress far below the elastic limit of the material, whereas short columns begin to fail when the combined stress due to compression and bending reaches approximately the yield point of the material.

The factor which is used to divide columns into the two classes is called "the slenderness ratio" denoted by $\frac{l}{r}$ the quotient of the length, to be exact the unsupported length, and the least radius of gyration, both in the same unit, generally inches. This brings to our attention a new quality which will now have to be explained.

Radius of Gyration

In the derivation of the flexure formula for beams use was made of a quantity "z" which was the distance from the neutral axis to the centre of gravity of the elementary strip or section. The z was raised to the second power in the expression for moment of inertia. It was seen that for absolute accuracy it would be necessary to choose an infinite number of elementary areas with a corresponding infinite number of z's. One might imagine that for the infinite number of elementary quantities of the order of

$$z^2 \delta A$$

which are afterwards aggregated that some average value for the

$$z^2 s$$

might be used which when multiplied by the total area of the section would give the total moment of inertia. This is exactly what is accomplished by the radius of gyration. The radius of gyration of a section is the distance from the neutral axis to a point where, if the total area of the section could be concentrated and multiplied by the square of this distance, the result would be the moment of inertia of the section. Thus using the ordinary symbols,

$$I = Ar^2 \quad \text{or}$$

$$r = \sqrt{\frac{I}{A}} \quad \ldots\ldots\ldots (20)$$

Example 1.—The moment of inertia for a 2" x 12" section about the neutral axis parallel to the short side is 288. Find the radius of gyration of the section.

Given that $I = Ar^2$ and $A = 24$ sq. ins. then $r^2 = 288 \div 24 = 12$, then $r = 12 = 3.46$".

Example 2.—The web of a 12" steel I-beam @ 31.5 lbs. about an axis through its centre of gravity and parallel to the flange is 215.8 as given in the Cambria handbook. The area of the section is given as 9.26 sq. ins. Determine its radius of gyration about the same axis.

$r = I \div A = 215.8 \div 9.26 = 4.83$ ins. which is the value given in the handbook.

Mark's handbook is inclined to consider all columns which have a slenderness ratio 100 or less short columns and those which have a slenderness ratio greater than 100 long columns. In Merriman's Mechanics of Materials the following division is made: Where $l \div r$ is between 25 and 200 the column is considered as a short column and where the ratio is greater than 200 the column is in the class known as long columns in which failing is generally due to bending alone. Merriman states that almost all columns met with in engineering practice have slenderness ratios varying from 50 to 150 so that they must be treated as short columns and the mathematics of short columns applied. The writer is inclined to consider the value 200 as too high but also 100 as too low. He would consider 140 as the limiting value for short columns. In machine design columns with $l \div r$ greater than 100 are practically never met with so that the short column is the one that shall be given preference and studied in detail.

Besides the conditions causing failure as mentioned above, the strength of columns depends on the conditions of the ends. Columns are divided into classes according to the manner in which the ends are fastened as follows:

(a) Free ended columns as for example the column of a high drill press or a flagpole both of which have one end

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

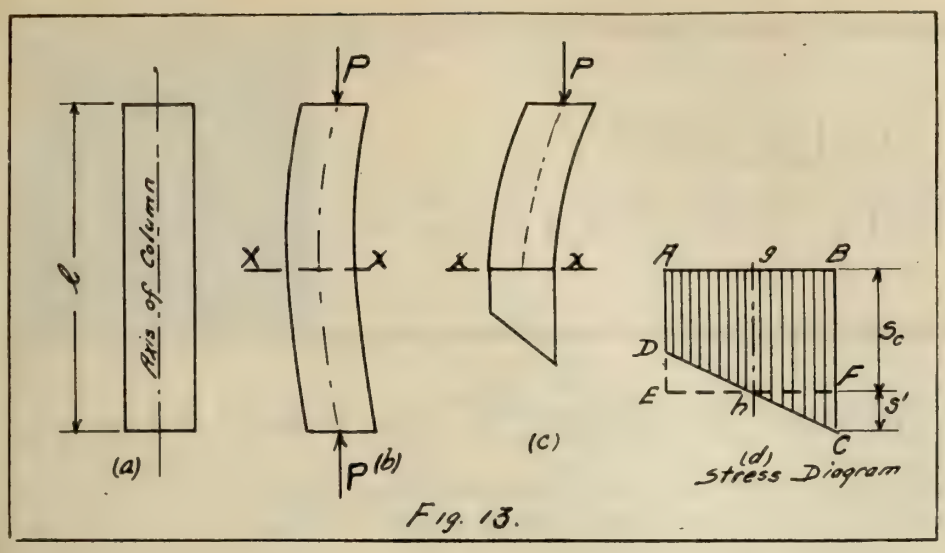


Fig. 13.

free; (b) Round-ended, as is the case where the end has a spherical end; (c) Fixed-ended, when rigidly connected like a compression member in a steel bridge or a steel column in a building; (d) Square-ended, as is the case in mill building construction, where a square ended or flat column rests on a support; (e) Combinations of any two of the preceding. Everyone recognizes the fact that a column with fixed ends is stronger than one with round ends or one with a free end. The square or flat ended column is about as strong as the fixed ended column.

Analysis of Stress in Columns

The theory for the stress developed in columns will herein be developed without considering the weight of the column. If the compression member is in a vertical position, its weight makes practically no difference to the stress but if the member is in a horizontal position then its weight causes bending or flexure stress as is the case in a beam. This latter condition demands more attention than the former.

Long columns are usually designed by Euler's formula or some modification of it and short columns by Rankine's formula or some modification of it. But as stated above, our attention will be concentrated on short columns, therefore we shall devote our attention to the derivation of Rankine's formula and the application of it.

RANKINE'S FORMULA:— Assume a short column of unsupported length l, of cross-sectional area A least moment of inertia I, the least radius of gyration r, and also assume the distance from the vertical axis of the column to the remotest fibre on the concave side to be (c). Let P be a load applied on the top of the column as close to the centre of the end of the column as is possible to apply it.

Fig. 13 (a) shows the column as it appears when unloaded; Fig. (b) shows to an exaggerated scale the column deflected by the load.

The total stress at any section of the column equals the sum of the stress due to straight compression and the stress due to bending. The stress due to simple compression equals $SC = P \div A$,

A typical section is taken at x——x. The amount of the compression stress is given in Fig. 13 (d) by the line gh or BF.

The maximum stress due to bending which we shall denote by the symbol S^1 is obtained by the use of the flexure formula $S \div C = M = I$ so that,

$$S' = \frac{Mc}{I}$$

Where C = the distance from the axis to the extreme fibre on the concave side where the stress is S^1

I = the moment of inertia of the section.

M = the resisting moment of the stress which is equal to the external load multiplied by the deflection of the axis at the section under consideration which in this case is at the middle of the column. Let the deflection be y which is a maximum value for the deflection in this column. Then the resisting moment is Py.

The stress S^1 is shown as a compression stress at 13 (d) by the line FC and as a tension on the convex side by DE which stress neutralizes an equal amount of compression and AD is the resulting stress on the fibre which is seen to be much less than the stress on the concave side.

$$S = \frac{P}{A} + S'$$
$$= \frac{P}{A} + \frac{Mc}{I}$$
$$= \frac{P}{A} + \frac{Pyc}{I}$$

Also $I = ar^2$ and for a beam

$$y = K\frac{l^2}{c}$$

The proof of which is given later in this discussion. Accepting the above for the meantime then

$$S = \frac{P}{A} + \frac{Pcy}{Ar^2}$$
$$= \frac{P}{A} + \frac{Pc}{Ar^2}\,\frac{Kl^2}{c}$$
$$= \frac{P}{A} + \frac{KPl^2}{Ar^2}$$
$$= \frac{P}{A}\left(1 + K\cdot\frac{l^2}{r^2}\right) \quad \cdots (21)$$

which the expression of Rankine's formula for short columns ..... (21).

The total maximum stress equals then

the $\frac{\text{total external load}}{\text{cross-sectional area}}$ multiplied

by the quantity

$$\left(1 + K\cdot\frac{l^2}{r^2}\right)$$

The factor K depends for its value on the material and the condition of the column ends. Its value is determined experimentally.

Because of the fact that assumptions are made in the above derivation and because the values of k are derived by experiment, the formula is somewhat empirical in nature, yet it is of great value and with careful determinations of values for k, the formula gives accurate results. The accompanying table gives values for "k" for various materials with different end connections.

Proof that $y = \frac{Kl^2}{c}$

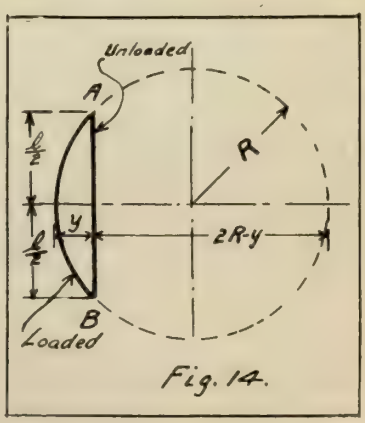


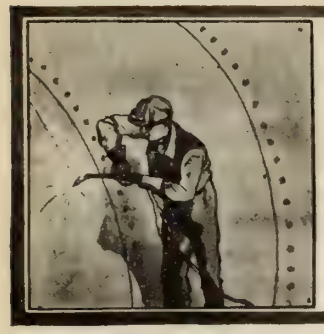
Fig. 14.

Assume the curvature of the column to be circular which is approximately correct, y being the deflection in inches at the middle point.

Let R = the radius of curvature of the bent axis of the column in inches.

l = the length of the column in inches.

(Continued on Page 44)



WELDING AND CUTTING



Various Hints on How Welding Can Save Money

Have You Made a Survey Lately of Your Manufacturing Plant—This Story Tells of An Inspection of this Nature—Places Where Money Can be Saved

*By G. E. HARCKE

IT IS quite the fashion nowadays to make surveys of all sorts of things to promote philanthropy, religion, manufacturing efficiency and other activities in which men and women are interested, and the following story tells of an unofficial survey by the author of the toolroom and machine department of a large Eastern U. S. manufacturing plant to show how the oxy-acetylene torch could be used to advantage. As stated, the survey was made unofficially and without previous intention, resulting from the stiff-necked attitude of the superintendent who derided oxy-acetylene welding as an obsolete process. It developed that the superintendent had only a smattering knowledge of welding, or the many applications that could profitably be made in his own province. He finally admitted that the possibilities were to him a great surprise. As a result, a tour of the departments was made with the following results, in part:—

Extending a Bolster Plate

A big pillar press was set up for a drawing job, and the die was supported on a bolster plate too short for the purpose. As the result, the holding down bolts clamped the ends of the bolster insecurely, resort having been made to washers and other togg'ed-up parts to furnish sufficient clamping effect to hold the die in place. Trouble had been experienced due to the insecure clamps giving way and the question was asked why a new bolster plate had not been provided.

Objection was raised that the job was a short run only and that they could not wait to have a pattern made and obtain the casting from the foundry; the job could not stand the expense of a new bolster in the first place and time could not be spared to make it even if the expense were warranted. Thereupon it was pointed out that the ears of the bolster plate could be very readily extended at small expense, and with very little loss of time. The superintendent was shown that it was not necessary to resort to the practice of making a new casting every time a change was required in a bolster plate, but that a mechanic properly trained could, in a few minutes, build on lugs, ears and bosses which would be as strong and dependable in service as though cast with the body in the foundry.

Building Up a Die Block

The next thing found to illustrate the value of the torch was a die block. Die blocks in stock, planed to standard thickness were too thin for a certain job, and it appeared that it would be necessary to make one up special, three-quarters inch thicker than the standard. This meant delay and high cost because of having to make one only. But the job was easy for the torch operator. It meant simply preheating a standard block and laying on the required amount of adding material to make the thickness required. Thus a block ready for laying out could be finished while an order was going through for a special one.

Repairing Morse Taper Shank Drills

In the toolroom a number of Morse taper shank twist drills lay on the workbench having the tangs twisted off. Preparations were being made to anneal the shanks so that new tapers could be turned and tangs milled. Here, indeed was a fine proposition for reclamation. A welder could readily build up a new tang using drill rods for adding material. "The time required for an ordinary shank should not be more than ten minutes," said the author of this article, including that required for slight preheating. When the building up process is finished the rough tang can be ground on a wheel to standard thickness and width.

Cutting Screw Machine Cam Blanks

Another job that claimed attention for a few minutes was a set of cam blocks for a Brown & Sharpe screw machine. These cams are made from steel plate, and are cut to the required contour on a special cam cutting machine that is geared up for the job. The ordinary procedure of cutting out a cam blank requires laying out and drilling a row of holes in the plate, the layout following the shape of the cam desired. If drilled out, the cam must be roughly worked out to a near size before it can be placed on the cam cutting machine for machining. The superintendent was shown how such jobs are easily done with the hand cutting torch, it being possible to cut out the cam so smooth and true to shape that comparatively little excess metal is required for finishing on the machine. He was also told that when sufficient of this class of work warranted the oxygraph had been found to be a very profitable investment for this and similar parts.

Removing Broken Taps

A little further on they stumbled over two dies that were to be taken to the heat treating room for annealing. The reason the dies had to be annealed was that taps had been broken off in each, and heating in a gas furnace was the only way available of softening them so that the broken taps could be drilled and removed. It was pointed out that the torch could be used to advantage to soften the taps themselves without annealing the entire die, and that it was quite feasible to work them out when softened in this manner.

The Torch a "Putting on" Tool

A number of spoiled shafts then received attention. The workman had made a mistake in reading the blueprint, and had turned a section on each to less than the required diameter. Building up with the torch to restore the lost metal would cost perhaps $10 including the overhead, and thus shafts worth probably $300 could be reclaimed.

Nearby was a worn crankshaft from a large press. The bearings were being turned down, and new bronze bearings were being bored to fit. It was pointed out that the worn bearings could also

* Author is director Davis Bournonville Institute.

be restored to the original size by adding metal, and fitted to the old bronze bearings. The saving would have been considerable both in labor cost and machine time.

Chipping old babbitt out of worn boxes is a disagreeable and tedious task but a necessary one if they cannot be safely heated to the temperature that will melt the babbitt out. The torch affords the millwright the means for readily melting out the babbitt and making boxes ready for re-babbitting. An example found on the way brought out this application.

Bending Levers With Aid of Torch

Certain kinds of wire-working machinery are fitted with a variety of cams and levers. The levers are necessarily bent to clear other parts, and when these machines are made in small lots it is customary to form the levers of iron or steel and bend them to the desired shape when assembling. It is difficult to localize heat with a gasoline torch so that the bend will be insured exactly where it is desired but the small flame of the oxy-acetylene torch can be concentrated within a small fraction of the inch of the desired location and hence bends can be made with great efficiency.

The author said that a man who new how, could make metal do astonishing corkscrew stunts when persuaded with the tiny white hot flame.

Repairing Broken Gear Teeth

In this plant many of the special machines contain large numbers of gears, and breakage of gear teeth is by no means uncommon. A broken tooth usually means that the gear is scrapped and a new one made to take its place. In some cases this may be cheaper than reclamation but in other cases substantial savings could be made by welding in metal and recutting on a gear cutter, thus restoring the gear to good condition.

Safety Work With The Torch

Safety work has made it necessary to provide a great variety of gear guards, and flywheel screens in manufacturing plants. The usual old-time practice in working out a gear guard using sheet metal is to cut the parts to the required shape, bend them, fasten on lugs and angles with rivets, or bolts. The work involves a great deal of labor; in many cases vibration soon loosens the fastenings, and repairs are frequently necessary. Such guards can be made with the aid of the welding and cutting torch at comparatively low cost, the cutting torch being used to form the parts, and the welding torch to unite them. The resulting product is strong and indestructible; it will last as long as the machine. Vibration cannot loosen the joints.

Repairing Pipes, Stokers and Hydrants

A leaking pipe called attention to the need of a pipe fitter. Inspection showed it would be necessary to take down replace the defective fitting, or it would be necessary to cut the pipe and insert a union. Either method involved about fifty feet of this pipe and also considerable expense and some new material. The author said that the leak could be repaired with a torch without disturbing the pipe, it being necessary only to shut off the pressure and drain it for the time required for welding each end of the fitting, a period of about twenty minutes.

Copper tinning kettles are costly equipment and with the best of care they spring leaks and require repairs. The torch settles such matters without trouble. No trip through a manufacturing plant is considered complete until the visitor has been taken through the power plant and shown the engines and boilers. It so happened that the fireman was stoking the boiler by hand although it was fitted with an automatic stoker. Inquiry revealed the fact that the stoker was temporarily out of commission owing to the breaking of a carrier bracket. This being a special form is was necessary to obtain a new one from the manufacturer and considerable delay was anticipated. The carrier bracket could easily have been welded by a fairly expert welder in two or three hours including the preparation time.

Walking from the boiler room into the yard brought the "surveyors" to a broken hydrant. Because of this hydrant being out of condition it was necessary to shut off the water from part of the plant, thus the insurance on that section was invalidated for the time being. The fracture in the hydrant could have been welded with the torch in half a day and the total time required for removing, preparing, welding and replacing should not have taken more than a day's time. As this would have been done during the daylight hours the risk involved from lack of fire protection would have been practically negligible.

These examples mentioned are only part of all that come up in the course of a tour but they will serve to illustrate the manifold uses that can be found for the oxy-acetylene torch in the average manufacturing plant. The superintendent was convinced but surprised to know how such a useful tool could be practically applied to take care of the jobs that could be reclaimed with it. The question being put to the author he answered as follows:

"The way to meet the situation is to train one of your best mechanics to use the torch. He should have a station in some accessible part of the plant where he can be readily reached by all the departments. The heads of departments should be instructed in the possibilities of welding and directed to send all parts to this station that can be profitably reclaimed. I would suggest that you take Harry Blank for the job as I happen to know that he could fill the bill very acceptably."

The superintendent was horrified at the suggestion of taking one of his best all-round men, and countered with the suggestion that one of the sweepers be trained for the job. Later on however he became convinced that the all-round mechanic was the best proposition in the end.

INDUSTRIAL RESPIRATORS

Before the war, respirators specially designed for use in industry were, practically speaking, non-existent. Experience with respirators as protection against poison gas during the war, however, has been turned to good account from the industrial point of view and Dr. Leonard Levy, at a recent meeting of the London Section of the Society of Chemical Industry, gave an account of latest developments that have been made in the face-piece of respirators over the type used in the Army, but the canisters employed are unused small box respirator canisters of the type used in the Army, which it has been found difficult to improve upon, and, moreover, they happen to be readily obtainable in large quantities. The fillings of the canisters, however, are quite different from the Army fillings. For industrial purposes, there are now ammonia respirators, which find extensive application in cold storage plant, and for which the most satisfactory absorbent has been found to be crystalline copper sulphate.

The next type gives protection against neutral vapors, such as hydrocarbon fumes in oil fields, cleaning out oil tanks, etc., and here the best results have been obtained with a filling of highly activated vegetable charcoal. A third type is designed to deal with acid gases, such as hydrochloric acid, chlorine, sulphuretted hydrogen, phosgene, sulphur dioxide, nitrous fumes, hydrocyanic acid, etc., and in this case it has been found that a uniform mixture of alkaline granules and charcoal has the longest life. The alkaline granules made use of by the author are slaked lime, diatomaceous earth, ferric hydroxide, and activated charcoal. Finally, there is the carbon monoxide respirator, which has presented many novel problems, because there is no known absorbent suitable for use in a respirator canister for the removal by chemical absorption of carbon monoxide. A thoroughly effective method ed with this gas. An effective method, however, is by the catalytic oxidation of the carbon monoxide by the oxygen of the atmosphere, using certain special mixtures of oxide, such as finely divided manganese dioxide, copper oxide, cobalt oxide and silver oxide. Moreover, as carbon monoxide gives no indication of its presence, it is necessary for a detector to be embodied in the respirator, so that the wearer can be warned if the respirator has accidentally failed.—Compressed Air Magazine.

Slotting the Inside of a Large Stator Ring

By H. A. WILSON

A SHORT time ago we published a description of the boring and facing operations on a stator ring at the Dominion Engineering Works, Lachine, Que. In each of the quarter sections of the ring fifteen slots are cut, or sixty in all, these slots being roughly ¾ inch wide and ½ inch deep. This operation was done with the stator ring still mounted on the table of the boring mill. The finished bore of the ring was carefully laid off and the location of the slots marked with scratch awl and centre punch. The original intention of the engineering department was to place an end on the ram of the boring mill and drive this mill by means of an electric motor and a reduction gear. However, a faster method was devised by employing the ram as a slotting machine head.

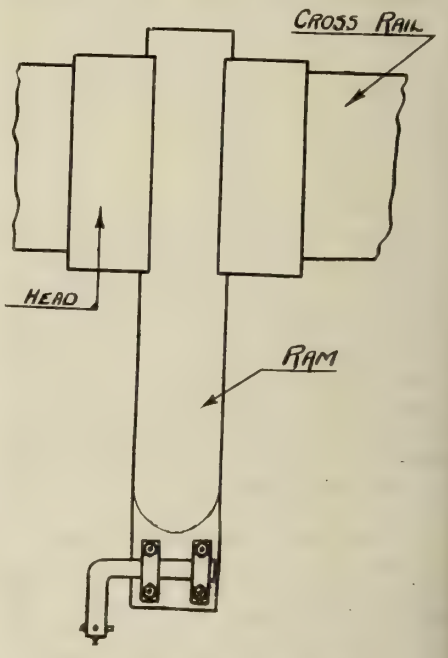
A reversing motor used to raise and lower the cross rail, was connected so as to operate the ram. A large pulley was placed on the motor, so that, running at ordinary speed, the motor caused the ram to travel up and down at the rate of about twelve feet a minute. The ram is equipped with the "European," or four-studs-and-two-strap type of tool holder. This holder was used to clamp on a piece of steel 2½ inches square, which was used as a small tool holder, as shown in Fig. 1. This allowed the tool to be fed into the work squarely and not off centre. The tool was made from high speed steel, ground very similar to that of a planer tool.

One man and a helper are necessary to operate the mechanism. The slots cut are approximately 45 inches long. Two chalk marks are placed on the ram, and when these marks register against another mark on the vertical guides of the ram, it is an indication that the end of the stroke has been reached. The helper is stationed at the platform on the cross rail, and the portable reversing switch of the motor is led to him. When the marks on the moving ram register on the marks on the stationary guides, the helper reverses the motor. From his position he can operate the hand feed which gives the transverse motion to the head and ram, on the cross rail. The tool is fed into the work by this hand method and cuts on the down stroke.

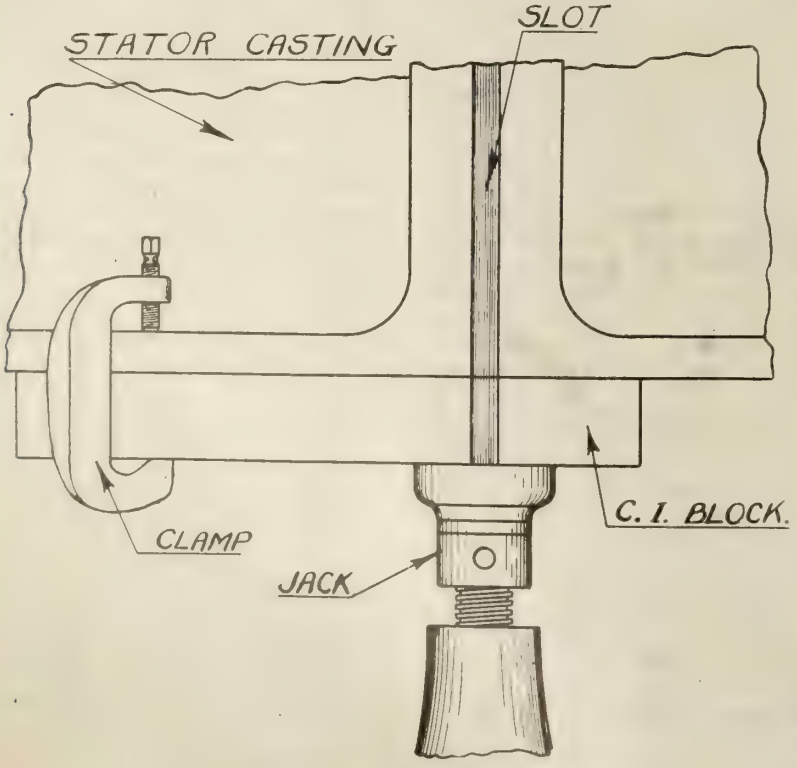
The width of tool determines the width of slot, but the depth is checked by operator with a depth gauge. He directs the helper at the beginning of each cut, and he in turn feeds in the tool at the top of each stroke. When the slot is near the required depth the operator gauges it carefuly after each cut, and signals the operator the depth of the last cut or two to bring the slot to the proper depth. All gauging by the operator is done at the top of slot, and as soon as the depth is obtained at this point an extra stroke or two is taken to overcome any tendency of tool to spring out and cause the depth at bottom of slot to be shallower. The overhang of the tool holder and ram is very great at the bottom of the stroke and, although they are very rugged, the slight tendency to spring shows up when delicate measuring instruments are used. At the bottom of cut a cast iron block is placed and the tool, in machining the slot, cuts through the stator ring into the iron block, thus preventing the ring from being chipped on its lower edge.

The regular main motor that operates the mill is used for indexing. The table is moved by power from one slot to another. A disc with holes in it to accommodate a bar is placed on the end of the motor shaft and the bar is used to move the table around to its exact position for the next slot to be machined. The writer saw a tool working that had machined thirty-four slots, yet had not been re-ground once. The reason the slots were laid off and marked in preference to using a gauge or some other form of mechanical indexing, was that an error in a gauge would be cumulative, and an indexing apparatus which would be accurate on this large circle, 27 ft. diam., would be very expensive. Each slot is gauged with a standard gauge or key, and this determines its size. Its position is checked by a gauge having three small projections on it. The latter gauging only serves to confirm the accuracy with which the slots were laid off and marked.

The sixty slots were machined in a little over four days. The method of machining left a great deal of responsibility on the shop foreman, and very little on mechanical devices. However, the mechanics at this plant are accustomed to large work carrying with it a great deal of responsibility, and where an error would run into a large sum of money. The ingenuity displayed when a job turns up for which there are no special tools, or jigs, on hand, is worthy of a great deal of admiration.



Showing How Tool Was Arranged



Showing how the casting was supported.

Interesting Method of Manufacturing Worms

Hobbing Method of Producing Worms—Special Helicoidal Cutter Used—Action of Hob—Examples of Work Performed—Field of Usefulness for Such a Process

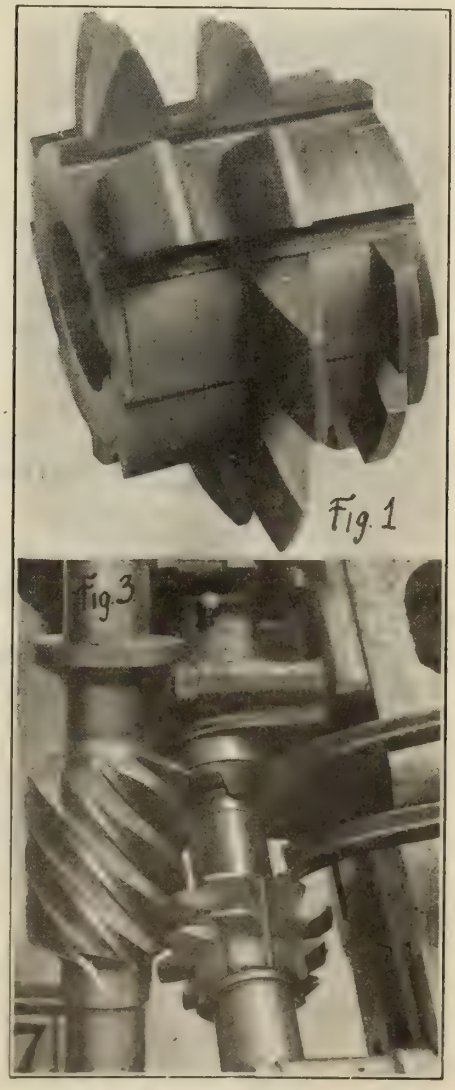
THE screw or worm and its mating gear constitute an extremely ancient combination. The compactness and simplicity of design, and large speed reduction attainable by using worm gearing, make it peculiarly applicable to many types of mechanism. When rigidly mounted and properly lubricated, this gearing is practically noiseless, and one of the efficient means developed of transmitting power between shafts lying in different planes. Worm gearing has not been used in the past, to as great an extent as its merits would seem to indicate. This has been due principally, to two reasons; first, the difficulty of producing correct multiple threaded worms, and worms with an excessive helix angle, second, the inability to successfully produce correct worm gearing of small velocity ratio, approaching one to one.

Most worms are made with helicoidal teeth, and this article will deal with worms having teeth of that contour. The axial plane of a helicoidal worm is a plain involute rack section, the teeth of the mating gear, at the central plane, will have involute curves thereon, unrolled from the basic rack. A single threaded worm with a moderate helix angle, can be successfully threaded in the lathe. The lathe tool used, can be set parallel to the axis of the worm, or can be set normal to the tooth helix. In the first case, it would be necessary to reverse the worm after finishing one side of the thread, and then cut the opposite side, due to the impractical cuttng angles otherwise obtained on a double sided cutting tool. When a straight sided tool is set normal to the tool helix of the worm, a modified form is produced in an axial plane, and the hob used to cut the mating wheel must be changed to correspond.

The Evolution

With the evolution of the machine tool industry and the development of machines which in production far outstripped their predecessors, the process of milling worms with a disc cutter was originated. This method answers very well for single threaded worms, and is much faster than cutting the threads in a lathe. To obtain a worm with true helicoidal teeth, with straight sides on the linear or axial section, it is necessary to correct the shape of the disc cutter, owing to the interference of the cutter and the helicoidal surface on the worm tooth. This is done by forming a lead or cast iron disc to the proper contour, and using it as a template in making the cutter. If the above process is not employed, the advantage of having a basic rack section, and conjugate teeth on the mating wheel, unrolled therefrom, is lost. Such a formed cutter, of course, can only be used to thread worms for which its tooth contours were intended. Worms of different diameters, threads or linear pitches require special cutters.

The Gould & Eberhardt Co., Newark, N. J., after extensive research and numerous experiments. have developed a novel method of hobbing worms. This method is said to be as far in advance of worm milling with a disc cutter, as the latter was superior to the old process of cutting the threads of worms in the lathe. Speaking on this new method the company says that the production of multiple threaded worms by lathe or thread milling process needs intermittent indexing motions, either hand or automatic, with the inevitable resulting inaccuracies. The hobbing method, with progressive and continuous indexing, entirely eliminates this objectionable feature. In the hobbing of worms, either single or multiple threaded, a hobbing machine is used, with the gearing ratios throughout so chosen that a velocity ratio of one to one is readily obtainable between the cutter and work spindles and the machine operated just as when cutting helicoidal gears. One of the novel features of this new method is the helicoidal cutter employed which also permits worms to be hobbed which have a shoulder on either or both ends.



Figs. 1 & 3. — Showing hob also rough threading operation.

The hob is illustrated in Fig. 1 and exemplifies several distinctive features. The teeth are arranged in a helical formation similar to gear hobs. There are about fourteen roughing and three finishing teeth. It will be noticed, that there are only about one and one half convolutions of teeth, thus making the hob much shorter than gear hobs, the length being about twice the normal circular pitch of the worm.

The action of the hob is in the nature of a progressive roughing and finishing operation. The roughing teeth have their tops and sides reduced in regular decrements, starting with the last finishing tooth, and ending with the first roughing tooth. This portion has somewhat the appearance of a spiral, the lowest tooth is made high enough to cut into the periphery of the worm as far as its centre line, while each succeeding tooth takes out a littlte more metal, ending with the finishing teeth, which smooth and complete the worm tooth shape. The arrangement of teeth just described, and the cutting action secured thereby, make the hob analogous to a broach coiled around a cylinder. The removal of metal is accomplished progressively, and distributes the cutting action over all teeth.

If the hob is made in the ordinary manner, it will be found that the following side of the hob teeth will, if incorrected, cut away a part of the worm tooth, from the pitch line to the outside diameter of the worm.

This necessitates a different lead on the two sides of the teeth, the leading side being made to the basic lead calculated from the normal circular pitch. The following side is recut to a shorter lead, sufficient to clear the theoretical contour of the worm tooth.

When the machine is set up, the middle finishing tooth is centered with the axis of the worm. The roughing teeth lead, and the finishing teeth follow, in the direction of hob rotation. The production and accuracy attainable with

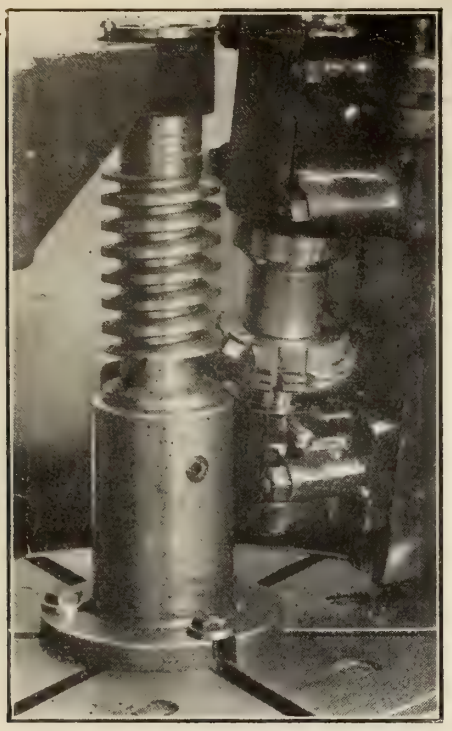


Fig. 2. — Finish threading low carbon steel worms.

any worm threading process are to the practical man, the outstanding features by which the merits of a given method are mainly judged. The production possible with the hobbing method is much greater than that which is possible with a lathe or disc cutter method. This is especially true of multiple thread worms, as the machine is geared for the number of teeth, just as in hobbing helical gears. This obviates the necessity of indexing by hand, and taking a fresh cut through the worm for each tooth, which must be done with a lathe tool or disc cutter.

The accuracy of worms produced by the hobbing method as outlined, is unquestioned. The reason being that in this system, the cutting action is progressive and continuous and produces accurately spaced multiple threaded worms which is an essential feature in efficient and successful worm drives. The cutting action is a result of the generating characteristics of the machine, and not dependent upon other devies which may be inaccurate or inaccurately operated. The amount of feed to the cutter and worm blank relatively to each other in an axial direction is dependent upon the helix angle of the worm. That is to say the greater the helix angle of the worm with the axis, the less the axial feed.

The hobbing method is also adaptable for roughing worms which are subsequently heat treated and then accurately ground. In roughing with this system the amount of metal remaining to be removed by grinding is uniform and also the spacing of teeth on worm is very accurate permitting a high degree of accuracy in the final grinding. The fixture for holding the worm blank should be of a very rigid design, with powerful means for driving, because the strains on this mechanism are severe.

Fig. 2 shows one of these hobs mounted in a gear generating machine finish threading low carbon steel worms, single threaded, 2.7in. pitch diameter, 0,666 linear pitch, with an output of 17 minutes each, floor to floor; while Fig. 3 shows the rough threading operation on an alloy steel seven threaded worm, 4.1 in. outside diameter, 4½ in. face, 1.-37 linear pitch. The time to thread this worm is 60 minutes, floor to floor. The teeth are, of course, ground to final size later. Another example of pro duction is the threading of alloy steel quadruple thread worms, 2.8in. outside diameter, 4½ in. face, 1.06 linear pitch in 8 minutes each, floor to floor.

MACHINE DESIGN

(Continued from Page 39)

The complete expression of the flexure formula for beams or structures subject to bending stress is

$$\frac{C}{S} = \frac{I}{M} = \frac{R}{E}$$

The last part of the formula was not obtained in Lesson 2[2] due to the fact that it is of less importance. In it E is the modulus of elasticity and R is the radius of curvature as given above.

We shall assume the complete formula for the proof in hand.

From the flexure formula $S = MC \div I$ where S is the stress at the extreme fibre on the concave side, and since $M = Py$ (load x deflection,) then $S = Py\ c \div I$ by substitution.

In Fig. 14 we have a distorted view of the deflected column, deflected at the middle by the amount y and arranged so that the deflected column becomes part of the circumference of a circle of radius R. In the figure there are two chords intersecting at right angles. The 35th proposition of the third book of Euclid states, that if two chords of a circle cut one another, the rectangle contained by the segments of the one shall be equal to the rectangle contained by the segments of the other.

$$\frac{l}{2} \times \frac{l}{2} = y(2R - y)$$

$$\text{or } \frac{l^2}{4} = y(2R - y)$$

$$= 2yR - y^2$$

$$= 2yR.$$

Approximately since the quantity y^2 is so small in comparison to 2yR as to be practically negligible, therefore

$$y = \frac{l^2}{8R}$$

Using the first and last ratios in the flexure formula, $S \div C = E \div R$ from which $R = E \div S\ C$; then after substitution in formula,

$$y = \frac{l^2}{8} \cdot \frac{S}{EC} = \frac{S}{8E} \cdot \frac{l^2}{C}$$

$$= \text{a constant} \times \frac{l^2}{C}$$

$$= K \frac{l^2}{C}$$

we have

$$y = \frac{l^2}{8R}$$

It is apparent that $S \div 8E$ is a constant since each term in it is a constant. Thus we have shown y to be equal to $k\ l^2 \div C$.

Merriman's Values of K to be used in Reakine's Formula

Material	Fixed Ends or Square Ends	Fixed and Rounded	Both Ends Rounded
Timber	1/3000	1.95/3000	4/3000
Cast Iron	1/5000	1.95/5000	4/5000
Wrot Iron	1/36000	1.95/36000	4/36000
Steel	1/25000	1.95/25000	4/25000

Table Showing Values of "K"



WHAT OUR READERS THINK AND DO



A NOVEL IDEA

By M. Srigley

Here is an idea that is to my mind novel, but well worth a trial. It has been developed by the workers in a machine shop in a small town in Ontario, and has been found to give satisfaction all around. The illustration shows the idea. Alongside of the regular time cards were placed what we termed "bank cards." One of these is shown in the cut. When a workman put in any overtime, he rang in the bank card instead of the regular one.

The foreman kept a bank book, as we called it, and in this book was entered the time spent by each worker on overtime in the week. When a man needed a day off through sickness, or had to take time off for any other purpose, the foreman was notified, and then the worker's regular card was rung in by the foreman himself, just as if the worker had been on the job. This amount of time was deducted from the bank book, and thus the men were assured of a more steady and regular income. Of course, we were allowed the added rate for overtime, and the deductions were made in proportion. During the winter and spring we put in considerable overtime, and thus the summer holidays were provided for.

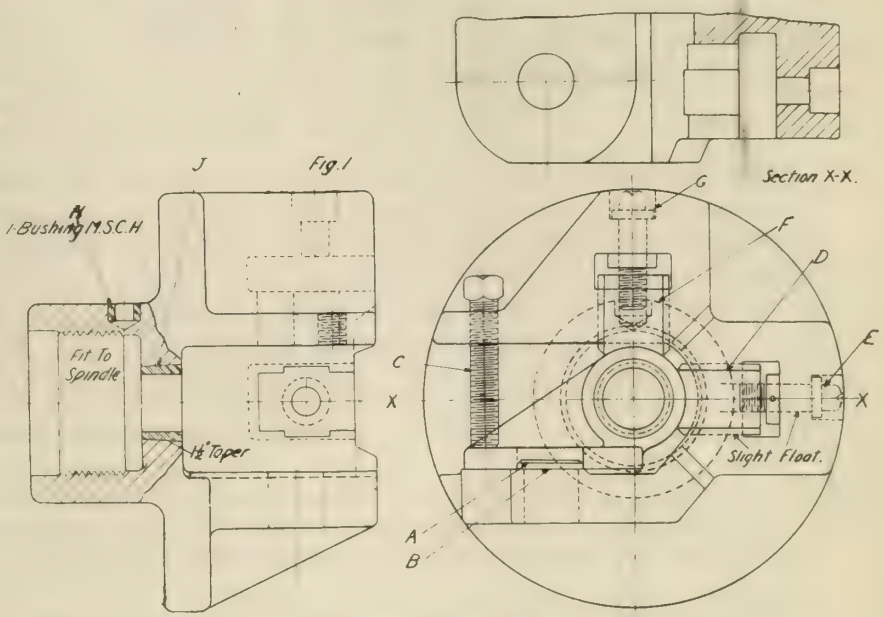
It was not compulsory for the men to use the system, but was adopted by all, as it worked out so well. When an employee left, or was laid off, he was paid what was due him at the regular overtime rate.

John Smith.	Card No 12.		
Date.	Deposit.	With Drown.	Total.
April 12	3 hours		3 hours
" 19	3½ "		6½ "
" 23	4 "		10½ "
" 30	7½ "		18 "
May 3		5 hours	13 "
" 14	6 "		19 "
" 24		10 "	9 "

Showing the blank card and how it was filled in.

SPINDLE NOSE FIXTURE FOR TURRET LATHE

In order to adapt the boring of the hole through the boss of the bracket illustrated in position at Fig. 1 to a turret lathe, it was necessary to build a special fixture which would enable the work to be located from a hole and surfaces previously machined. In machining this piece it is necessary that the two holes be very accurately spaced with relation to each other and consequently the fixture is built up with this in view. Referring to the illustration. The work is set over plug A with its finished bottom against surface B. In this position screw C is tightened just sufficient to hold the work in place, following with the slide D is advanced by means of screw E against the side of the boss, thereby squaring the work and partially clamping it at the same time. Following this, the slide F is caused to clamp on the upper side of the boss by means of screw G, and by completing the tightening of screw C, it will be evident the work is securely held in three places against the locating seat B of the fixture.



Sketch showing the type of fixture used.

The entire fixture is screwed on the spindle nose of the machine, a pin being used in bushing H for tightening purposes, while bushing J is used to guide the pilot of the boring tools, it being necessary to first rough bore the hole, followed by finish boring after which the hole is reamed. It will be noticed that this fixture has been made circular in shape and is so proportioned, or the weight so distributed, that it will be in running balance when the work is mounted in position, as otherwise the fixture would vibrate and produce poor work.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Two readers, Geoffrey Ward and P. Lawson, both of Hamilton, Ont., submitted correct lists to the Oct. 27th issue. Quite a number of other readers had eleven answers correct, but not the twelve. G. Ward won out in the elimination test. Try again Mr. Lawson, and good luck to you.

CONTEST FOR NOVEMBER 17TH ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—What to do in cold weather.
2—How to prevent being misled.
3—Something that is at your command and will prevent experimenting.
4—A case where the mixture is important.
5—How to meet traffic requirements.
6—A case where dirt cannot get in.
7—Something that finishes to any desired shape.
8—A case where a certain kind of bath is unnecessary.
9—Something that is instantly accessible.
10—Something that has unusual capacity.
11—A case where location does not count.
12—Something you owe to yourself.

These are Correct Answers for List from October 27th Issue

1—Northern Electric Co.
2—Wright Mfg. Co.
3—W. H. Banfield & Sons.
4—W. S. Rockwell Co.
5—United States Electric Tool Co.
6—J. T. Hepburn Ltd.
7—The Wallace Barnes Co.
8—Smooth-On Mfg. Co.
9—Dominion Steel Products Co.
10—Simons Canada Saw Co.
11—Algoma Steel Corporation.
12—Pratt & Whitney Co.

Closing Date for This Contest is December 8th.



DEVELOPMENTS IN SHOP EQUIPMENT



NEW TYPE WHEEL DRESSER

The Canadian Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ont., have marketed a new type of grinding wheel dresser, which is to be known by the trade name of "Desmond-Hex." The principle feature of this dresser is that it provides a number of interchangeable bearings for the pin carrying the cutters. It is said that the chief weakness in the type of dresser formerly made, which carried the pin or spindle in hardened steel bushings mounted in the handle, was that the bushings eventually became loose through wear. Although the bushings were replaceable, the holes containing them usually became large, so that the handle itself had to be discarded.

The handle of the new dresser, however, is channeled on the inner sides of the head to hold removable, hardened, hexagon nuts having six holes drilled partially through each nut. The holes serve as bearings for each end of the spindle carrying the cutters, and each nut is held in place by a setscrew from the outside that fits a tapped hole in its centre. When the holes in which the spindle is running become worn, the nuts are removed by loosening these screws, and turning the hexagon so that the next pair of holes comes into use, the spindle being placed in them. In this way six pairs of bearings are available with each set of nuts and the nuts can be replaced when all the holes have become worn. The dressers are made in two sizes, the No 1 size taking the ordinary standard cutters 1½ in. in diameter, while the No. 2 size carries seven cutters 2⅜ in. in diameter, being intended for use on large and coarse wheels.

PROCESS TIMING INSTRUMENT

The Stromberg Electrical Co., of Chicago, Ill., have developed a very useful Process Timing and Signalling Instrument. It is primarily designed for manufacturing processes where the element of time is a factor, such as the heat treatment of coal, enamelling, plating, etc. Clockwork is eliminated and an electric motor provided in its place. A reducing train of gears is placed between the motor and the hands on the dial. The motor operates on either 110 or 220 volt circuits of any standard frequency. The dial is circular, 3½" in diameter, and graduated in several ways, according to the length of periods of time to be taken care of. In all cases, however, zero is where 12 is on a clock. In timing an operation, the red hand is moved through operating a "change" button and this hand is placed at any required point indicating on the dial a certain amount of time between it and zero. The indicating hand starts from the location of the red hand and moves toward zero in an anti-clockwise direction. Thus at any time during the process a glance at the instrument shows how much time must elapse before completion, by reading same directly from the dial. When the indicating hand reaches zero a fell signal or a light signal, or both, are operated and continue to operate, until the operator moves the indicating hand through the medium of the "set back" button, to its position coincident with the red hand. The current used in thus signalling the completion of a process can be also used to control air or steam valves or any other such mechanism as the process would require. When the indicating hand is returned to the starting point, namely, that of the position of the red hand, it remains there until set in motion by the use of the "start" button. The instrument is very rugged weighing about 9 pounds. It is 7 inches high, 5⅝ inches wide, and 5½ inches deep.

STAKING MACHINE

The H. C. Giles Corporation, of Rochester, N.Y., have recently perfected, and are now marketing, a machine for staking cupped or drilled rivets, studs, screws, and other small screw machine products. The machine is designed to be mounted on a bench or pedestal. The actual blow is caused through the medium of a treadle. The enclosed spring inside the frame of the machine and extending below and outside it, lifts the treadle, but springs on the side of the hammer provide an adjustment for the force of the blow. The spindle houses the hammer and the staking set. There is an arrangement by means of which the bar at the top of the machine acting as a hammer, is tripped, when the staking set has been brought to position.

Work can be quickly, neatly, and uniformly done on this machine. Adjustments taking care of a wide range of work are provided.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Should Play No Favorites

THE PRESENT controversy going on in the United States regarding the payment of tolls for the use of the Panama canal, deserves more than a passing mention. Briefly, the situation is this. There is a movement on foot to allow American vessels the free use of the canal, while of course the usual tolls would be collected from the vessels of every other country. From an American standpoint, this arrangement would be an ideal one, but the point must not be lost sight of that this question is an international one, and not a case where the whims of a few should settle the matter. Public opinion the world over is interested, therefore it behooves the Government at Washington to step cautiously.

Seven years ago, the United States admitted its treaty obligation to grant vessels of all countries the use of the canal, providing the same tolls were paid as on their own vessels passing through. This arrangement satisfied everbody, and should continue to do so. Luckily, the better class of American newspapers are not in accord with the new suggestion to eliminate tolls for American vessels and some of them in leading editorials ask the pertinent question "is America one of the countries who regard a treaty as a scrap of paper?" In baseball parlance, "this is a hot one," and should cause those who are fostering the new movement to pause for thought.

America must not repudiate its established international obligations, otherwise it will be placed on a par with another nation which laughed at a certain treaty some seven years ago.

Another suggestion is to leave the toll on American vessels, but to give them a subsidy which will in effect be a return to them of the money thus paid.

If such an arrangement came into effect America would more than likely become the laughing stock of the entire world. It would be no doubt generally discussed, that America, not wishing to break her treaty and her honor, found a new way to accomplish the same thing without losing that same honor(?) Surely the authorities will not allow either of these suggestions to go through, but will levy a toll on all vessels in a standardized way.

An Unexpected Result

AN ACCIDENT which resulted in the death of ten persons and a large amount of property damage was recently caused by the carelessness of a workman in taking a cover off a gasoline tank. This car contained a particular highly volatile type of gasoline, known as casing head gasoline. The gasoline is also known, according to the "Traveller's Standard" which describes the accident, as "wild" or "natural gas" gasoline.

The causes which led up to the disastrous effect seem to have been the omission of certain precautions, and the commission of grave errors. There is a safety valve on each gasoline tank car, which is supposed to lift at a pressure of 25 lb. per square inch, but which is also, according to regulations, supposed to be slacked off before the cover is taken off the dome of the tank, thus releasing all pressure that there may be inside. The workman who was detailed to unload the car first neglected to release this valve, and therefore the pressure, and secondly, on attempting to turn back the cover of the dome with a bar, and not succeeding, took a hammer and chisel to start the cover back. This practice is specifically forbidden by the regulations. When the dome cap was started, the gasoline being under pressure, forced some of the vapour through the cap, and a spark presumably from the chisel, ignited this vapour, with the disastrous result already mentioned.

It seems that no amount of warnings, regulations, or propaganda can ever imbue men with a sense of responsibility, or keep it alive in them day in and day out. It is probable that this man who was doing this was fully aware that he was breaking a regulation, and it is quite probable that he had done so before, and thought he could save a little time or a little trouble by disregarding it on this occasion. He not only lost his own life but caused the death of others, and huge damage besides. In most cases regulations are made for the purpose of protecting life and property, and are made after due consideration of their effects as regards retarding work. This loss of time is considered of less importance than the danger that would ensue if the regulation was not there. It seems to be inevitable however, that familiarity shall breed contempt in the minds of those who should be governed by these regulations, and sooner or later their contempt is visited by some calamity. This carelessness is not confined to any one industry, but can be found almost wherever men are engaged in occupations that carry a hazard of any kind. Even power plant men are not immune to this form of carelessness, and it is not unusual to find guards around eccentrics or crank webs removed for some repair, and never replaced. It is not unknown either for electric station operators to be killed by working in narrow places on live wires which could have been switched off with a little expenditure of time or trouble. The remarkable part of the whole thing is that men who would ordinarily kick loud and long if ordered to do any dangerous thing, will of their own free will break regulations made to safeguard them, for the sake of saving themselves a moment's inconvenience.



MARKET DEVELOPMENTS



Not Much Activity Showing on Various Markets

With Exception of Large Steel Order and Railway Car Repair Work in Montreal District, Business is Very Quiet—Machine Tools are Dull and Scrap is Practically Stagnant

THE BRIGHT spot in this week's market is the placing of an order for 4,300 tons of steel. This material is to be used in the construction of the new Mount Royal Hotel in Montreal. Next in importance is the announcement that the Canadian Car & Foundry have received an order from the Canadian National Railways to repair one thousand cars. Both these orders mean quite a bit to the Montreal district at the present time.

Our Montreal correspondent says that machine tool manufacturers are announcing improvements in the design of their tools, and that conditions are improved somewhat, because salesmen can now get a hearing, where previously such was not possible. This information is cheering in itself, although the actual amount of business closed is not so comforting.

Toronto machine tool dealers say that the small demand for machines in October has dwindled away to almost nothing this month, and that they cannot see any improvement in sight until business generally picks up. Price seems to be tight, feeling the time is bound to come before long.

a minor consideration in the purchasing of such tools. Even the small tool market shows a decrease this month.

Our Pittsburgh correspondent tells us that the production of steel ingots in October was at the rate of 23,000,000 gross tons a year, or about 44 per cent. of productive capacity. This rate is about one third greater than the rate in September, or more than double the rate in July.

He also says that there is almost complete stagnation in large construction work, like hotel and office skyscrapers, bridges, factories and power plants, and that most of the building activity is confined to garage and dwelling house construction. Such building is occurring becauses the owners want the facilities right away.

The pig iron market is very quiet, and prices remain the same. Coke prices are softer, as ovens have been blown in too rapidly in proportion to increasing consumption. In the past few weeks some merchant ovens have been going out.

The scrap metal market is as poor as ever and from present outlook is likely to stay in that condition.

Railroads Are Not Buying—Some Lines Active—Others Are Stagnant

PITTSBURGH, November 17th.—Production of steel ingots in October was at the rate of about 23,000,000 gross tons a year, equal to about 44 per cent. of productive capacity, which may be estimated at 52,500,000 tons. The rate of production in October was one-third greater than the rate in September, and was more than double the rate in July.

Steel production is now in harmony with the condition of business generally, that is, there is as much steel production as one would expect there to be when conditions generally are, as they are. There is neither more production nor less production than one would expect. From April to August inclusive the condition was different. Steel production was far below the rate one would expect considering the amount and character of the business the country was doing. That was because the country was running in part on stocks of steel. A corollary to this is that there has been little increase in the actual consumption of steel since July. The difference is that what is needed has to be made by the mills from day to day.

Despite the great increase since July, steel production is at a low rate compared either with productive capacity or with production in recent years. Probably the most common view is that this is because "business is bad" but business is not really bad all along the line. Some lines of business are quite active, some are stagnant. As to steel consumption, there is absolute stagnation as to railroad consumption of steel and there is almost complete stagnation in large construction work, like hotel and office skyscrapers, bridges, factories and power plants. There is by no means stagnation in "building" generally, for there is a great deal of activity in garage and dwelling house construction. Such building occurs because the owners want the facilities right away. They are getting older day by day and do not want to wait for lower costs. They would save money but lose time. Investors, on the other hand, consider simply the money and they are waiting for lower costs. As to the railroads, everyone knows that they cannot spend money on steel now, one sufficient reason being that they have not the money.

A simple proof that the general line consumption of steel is heavy can be furnished; general line consumption involving machinery, hardware, tools, implements and a wide variety of things, railroad consumption and consumption in large construction projects being light. In 1906 there was heavy demand for steel by all lines of consumption. The mills ran at full capacity throughout the year and produced 22,600,000 tons of ingots, just a trifle under the rate of production shown for last month. In 1906 there were 5,623 miles of new railroad built in the United States, besides many miles of secondary track, and in the United States and Canada there were built 243,670 freight cars and 6,952 locomotives. There were many skyscrapers erected, also power plants, bridges, factories, etc. Of these things there is now very little, yet the total production of steel is a shade greater, hence the consumption in other lines has greatly increased, in a proportion somewhere between 50 and 100 per cent. Population has increased about 23 per cent. since 1906. Precisely where the steel is going now no one can say, simply because it is being so widely dis-

tributed both geographically and by lines of consumption.

Production is hardly likely to increase in the next couple months over the October rate. Consumption usually decreases a little in the winter months. The steel market has been quieter since the middle of October, and this will probably be reflected in somewhat lighter production, but there is no decrease observed thus far.

Steel Prices

The steel price situation is a simple one. There is merely a slight sagging tendency, whereby, to illustrate, one is likely to be able to place a given order now at say a dollar a ton less than he would have to pay on precisely the same order two or three weeks ago, while two or three weeks hence a mill may be willing to concede a dollar more in the price than it would today. There are no clear cut declines, one reason being that in most lines there are no clear cut market prices, a quotation being made on each order according to its desirability to the mill at the time.

Roughly speaking, bars, shapes and plates are between 1.50c and 1.65c depending on circumstances. Regular prices on sheets are 3.00c for black and 4.00c for galvanized, while these prices are being shaded by a number of mills, generally $1 to $3 a ton but possibly $5 in extreme cases. The lists of September 16 on tubular goods are being observed by some mills while others are making slight concessions. These concessions have hardly increased in extreme amount in the past week or two, but they have become more common, applying to a larger number of orders.

The financial reports of steed companies lately have shown that steel can be made at somewhat lower costs than was assumed. The reports differ widely, the differences evidently being due to some producers having made their adjustments, in inventory, etc., some time ago, while others have had to write off large sums in the September quarter, thus producing losses. There is room for prices to taper off a trifle more, with fundamental items of cost remaining as they are, while with the lower freight rates so commonly expected, but which may be long deferred, there would be room for a little more downward readjustment. Mills will hardly make their final concessions until the time comes when they see buyers are ready to take hold freely, making contracts for the future and being ready to stock up in a moderate way. Stocks now are down to almost nothing, being below what they should be for normal conduct of business.

The freight ton-mileage of the railroads in August has just been reported. It shows a quantity 29 per cent. under that in August, 1920, which was the record high month in the whole history of the railroads. The ton-mileage in the eight months ending with August was 22 per cent. under that in the same months of 1920, and 1920 as a whole was the record year in ton-mileage. The ton-mileage statistics are not consulted as much as they should be. These figures show there is not a great deal in the argument that the railroads must reduce freight rates for their own good, so as to get more business. The rate reduction is needed to stimulate general business, rather than to help the railroads. The figures also show, however, that business in general has not been nearly as slack as has been commonly assumed.

POINTS IN WEEK'S MARKETING NOTES

The production of steel ingots in October, according to Pittsburgh reports, was about equal to 44 per cent. of productive capacity.

A great deal of activity is going on in garage and dwelling house construction, but not much in railroad work, large hotel work, bridges, office, skyscrapers, etc.

Pittsburgh states that bars, shapes and plates are between $1.50 and $1.65 depending on circumstances. Regular prices on sheets are 3c, for black and 4c, for galvanized, but these prices are being shaded by a number of mills, generally $1 to $3 a ton, and in some extreme cases $5.

The Toronto market is very dull this week. Even the small tool dealers are disappointed at the volume of business coming in. Up until this month small tools were moving fairly steady, and better things were expected, but instead of becoming better, business has tapered off.

A large structural steel deal went through this week in Montreal, some 4,300 tons of steel being ordered. An order to repair 1,000 railway cars also went through in this district.

Montreal reports no change in price in the pig iron market. Business has been very quiet, and no increase in demand is expected. Foundries asking for quotations on pig iron, are still asking to be protected apainst declining freight rates.

Business in machine tools shows no improvement. Improvements in design are being made, this resulting in considerable interest. It shows that manufacturers are watching the market carefully.

The scrap metal market is just as dull as ever, and dealers do not look for any improvement until foundries generally are able to secure orders.

The pig iron markets are all very quiet. Prices are not quotably changed, but large inquiries might easily bring out somewhat lower figures. The local market remains at $20 for Bessemer, $19 for basic and $21 for foundry, f.o.b. valley furnaces, freight to Pittsburgh being $1.96.

Connellesville coke is softer, owing to ovens having been blown in too rapidly in proportion to increasing consumption, and in the past week or two some merchant ovens have been going out. Spot furnace coke is $3.25 as an asking price, and shading would extend to 15 cents, perhaps 25 cents. A fortnight ago $3.25 was the minimum. Spot foundry coke is still quotable at $4.25 to $4.75, but even the best brands sell poorly at $4.75 and probably some fairly good coke could be picked up at under $4.25.

TORONTO MARKET IS VERY QUIET

TORONTO, Nov. 17th—There is a story now going the rounds which defines in a peculiar manner the difference between an optimist and a pessimist. It says "that an optimist is a man who sees a light afar off, which isn't there, and that a pessimist is a man that comes along and blows out said light." If such a condition were possible, it would be safe to say that the majority of dealers on the Toronto market this week, had their cheeks all puffed up ready to blow out the light which isn't even there.

When asked how the market was going, so far as machine tools were concerned, one dealer replied "that there wasn't any such animal." To prove his point he told of how he had offered a grouping of first class tools at what he figured were ridiculously low prices in order to get them out of stock. In spite of the sacrifice he was making, the prospect laughingly offered him about one-half of what he had asked. Needless to say the tools did not change hands, and according to this dealer, he is through trying to sell on a price basis. Price is a secondary matter alongside of the fact that unless a manufacturer actually needs the tool, he will not buy at any old price. If one were to group all the business closed locally in machine tool circles since the first of the month, the total would not be imposing. In fact dealers frankly admit that September was a much better month than October has proved to be so far.

A certain salesman of tool steel turned in a splendid sales record for September. Naturally he was uplifted, and so was his firm, and for good reason. It was the best month he had turned in during 1921. Full of enthusiasm he started out this month feeling the turn had been reached, but up to present date he has not closed enough business to even pay his expenses. The disappointment he is showing is a good sample of how the average dealer in any line of the metal market is feeling. They had all expected things to be better, and the spurt of September added to that belief, but unfortunately this spurt has not lasted, with the result that the first half of October can be said to have been a very poor fortnight.

The Steel Market

To ask a dealer on the steel market, how business is progressing, is courting trouble. Like as not he'll bite your head off with the remark "Horrible." Apart from sheets the demand is very

light, and even these are tapering off considerably. On our quotation sheet this week we quote $3.25 per 100 lbs. for both iron and steel bars. This may cause a roar from some quarters as $3.50 is supposed to be the regular price, but as about 75 per cent. of the business is being closed at the lower figure, $3.25 seems to be the correct one to quote.

About the worst member of all, is the scrap market. The amount of business being closed is practically nil, and as long as foundries keep working spasmodically, this condition is likely to continue.

Although frankly disappointed, the dealers in the various lines are not despairing. They feel that before long conditions will improve, but just when this will take place is another question, and one which very few care to offer a prophecy on. A few courageous dealers say that after the elections are cleared away things will be better, but when questioned closely they admit that this is only their opinion and they have nothing concrete to back it up. One dealer, when asked his opinion of the near future, remarked that he would leave it to others to prophesy, but in the meantime he'd bust a button if necessary in order to secure business. It would seem as if the present condition will exist for at least the balance of the present month, if not until the end of the year.

Large Steel Order is Placed Thousand Cars to be Repaired

MONTREAL, Nov. 17th:—The outstanding event in the past week was the placing of the order with the Dominion Bridge Co., for the 4,300 tons of steel to be used in the construction of the new Mount Royal Hotel in this city. After a period of time, during which business has been at a very low ebb, this order has created a great deal of interest. The order for the cut stone for the same building was also placed this week. In addition, the Canadian Car & Foundry announce that they have received an order from the Canadian National Railways for the repairing of one thousand cars. It is understood that five hundred of these will handled at the Montreal plant, and the balance at the Amherst, N.S., plant. Generally speaking, trade in sheet plates, and other lines, is feeling the usual increase of business just prior to the close of navigation. Business locally has not shown any improvement over that of the last few weeks. The small volume moving is still much better than that of the low point in July and August. The stocks carried by most jobbers are rather small and there appears to be no attempt at increasing these before business shows a much better tone than that exhibited at present.

Steel Market

Sheets have been moving a little better this week owing to the approaching close of navigation. The increase has been occasioned by trade coming from points outside the city. Local business is much the same. Although local jobbers have been stating for some time past that the next revision in base prices of steel would be upward, this last week they have announced prices that are about ¼ of a cent per pound less than that prevailing for some time. These prices apply to both iron and steel bars, base, Montreal. There has been but little demand for either iron or steel bars for some time, and this reduction is considered the limit to which the manufacturer will go to try to induce the consumer to place business. With the exception of the Mount Royal hotel order there has been a very quiet time lately in structural steel. It is not expected that there will be much activity till the business for 1922 comes up for consideration. Everything points to a very large year in building next season.

Pig Iron

No change in price has been made in the last week. Business has been rather quiet and no changes are expected either in the demand, or prices. Foundries asking for quotations on pig are still asking to be protected against declining freight rates. This end of the pig iron business involves a little speculaton. Producers of the iron usually have sold f.o.b. furnaces, freight allowed to destination, and have been in the habit, in the past, of absorbing any declines in freight rates as a legitimate profit, and on the other hand they have had to stand any increases in freight. Thus they do not look with favor on protecting the consumer against such a decline. They do not care to contract for iron for any great length of time at present prices. There is every reason to believe that when pig iron becomes more active, there will be another upward revision in price. Forecasts for the 1922 season are being made, and from all reports the foundries will be doing a far greater volume of business, when next year's business opens up.

Machine Tools

Business for the last week has not shown any improvement in the machine tool line. From time to time manufacturers are announcing improvements in design, or the introduction of a new line of machine tools. All these are being gladly received by the shops, and the merits of the various offerings are investigated, but few orders are materializing. All this is an improvement over the condition existing a few months ago when a machine tool salesman could not get a hearing. Now he can not only get a hearing but he often receives inquiries. This shows the machine shop men are watching the market carefully and are much nearer the buying point than they have been for some time. It is doubtful though, if there will be much buying of machine tools before there is a real improvement in general business conditions. The announcement of several machine tool builders of international repute to sell their product at cost, is not looked upon as of any real importance as manufacturers do not want additional equipment at any price.

Small Tools and Supplies

This department of the iron and metal markets keeps to the even tenor of its way and leads all departments in stability. No great change in volume has been noted for several weeks. Prices have not undergone any radical changes but appear to have reached their normal level. Manufacturer and jobber are doing business along the accepted conventional lines and the price list, which was for a time discarded, is now an important factor in all negotiations Withal, buying is only a stage or two removed from the hand to mouth methods.

Very litle activity has been noticed on the non-ferrous metals for the past week. Usually these metals have very active price lists and quite often they are coupled up with speculative interests, but for the past two weeks they have been abnormally quiet. Copper prices have been pretty steady for some time. Tin is down slightly. No immediate changes are looked for at present but the market may develop into an active one on short notice.

Another week of little or no trading has to be noted on the scrap metal market. From all quarters comes the same report that foundries cannot see their way clear to take on a stock of scrap iron. Non-ferrous metal scrap is also very dull indeed. The brass foundries appear to be quite as dull as the cast iron shops but reports that foundries generally will be doing a largely increased business in the early part of the new year has had the effect of giving scrap iron dealers something to look forward to, which will be a lot better than the future they have been facing for the last few months.

The annual meeting of the Canadian National Newspapers and Periodicals Association, took place in Toronto on Nov. 10 and 11, and many interesting papers were presented. On Nov. 10, a luncheon was held at the King Edward Hotel, at which many prominent speakers took part including the new Lieut. Govenor General for Ontario. His message to the business and technical papers of the country was especially inspiring. He pointed out that Canada was passing through a very critical period, and that is was up to the editors of the various business, religious, technical and kindred journals to lead, and lead carefully. The power of such periodicals was pointed out, and his Honor concluded by saying that he felt Canada would come through with great success as we had as our backbone a wonderful country in itself.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	3 00
Steel bars, base, Montreal	3 00
Reinforcing bars, base	3 00
Steel hoops	5 00
Tire steel	3 50
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 50
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross Montreal	Gross Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	35 00	37 00
Spelter	7 25	7 50
Lead	6 50	7 50
Antimony	7 00	8 25
Aluminum	28 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 00	$3 75
Plates, ¼ up	3 50	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 38	14 71	17 77
½ in.	6 50	8 03	7 95	9 48
.....	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 55
Cut nails, base	5 10
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	60	75
Class B	26	36
Class C	17	26

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 25	4 25
Canada plates, dull, 52 sheets	6 00	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	8.00	....
Fleur-de-Lis, 28 B. W. G.	7.50	....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	....
Premier, No. 28, U.S.	6 45	6 35
Premier, 10¾ oz.	6 85	6 75
Zinc sheets	8 50	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.	.....	34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	28
Palacine	31
Machine oil, per gal.	58
Black oil, per gal.	27
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	12½	Popular	.10
Standard	.11	Keen	9
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White	20	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Malcolm furniture factories, Listowel, Ont., are in full swing.

A. L. Clarke, patent leather manufacturers of Toronto, are installing a new boiler.

The Toronto Saw and Tool Co., has been incorporated in Toronto with $400,000 capital stock.

Thos. W. Hayes & Co., Montreal, has been incorporated with $50,000 capital stock.

The Master Tires, Ltd., Toronto, has been incorporated to manufacture automobile tires with $1,000,000 capital stock.

Giles, Rice & Peters, Ltd., Toronto, Ont., has been incorporated to manufacture automobiles, etc., with $100,000 capital stock.

The Ottawa Metal Products, Ltd., Ottawa, Ontario has been incorporated to manufacture metal products, etc., with $300,000 capital.

The Public Utilities Commission, Galt, Ontario, has awarded a contract for 1600 ⅝ of one inch water meters to the Neptune Meter Co., Limited, Toronto.

The Williams Engineering Co., Ltd., Winnipeg, has been incorporated with a Dominion charter and the capitalization of $50,000.

The Consumers Metal Co., of Lachine, Que., was sold on Nov. 9. by Chartrand & Turgeon, liquidators, Montreal, to the Bankers Trust Company of that city.

The City Council of Toronto, Ont., is considering the temporary heating of the new livestock arena, to be part of the permanent heating at a cost of $28,000.

The Parish and Heinbecker Company of Winnipeg is reported to have purchased water frontage in Port Arthur with the intention of building a grain elevator.

The Multiple Co., Toronto, Ontario has been granted a license to manufacture stamp affixing machines, wire fencing machines, machinery tools, etc., with $10,000 capital stock.

The American Bed and Spring Co., Toronto, has been incorporated to manufacture beds, springs, articles in which iron, steel, wood, metal, etc., are used. $40,000 capital stock is the rating.

Some seventy manufacturers had their products on display at the Made-in-Galt exhibition this week. This is Galt's first venture in this line and results were gratifying.

The foundry owned by the Chicoutimi Pulp Co., Chicoutimi, Quebec, was recently damaged by fire with a loss of $50,000. It is expected that the owners will rebuild.

Mr. Parker, sales manager of the Burke Machine Co., Conneaut, Ohio, says that his company closed twice as much business in October as they did in September.

Mr. E. L. Curzon advertising manager of Darling Bros., Montreal, will leave that position at the end of the present year to occupy a similar one with Tooke Bros., Ltd., Montreal.

The Buffalo Specialty Co., Bridgeport, Ont., manufacturers of Liquid Veneer, plan to rebuild its plant which was destroyed by fire. The estimate of loss is $75,000.

The city architect of Toronto has issued to the Auto Service Syndicate a permit to alter a factory into a garage and instal gasoline equipment at the southwest corner of Dundas and Victoria streets at a cost of $40,000.

Fire losses in Canada during the week ending October 26th, are estimated at $443,800, compared with $509,750 the previous week.

A strong protest against a proposed wage cut is made by the miners of district 26 united mine workers. The Wage cut goes into effect November 30th, when what is known as the Montreal agreement expires.

The finance committee of the city council of Kitchener, Ont., decided to submit to the council a proposal for the erection of a new city hall at an estimated cost of $250,000.

It is learned that large quantities of Canadian wheat estimated at 2,000,000 bushels have been purchased by the Government of Greece. On account of financing difficulties the buying is done through New York Houses.

Authority for the construction of a $500,000 plant has been given to the Three Rivers Pulp & Paper Co., Three Rivers, Quebec, by the Municipal Council. The erection of this plant will be commenced this year.

The Mona Petroleum Products, Ltd., Toronto, which has been incorporated with a capital stock of $500,000, will soon start the erection of a plant at Trenton, Ontario, a sixty acre site having been secured.

Permits have been issued for the erection of the Notre Dame Hospital, Montreal, a seven storey building to cost $500,000. An office building is also to be erected for Crane Limited, Beaver Hall Hill to cost $220,000.

Tenders amounting to $13,000 for an additional machine shop at the Central Technical School, Toronto, has been passed. The new equipment includes 21 lathes, one drill, a hacksaw, a grinder, 12 motors and various kinds of tools.

Canadian Crucible Alloys, Limited, Fraser, Ont., have their steel plant perfected to such an extent as to be able to take off tests from the Canadian ores from which they plan to produce high speed steels.

A meeting was held in Toronto on November 15th, by the various manufacturers interested in the proposed new machinery hall for exhibit purposes at the Toronto Exhibition. We will give further particulars of this meeting in our next issue.

Langley & Austin, brass, bronze and aluminum founders, Galt, report some improvement during the past ten days. This applies particularly to the demand for trolley wheels, bushings and gears, the latter indicating a better feeling in rubber goods manufacture in that locality.

The village of Lyndhurst in the vicinity of Brockville, Ont., is proposing to erect a High School to replace that recently destroyed by fire in the neighboring village of Athens.

It is expected that the total expenditure on good roads in the Province of Ontario will amount to $25,000,000. A large part of this amount will be carried by the Provincial Treasury. These figures have been quoted by the Department of Highways.

A. B. Jardine Co., Hespeler, reports improved demand for pipe threaders and small tools. While this improvement, they state, apears to be spasmodic, the fact that orders are coming in for stock purposes indicates a slightly more optimistic outlook among jobbers.

The Ontario Show Case Co., 321 King St., Toronto, Ont., has awarded contracts for a factory to cost $50,000.

2,066,400 tons of Gold ore are being put through reduction plants in the gold mines within the province of Ontario, per annum. The monetary value of the production per month amounts to approximately $1,584,000. This means a production at the rate of about $19,800,000 per year.

Ontario Potteries, Ltd., Bowmanville, Ont., will erect a pottery plant at the cost of $50,000.

Buchanan & Hall of Yale, B.C., are erecting a sawmill at Choate, B.C., at the cost of $10,000.

The Bowmanville Foundry Co., state that they find business very much improved, and still improving. At present they are running 55 hands.

A new plant for the Rawley Drug Co., will be erected on Dundas St., London, Ontario, construction commencing about the first of the new year.

The Lumber Mill of the Canada Lumber and Timber Co., Vancouver, B.C., was recently destroyed by fire with a loss of $100,000.

Business is so brisk at the plant of the Langslow Co., Cobourg, Ont., that it is necessary for a night shift to work several hours.

The newest freighter of the Canadian Government Merchant Marine, The Canadian Britisher, will leave for Vancouver on Saturday, November, 12th. On her trial trip recently she proved most satisfactory.

Knitting mills in Listowel find difficulty in securing sufficient girls. The mills are turning out between $25,000 and $30,000 worth of goods monthly, despite reduction in price to about half that paid for the product a year ago.

An extensive deposit of high grade Asbestos has been located on the main line of the Canadian Pacific Railway, near Kamloops, B.C. Provincial Government engineers are now examining the deposit.

The opening of the New Bacistan Bridge, which was the last link in the Montreal-Quebec highway took place recently. The bridge is 1,219 ft. in length, of new construction, and cost about $200,000 to construct.

Mr. Grant Hall of Montreal, vice president of the C.P.R. was in London, Ont., quite recently. While there he stated that business conditions in Canada are now better than for a long time and will continue to improve. He is looking for a big increase in freight traffic shortly.

The Sterling Motor Truck Co.; The Wisconsin Corporation, have been licensed to manufacture automobiles, etc. in Ontario with a capital stock of $40,000. Mr. Frank E. Brown of Toronto, Ont., has been appointed to represent the company here.

Thorold, Ont., has obtained a new industry, known as Thorold Motors Limited. Work will be commenced very shortly on the erection of the plant. High grade motor-propelled vehicles will be made. The company is composed largely of local men.

The Main Belting Co., of Canada, Montreal, announce that their new factory has recently been opened in Montreal. The new plant will be utilized for the manufacture of their special lines of belting which has been sold in Canada for the last ten years.

The Lewis Engineering Co., Toronto, Ont., has been incorporated at $500,000 to acquire from the Lewis Crest Appliance Co., Chicago, Ill., the benefit of certain Canadian patents for improvements in making appliances for locomotives, etc., and to manufacture and assemble equipment, machinery, etc.

The National Sanitorium Association of which Mr. E. L. Ruddy, 372 Spadina Avenue, Toronto is chairman, will soon award the contract for a three storey hospital to be erected at Gravenhurst, Ontario, including a steam and mechanical ventilation system. About $600,000 will be the cost.

According to information received from London, England, Canadian Products are to be given first consideration in awarding contracts. Mr. F. C. Wade, British Columbia Agent-General in London, England, says:—"I am all for cementing the Empire, but I do not see any reason why we should not specify 'Canadian cement'."

The location at Walkerville, Ont., of a new million dollar company operating under a Provincial Charter and known as Colonial Motors, Ltd., is arousing much interest in the Auto trade. The company plans to commence operations as soon as possible and may purchase the factory of the Canadian-Detroit Lubrication Company in order to facilitate production.

The Douglas Packing Co., Cobourg, Ont., is very busy at the present time filling orders and is experiencing a great revival of activities. About 26 cars of apples are dsposed of weekly. Owing to the destruction by fire of their plant at Rochester, N.Y., the local plant is filling many United States orders. It is expected that business will be brisk for some time.

The total amount of contracts awarded for construction in the Dominion of Canada for the month of October 1921 totalled to $18,997,200. Of this item $1,616,600 was spent for the erection of factories only. This of course does not take in stores or warehouses. The totoal of contemplated new construction work in Canada for the month of October, 1921 amounted to $19,651,100.

Negotiations have been completed for the purchase outright by the London Concrete Machinery Co., of London Ontario, of the business of the Ideal Concrete Machinery Co. of Windsor. This is the Canadian branch of one of the largest concerns in the United States. The plant will be removed to London and it has not yet been decided whether the business will be operated independently or in connection with the London firms factory.

The International Wheel and Rim Co., have just been granted a charter to manufacture double-disc steel automobile wheels. The company has decided to locate its factory in Toronto but have not as yet picked out a permanent site. An option has already been secured on temporary manufacturing quarters. It is intended to make Toronto the headquarters for its export business, and it is the recent acquisition of the Durant Plant that made them decide to locate in Toronto.

The Jenssen Engineering Products Co. Montreal, have taken over the business of the plant, and of the Power Equipment and Supply Co. The new company will analyze industrial problems, make recommendations and supply materials, machinery, equipment, building, etc.

Reports from Vancouver, B. C. state that shipments of lumber to the Orient from there this year have been heavy. It is estimated that Japan has taken some 200,000,000 feet of lumber from British Columbia and the Pacific coast states, as against a total importation of 66,000,000 feet for the whole of 1920, and 12,000,000 to 14,000,000 in a normal year.

There are other industries looking to London with a view to locating there. In this connection it is pointed out that with two large motor truck factories and a large automobile industry there, it will be a good chance for establishing factories to manufacture automobile and motor truck parts. The Service Truck Co., are considering the erection of a factory upon the site which has been purchased on the Wellington road, London. Construction operations will commence early in the New Year.

Negotiations for the location of another new factory at Brockville, Ont., were completed quite recently with the signing of agreements between J. R. Baxter Co., Montreal, and J. Amos Johnston Industrial Commissioner of Brockville, for the immediate erection of a Grinding Wheel Factory, 200 ft. by 50 ft. to be built at an approximate cost of $24,000. The erection of this factory will be commenced immediately and every effort will be made to have the plant in operation before the new year.

Mr. J. S. Nicholson of Manchester, England, a member of the Nicholson Rain Coat Co., of Manchester and London, England, is in Toronto after a business tour of the Canadian West. He had not been in Canada since before the war, but states he is frankly astonished to find trade in this country in such an excellent condition. He says that business in England is picking up, but there is far more business in this country in relation to population than there is in England.

In leaflet 3665, just issued by the Westinghouse Electric & Mfg., Co., motors for elevator service are discussed and illustrated. It is shown how satisfactory elevator service may be obtained. Further, it points out how to select the elevator motor, for which purpose several formulae are given. Type LC crane safety switches are illustrated on a small blotter (No. 57) for vest pockets, which is being distributed by the same company. Insure against loss by stocking renewal parts is the theme of blotter No. 56 which has also been printed by this concern.

Plans of the Ontario Hydro-Electric Commission for the deepening of the St. Lawrence was presented at a meeting of the International Joint Commission on November 14th in Ottawa.

The N. B. Pritchard manufacturing plant at Sherbrooke, Ontario, owned by the Dominion Metal Co., is to be enlarged and new equipment installed. Plans are now under way for the erection of a three story building. In addition to their regular line the company intend to manufacture high temperature fire cement, etc.

The number of manufacturers who are in the backwoods these days, would seem to indicate a marked demand for long-distance boring machines in these quarters. That so many of them are reporting good business in the frozen north, speaks well for their lessons in high speed during the war.

Armstrong Whitworth & Co., England, is said to have been awarded the contract for one of the new Super Dreadnoughts ordered by the English admiralty at a cost of £7,500,000 Sterling. It is estimated that it will require three years and the services of 500 men to complete the vessel. The Canadian office of this company is situated in Montreal, Quebec.

Greenshields, of Montreal, have purchased the merchandise of Gault Bros. This is one of the most important sales of dry goods stocks ever recorded in Canada, the purchase price being one million dollars. In discussing the purchase yesterday, Mr. Cains said that of late the firm had been experiencing a steady improvement in business throughout Canada, sales increasing and collections being satisfactory. Indications he said pointed to the largest turnover in the history of the company.

The Vanadium-Alloys Steel Co., Latrobe, Pa., have issued a handy reference card, giving a number of practical points to the tool hardener. The size of this chart is 8½ in. x 11 in., and it is made of heavy cardboard, provided with a cord for hanging on the wall of the hardening room or the tool room. On one side are printed 37 tips, and on the other are shown the various grades of tool steel made by the company. The card is entitled "Tips for the Tool Hardener. Suggestions of a Practical Man of Long Experience."

The contract for the structural steel to be used in the new United Hotels Co., Mount Royal Hotel at Montreal has been let to the Dominion Bridge Co. The total tonnage used will be 4,300 tons. Details and drawings have been practically completed and the work is now under way. The start on the erection of steel will be made not later than January 1st. The steel work will be completed before the end of March. The contract for the cut stone for this same building was also awarded during the week, to the Canadian Benedict Stone Co., which firm has a plant at Maisonneuve, P. Q. Competitive bids from companies proposing to furnish Indiana stone were received, but the local firm managed to present the better proposition and secure the order.

The Davis Bournonville Co., Jersey City, N. J., has placed on the market a welding torch and carrying case outfit, which is especially adaptable for garage and machine shop use. The outfit is portable and consists of a torch, three extension tubes, five welding tips, one decarbonizing tube, one oxygen regulator, one actylene regulator, some hose for both regulators with suitable connections, a spark-lighter, a torch wrench, also a regulator wrench.

This outfit is not intended as a makeshift or emergency outfit, but is capable of handling any welding job regardless of size or conditions. The chief feature is its portability. In the literature describing this new product, instruction is given as to its uses.

Mr. W. M. McRobert, president and sales manager of the Canada Stoker Co., Ltd., states that their business this year can be designated as a good average year. Last year's business was above the average, this year's slightly below 1920. They attribute their success to persistent advertising and aggressive salesmanship. They have extended their business to the U.S. and find that they can manufacture their stokers in Canada and sell in the U.S. at less cost than they can have their product manufactured in U.S. This, in spite of the fact that there is a substantial duty on stokers imported into the U.S. also freight and other charges. Mr. McRobert considers the outlook for business as promising and expects that conditions will become more settled after the election. At present, there is more activity in the textile industry than in any other field.

Something like the public spirit that is going to assist in solving the problems of unemployment, is manifested by William J. Connors, proprietor of the Buffalo Courier. He has leased the East Buffalo car shops of the New York Central Railroad, and intends employing from 1500 to 2000 men in the work of repairing railroad cars. The plant is one of the largest and most modern in the United States and has been idle for eight months. Mr. Connors, outlining his plans, states: "I intend to make the wheels of industry hum in the section of the city where the car shops are located. Business will be helped by this and not only East Buffalo, but the whole city will benefit." The East Buffalo railroad yards are full of cars awaiting repairs. Only the most essential repairs on such cars as have been required by the traffic have been made for the railroads.

The John Watson Company, Ayr, Ont., manufacturers of barrows, factory trucks and certain lines of agricultural implements, are steadily recovering from the effects of the disastrous fire of eighteen months ago, when their main building was wiped out. A new factory of about 50,000 square feet is nearing completion. They are now operating in a small building 50 x 60 feet, and are badly handicapped by narrow quarters. Their foundry and blacksmith shop escaped the flames. The Watson Company had its origin some seventy-three years ago, as manufacturers of stoves. These were sold, at that time, by wagon from house to house, and very often the man who actually made the stoves, was also the salesman on the road. Agricultural implements were then added and, latterly, they specialized in light factory trucks but retaining certain types of farm machinery.

Garfield Hood, who for some years has been connected with The Steel Company of Canada, Ltd., latterly at the Swansea office of the company in Toronto, is severing his connection with this firm at the end of November to become sales manager of the Ontario Steel Products Company with headquarters in Gananoque, Ontario. This is a newly created position with the latter company.

Mr. Hood's identification with The Steel Company of Canada extends over a period of seventeen years, part of which time was spent at the head office in Hamilton, Ont. Practically throughout this time he has been connected with the bolt, nut and forgings branch of the firm's business.

Canadian Machinery is informed that no appointment has yet been made of a successor to Mr. Hood at the Swansea office of The Steel Company of Canada.

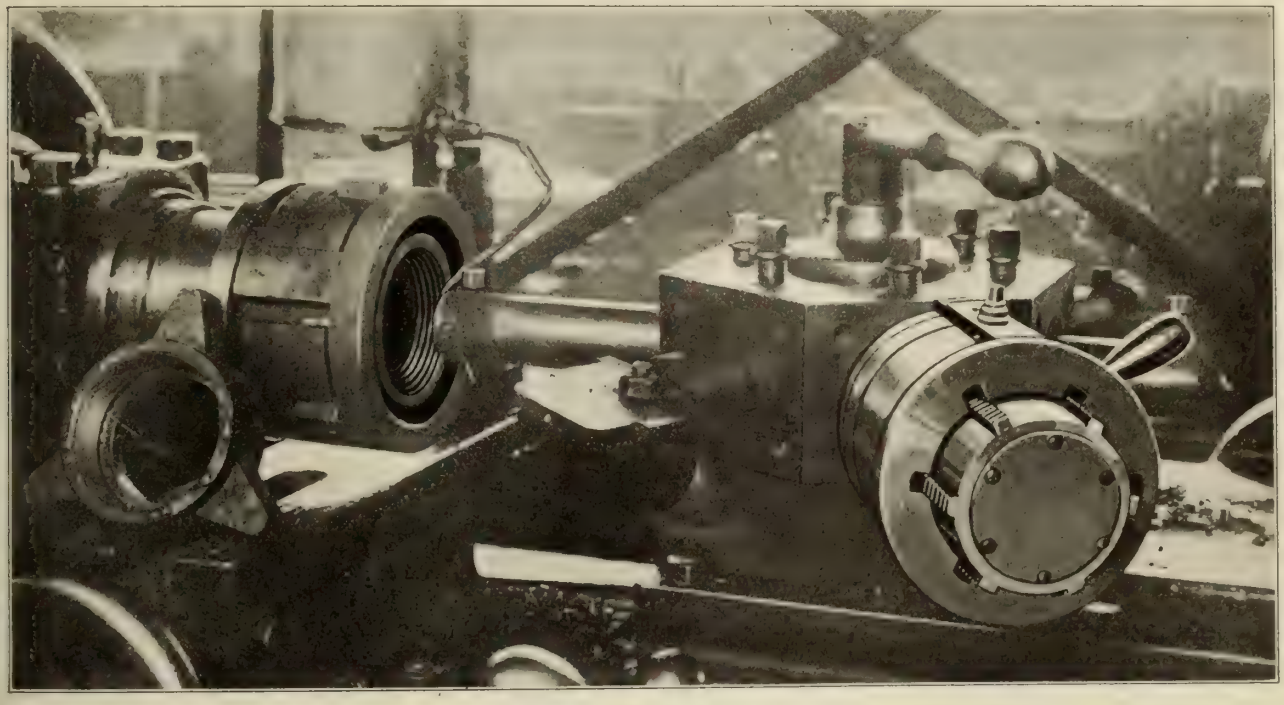
An automobile without a front axle is the proposed product of the Colonial Motors Limited, recently organized with a capital of one million dollars under a charter from the Province of Ontario. Head offices have been established in the Exchange Building at Windsor and negotiations are under way for the purchase of the war-time plant of the Canadian Detroit Lubricator Co., in Walkerville. The car, which is being demonstrated in and around the Border Cities' is a medium sized six, and is called "The Canadian." It weighs about 3,000 pounds. Earl G. Gunn, formerly with the Packard Motor Car Co., and designer of the engines of the Cole Aero-Eight and of the Oldsmobile Eight, is the designer of "the Canadian" and chief engineer of the new company. Mr. Gunn has recently designed an engine for a new American car which has not yet been announced. The Colonial Motors will have the exclusive Canadian rights to this engine. The one radical feature of the car is the construction of the front end. Instead of the usual 1-beam front axle, the steering knuckles, or spindles, are attached to the ends of two parallel, transverse, five-leaf springs placed one above the other with six inches between them and bolted at their centers to the frame of the car. The object, of course, is the absorption of shocks in travelling on rough roads. The company which is claimed to have no connection with any United States firm is composed of New York and Pennsylvania men. They declare it their intention to make a real Canadian car, using Canadian labor, and as far as possible Canadian materials.—

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CORROSION OF IRON AND STEEL IMPORTANCE OF SIMILAR MATERIALS

At a recent meeting of the Railway Club at Montreal, Allerton S. Cushman, A.M. Ph. D. director of Institute of Industrial Research Inc., Washington D. C., read a paper on the "Corrosion of Iron and Steel" dealing particularly with the developments of the last ten years.

Speaking on the subject of a book he wrote in co-authorship with H. A. Gardener on the "Corrosion and Reservation of Iron and Steel" during 1910, he said that here was advanced the electrolytic theory of the corrosion, or better expressed, the electrolytic explanation of the corrosion of metals. This statement is briefly as follows:—No metal can corrode or rust unless it first enters into solution in water or some watery solution or liquid medium. Having entered into this solution the atoms of the metal obey the laws of electrolytic dissociation. Put in practical language it may be stated that iron cannot corrode or rust unless water is present to act as a medium and unless also oxygen is present to complete the oxidation. Water causes a small portion of the metal surface to dissolve, as it were, and in dissolving the basic chemical construction of the dissolved metal is unstable and breaks up into small groups of opposite electric polarity. The electric activity increases the chemical activity and the process progresses with familiar results.

The exposure test to the atmosphere is altogether different from immersion tests and the results of one test will not permit any conclusions being drawn in regard to the other state of affairs. The doctor was rather reluctant to admit that copper, varying from a trace up to 3 per cent., introduced into iron was beneficial. In the case of immersion tests he stated it was actually detrimental, as it only tended to increase the trouble. In tests of atmosphere exposure the best he could say was that it did not do any harm. The result of his experiments was that pure iron, that is to say iron with all constituent elements such as sulphur, silicon, manganese, carbon phosphorus, etc. reduced to a total of not more than 0.16 per cent. gave the best results, as regards its ability to resist corrosion, as was particularly shown in the case of sheets and plates, etc., manufactured from this pure iron.

In the cases where metals are immersed, or a state of partial immersion exists, such as in boilers, water pipes, etc., some peculiar phenomena were described. The doctor stated that if the oxygen could be removed from the water, corrosion on the inside at least would cease. Some years ago he advocated the passing of water over iron turnings and filings before entering a system, pipe line, or boiler, and there extract oxygen from the water. Experiments along this line, conducted over a wide range of conditions and over an extended period of time, had shown that corrosion is absolutely stopped by this method, as far as all practical purposes are concerned.

Mr. Job of the firm of Milton Hersey & Co. stated that only a short time ago a boiler tube had come to his attention for analysis. In one place it was in perfect condition, and at a point not 18" away it had been corroded completely through. It was found that this corrosion had taken place in the short period of three weeks. The analysis showed the tube to be of first class metal homogeneous in stricture throughout. The cause of corrosion was that the corroded point was directly in front of the boiler feed water inlet and the oxygen in the feed water stimulated the corrosive action.

Another factor that stimulates corrosion is the riveting up of steel plates with rivets of a different chemical analysis. An instance of the effect of corrosive action due to this cause was the American light ship stationed off Cape Hatteras. This was a steel ship fabricated to the best government specifications and of very heavy construction. Swedish low ore iron rivets were specified and used. Inside of a year the ship was leaking badly and an inspection showed she was in dangerous condition. She was towed to Norfolk, Va. and examined. The rivets had become mere strings, likened to the straws of a whisk broom. An electric couple had been set up and rapid corrosion occurred. To offset such a condition it is necessary to use rivets of precisely the same analysis as the material they are holding together, or at least as near the analysis as practical. If steel rivets had been used in the above mentioned light ship she would undoubtedly be intact to-day.

Railway signal towers built several years ago on the Boston and Maine railway from a more or less mixed stock of material on hand at the time showed rapid corrosion, and it was found that the angles and other shapes entering into the construction were of widely varying analyses resulting in the harmful electric couple being created followed by the inevitable results of corrosion under such conditions. Departing a moment from the consideration of iron and steel, it was shown that a new copper roof which was tinned was corroded into a mass of finally perforated material inside of a year. Had the copper not been tinned the roof should have been good for a century as no electric couple would have been set up.

The corrosion of brass condenser tubes in a non-uniform manner was touched upon. Experiments had shown that if brass was poorly annealed and internal strains were thus present, that corrosion invariably occurs as zinc is lost from the brass under such conditions, and the physical properties of the metal are weakened and it consequently breaks down. In the general discussion that followed the reading of the paper, professors of metallurgy at McGill, Milton Hersey, representatives from the American Rolling Mills, The Pedlar People, Oshawa, and many other men, prominent in the metallurgy field, gave various experiences of corrosion difficulties.

An aged consulting engineer from Russia, Mr. Gordon, expressed his deep appreciation of Dr. Cushman's paper and related an instance of a bridge over a river entering the Sea of Azof where an electrical couple had been set up between the rivets and the bridge members with the resulting rapid corrosion. He stated that in repairing, a special paint was used to insulate the new rivets from the members. The results he was not able to give, as the recent troubles had driven him from that section of the country. It was the opinion of Dr. Cushman and others that the paint was a good insulator and the success of the expedient depended entirely on the life of the paint and its ability to resist deterioration.

PECULIAR REPAIR JOB

A job which has been bothering expert engineers for some weeks past is the repair of the Bascule bridge over the St. Mary's American ship canals, and said to be the largest bridge of its kind in the world. Early in October, gusset plates were found torn in the bridge with the counter weight at the southern end of the jackknife displaced. One support beam was broken and another badly twisted, and C. P. R. connections across the bridge were held up for over a week, while 100 men were rushed from Chicago to effect repairs. Traffic has been resumed, but the southern span has to be kept stationary, and cannot be raised. The cause of the trouble originally is believed to have either been from a flaw in the material in the gusset plates, or from some sudden impact on the bridge. The structure has been in operation since 1914, and by reason of its opening up in the centre, by means of counterweights at either end, with the spans raised perpendicularly, it is known as the "Jackknife bridge." The counterweight at the south end was lowered four inches out of place. It is a cemen block 1400 tons in weight and to get i back in place with a limited amount o room for the workmen proved difficult Over 30 jacks were used, fifteen 100 to compressed air jacks, ten 50 ton jacks and five smaller ones were put in ser vice. Over 50 men were employed o the jacks alone.

ELECTRIC DRILL

The Black and Decker Mfg. Co., Baltimore, Md., have added a new to to their list, in the form of a "Lig Quarter-inch Electric Drill" with pist trip and trigger switch, designed to dr metal or wood. The drill has an alumi um alloy housing, double reduction gea ing, giving a no-load speed of 1,6 r.p.m., and weighs only five poun The construction is such that it c be used to drill a hole right up in close corner. It can drill within inch of an obstruction. The drill is v accessible and the cord is supplied w a clamp which removes all strains t have a tendency to pull the cable t minals loose.

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631: Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.
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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

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FOR SALE—1, 5, 7½ AND 10 H.P., 550 VOLT, and 3, 8, 15 and 20 H.P., 220 Volt, 25 Cycle, Motors; good condition. Canadian Linderman Co., Limited, Woodstock, Ont. (C20M.)

1—40 H.P. MOTOR, 750 R.P.M., 550 VOLTS, 25 Cycle, 3 phase.
1—50 H.P. MOTOR, 750 R.P.M., 550 VOLTS, 25 Cycle, 3 Phase.
1—25 H.P. MOTOR, 750 R.P.M., 550 Volts, 25 Cycle, 3 Phase.
3—TRANSFORMERS, 25 CYCLE, 1 PHASE. Volts, 2200, 1100 to 550.
For prices and further information apply to General Forgings and Stampings, Limited, Merritton, Ontario. (C20M)

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Oxygen, Acetylene, and complete line of Welding and Cutting Supplies.

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ADVERTISER WOULD LIKE TO HEAR FROM a man who first of all is a real salesman; who has vision and a capacity for putting across big things. He should possess a knowledge of the Canadian trade, and of machine tools, and up-to-date engineering practice. State age, experience, and sufficient information to enable us to determine whether you are the man we want. The salary we are prepared to pay is big enough to attract a big man. If desired, information regarding identity of advertiser may be secured from Canadian Machinery before sending application. Apply Box 794N, Canadian Machinery.

HELP WANTED

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Sheffield, England, steel mill wants good workman for Log Band Saws (all sizes). Must be capable of brazing, tensioning, and straightening. Give full particulars of experience in this work and where obtained. State wages expected. Box 796, Canadian Machinery. (c20m)

SITUATION WANTED

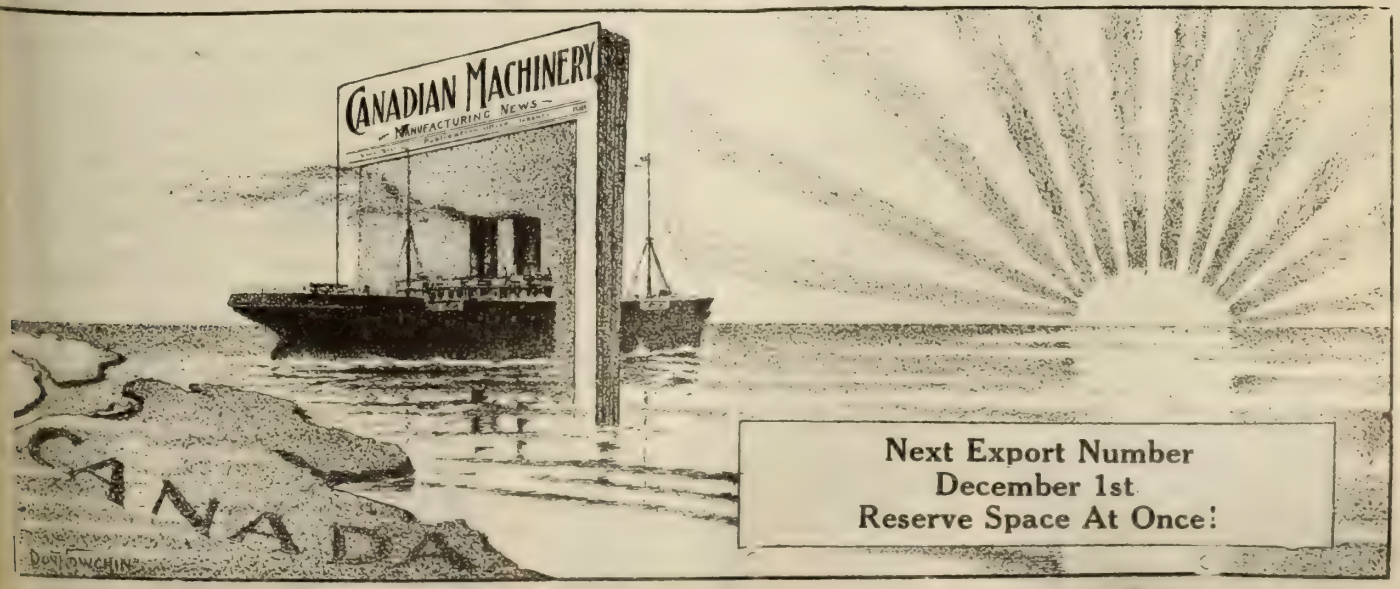
SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 795 Canadian Machinery. (c23m)

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Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

Machinery Wanted

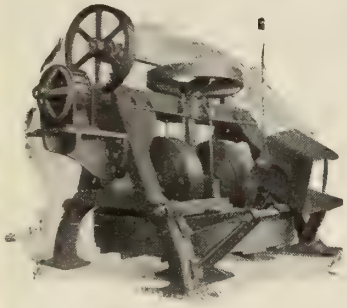
Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.



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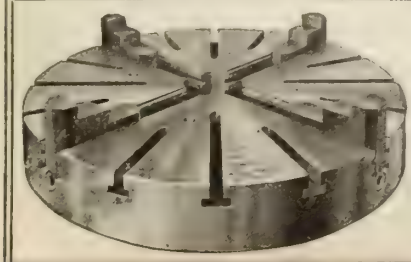
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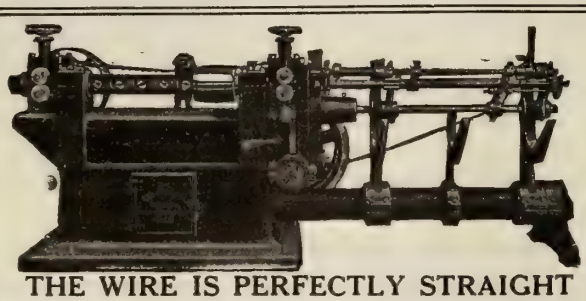
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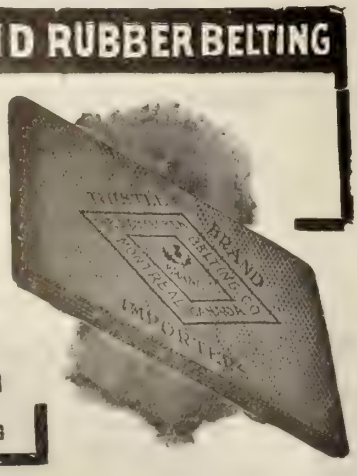
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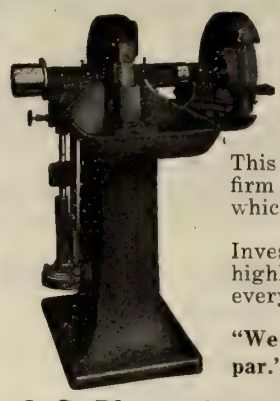
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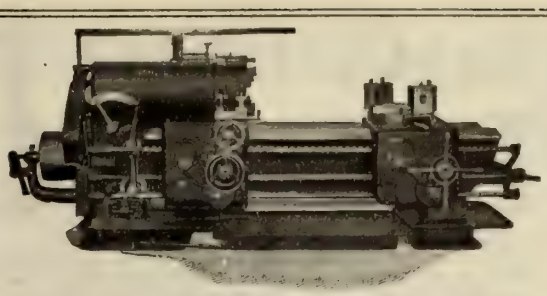
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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd.,
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Prest-O-Lite Company, Toronto.

Accumulators, Hydraulic
Stewart & Co., Duncan, Glasgow, Scot.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

For list of Dealers see the last page of This Buyers' Directory

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Building Materials
Robertson Co., H. H., Cleveland.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bort
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd., W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

ar Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

BUYERS' DIRECTORY

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyers
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa
Fisher Motor Co., Ltd., Orillia, Ont

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont
Petrie, Ltd., H. W., Toronto, Ont

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q
Hepburn Ltd., John T., Toronto, Ont

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. R., New Haven, Conn.
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R. Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford; Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.

Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton,

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.

Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, I
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Kempsmith Mfg. Co., Milwaukee, Wis
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.
Charles Parker Co., Meriden, Conn

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
See Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co. Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

CANADIAN MACHINERY AND MANUFACTURING NEWS

143 UNIVERSITY AVE., TORONTO, CANADA

CANADA—Montreal, Southam Bldg., 128 Bleury St., Phone Plateau 946. Winnipeg, 901 Confederation Life Bldg., Phone Main 3449. Vancouver, 314 Carter-Cotton Bldg., 198 Hastings St. West. St. John, N.B., John S. Scott, General Delivery.
GREAT BRITAIN—London, The MacLean Publishing Company of Great Britain, Limited, 88 Fleet St., E. C., E. J. Dodd, Director, Telephone Central 12960. Cable Address: Atabek, London, Eng.
UNITED STATES—New York, J. J. Gillen, 1606 St. James Bldg., 1133 Broadway, Phone Watkins 5869. Boston, C. L. Morton, Room 734, Old South Bldg., Phone Main 1024. Chicago, A. H. Byrne, 405-6 Transportation Bldg., 608 S. Dearborn St., Phone Wabash 9430. Cleveland, W. L. Gifford, 1811 Allandale Ave.

THE

TRADE K—T MARK

FOUNDRY
GALT, ONT.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25 per cent.; a different method of molding them might double your production at no increase in molding cost. We can advise you and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us. Ask us.

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

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Are *YOU* Represented ?

The Annual Review Number, December 29th 1921 will contain special features. Forms close Dec. 1st.

CANADIAN MACHINERY, *143 University Ave.*
TORONTO, CANADA

Rounding the Corner

Better business requires co-operation between buyer and seller.

Manufacturers have made heavier price reductions than the present cost of doing business warrants. We hope to justify these lower prices by increasing sales and hammering away at the costs of production and selling. Substantial economies have already been made along these lines.

Johansson offers his customers the benefit of these economies, confidently counting upon the co-operation of intelligent buying.

In putting new gage prices into effect, we have protected all Johansson dealers so they can cheerfully pass these reductions along to the consumer at once. Buyers know the advantage of being served by enthusiastic dealers.

Johansson Gages possess advantages of design, maximum utility, accuracy and permanency which attract the careful buyer. Economy requires no sacrifice in quality.

When you need gages, you need the best.

Consult Johansson.

Standard Gages
Adjustable Snaps
Tolerance Plugs
Standard Plugs
Ring Gages
Adjustable Plugs
Angle Gages
Special Gages



C·E·Johansson·Inc
POUGHKEEPSIE·N·Y

Johansson Dealers

CHAS. A. STRELINGER CO. LTD., Windsor, Ont.
AIKENHEAD HARDWARE Toronto, Ont.
WILLIAMS & WILSON, LTD., Montreal, Que.

Emblem of Integrity

LIQUID AIR Co

Standard of Excellence

OXYGEN
ACETYLENE
BLOWPIPES-REGULATORS
FILLING RODS - FLUXES
ACCESSORIES

THE LIQUID AIR Co

SOCIÉTÉ L'AIR LIQUIDE

FACTORIES FOR SERVICE

HALIFAX, THREE RIVERS, MONTREAL, TORONTO,
LONDON, SUDBURY, WINNIPEG, CALGARY, VANCOUVER.

OPERATED IN CONJUNCTION WITH A CONTINENT WIDE NET-WORK OF DISTRIBUTION STATIONS



"Liquid Air" Oxygen Means a Saving in Transportation

With a network of Factories, not only planned, but in actual operation, and a number of Distribution Stations situated at all large centres all over Canada, Purchasers of Oxygen can obtain their supplies at a point very near to the point of consumption. This completely obviates heavy freight charges on cylinders and assures an immediate supply at any time within a few hours and even minutes after the orders are placed.

All cylinders conform to the specifications of the Canadian Railroad Board and are made to ensure safety without unnecessary weight. When purchasing "Liquid Air" Oxygen you not only save on freight, but in very many cases this expense is almost eliminated.



CANADIAN MACHINERY
MANUFACTURING NEWS

Vol. XXVI., No. 21 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Nov. 24, 1921 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Your Business for 1922

There are indications on every side that business is improving. There is a growing confidence and optimism. There is a realization that the time of waiting is past. There is a noticeable concern on the part of manufacturers and dealers about the coming race for business, and there is already in evidence a keen jockeying for position.

THE YEAR 1921 has been abnormal—an aftermath of the war. The year 1922 will be what you make it. The process of shrinking, deflation and readjusting has been going on with relentless thoroughness. It remains now to take up and carry on from almost the exact point where we left off seven years ago.

The forced apathy and idleness of the past year are giving place to aggressive thought and action, and there is every promise of keen and intelligent sales effort. This is needed if we are to start something. This is a time for aggressive leadership. A forward drive by everybody using constructive sales methods would produce surprising results. There is a responsibility resting with every firm to do whatever can be done to revive business, because whatever is accomplished by one, directly or indirectly affects and benefits the other. All should pull together.



ONE OF THE prime necessities at this time is advertising of a virile, constructive character. It will inspire confidence in the buying public, and it will inspire confidence in the men who are doing the selling. The need of it now is vital if we are to look for a recovery of business. Many firms, through force of circumstances, have been compelled to curtail their advertising, but this policy, if persisted in, would be most disastrous, and its extreme danger would be noticed only after the harm had been done. Many of the largest and most successful firms are big advertisers, and it is a significant fact that their advertising has been kept going to an efficient degree during all the trying period through which the world has just passed. If your advertising has not been kept up to full efficiency during the past year, then your handicap will be all the greater if you postpone a resumption of your publicity.

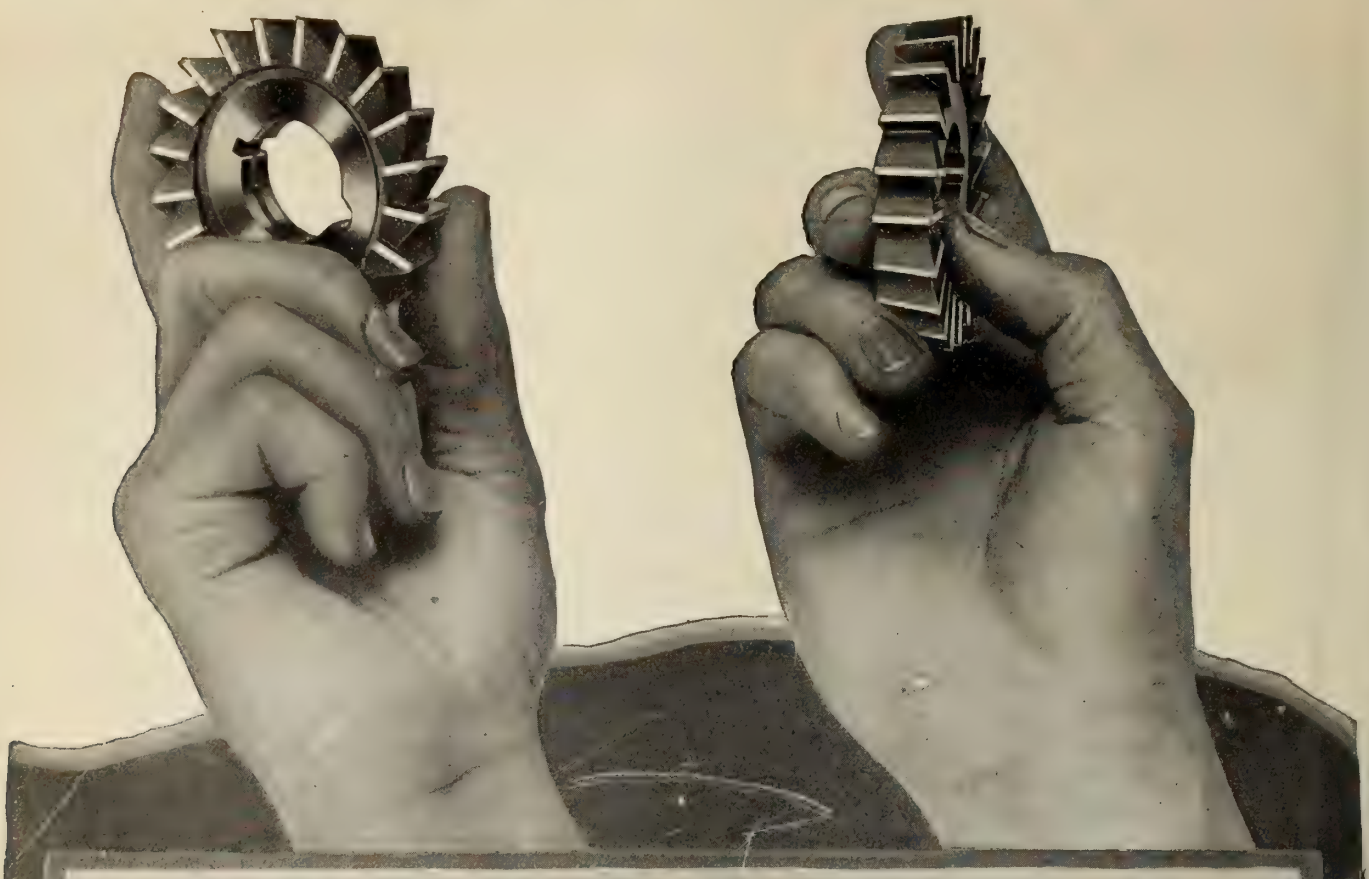
If you wish to reach the metal-working industry of Canada in a most effective manner, then it will pay you to get full information about CANADIAN MACHINERY without delay. Our "Annual Review Number" will be published Decembr 29, 1921. This will be the biggest buying number of the year, and will be reserved for reference purposes for many months. You should have an effective message in this number and follow it up with regular space.

1922 will be largely what you make it.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron, Steel, and Metal Working Industries. Member of the A. B. C., Associated Business Papers and Canadian Newspapers and Periodicals Association.

THE MACLEAN PUBLISHING COMPANY, LIMITED
143 University Avenue, Toronto, Canada



If it's speed you need--

One trial will prove the advantage of Pratt & Whitney Milling Cutters. No matter what the nature of the work they will give you the highest production the machine is capable of.

They're designed for free, fast cutting. And tempered and seasoned to last longer.

PRATT & WHITNEY MILLING CUTTERS

Ask us for prices and details on Plain Milling Cutters, Side Milling Cutters, Inserted Blade End and Side Cutters, Screw Slot Cutters, Coarse Tooth Side or Plain Milling Cutters, Involute Gear Cutters, Concave, Convex and Double Angle Cutters, Cutters for Spiral Mills, Roll Thread Die Hobs, Key-Seating and Slotting Cutters, Straight and Spiral Cut End Mills (B. & S. and M. T. Shank), Spiral and Straight Shell End Mills, etc.

And we make formed cutters for special work also. All are backed by the guarantee for goodness that the P. & W. trademark indicates.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Works: Dundas, Ontario

MONTREAL
723 Drummond Bldg.

TORONTO
1002 C. P. R. Bldg.

WALKERVILLE
103½ Sandwich St.

WINNIPEG
1205 McArthur Bldg.

HALIFAX
Roy Building

VANCOUVER
B. C. Equipment Co.

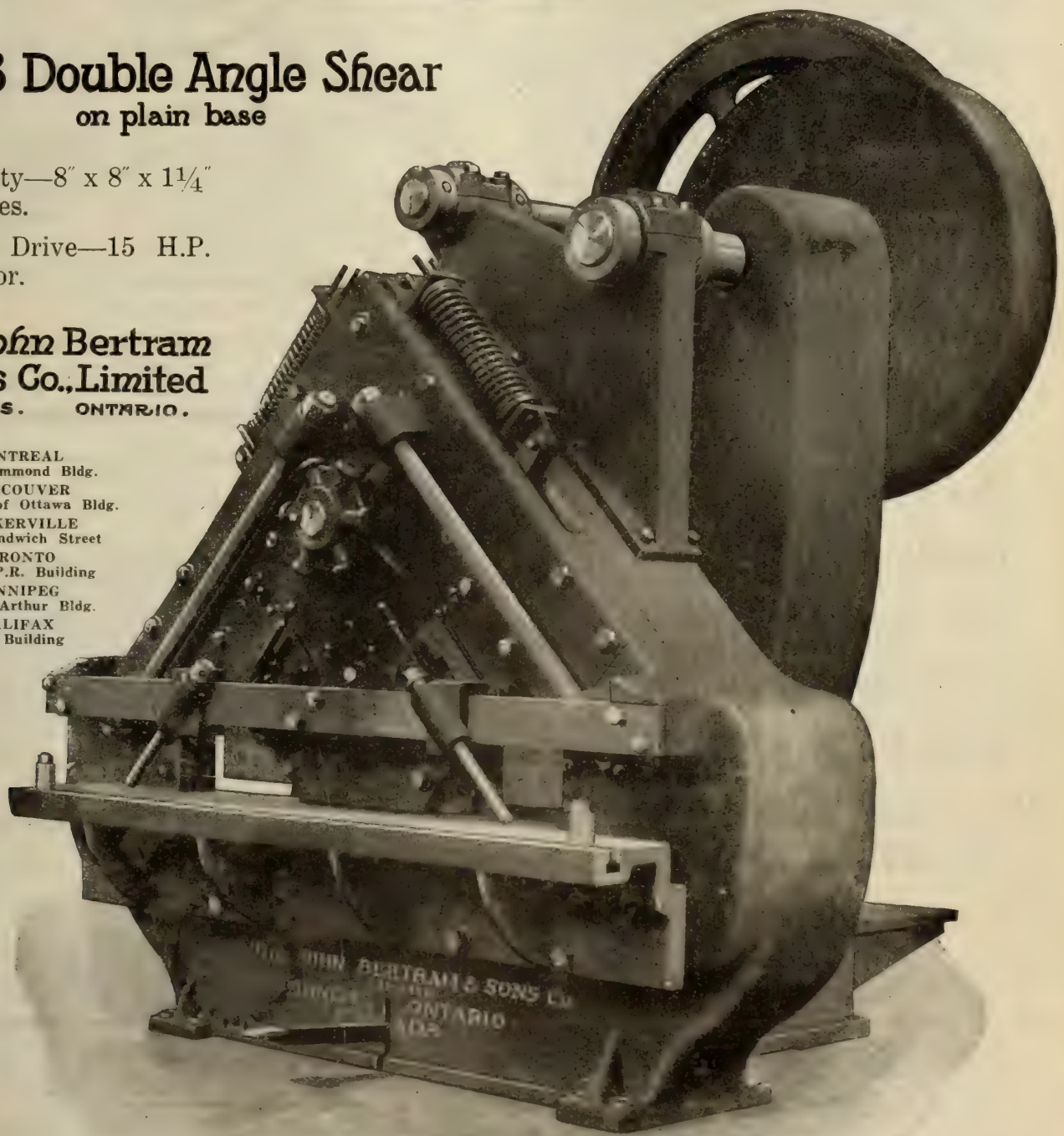
The BERTRAM Page

MACHINE TOOLS

No. 8 Double Angle Shear
on plain base

Capacity—8″ x 8″ x 1¼″ angles.

Motor Drive—15 H.P. Motor.



P13201

The John Bertram & Sons Co., Limited
DUNDAS. ONTARIO.

MONTREAL
723 Drummond Bldg.
VANCOUVER
609 Bank of Ottawa Bldg.
WALKERVILLE
103½ Sandwich Street
TORONTO
1002 C.P.R. Building
WINNIPEG
1205 McArthur Bldg.
HALIFAX
Roy Building

It is just as unreasonable to attempt a filing job with a file that has begun to get dull as it would be to run a machine without oil.

Full service from a file is possible only when the teeth cut keenly.

Discard a file as soon as it ceases to do this, and buy a new one.

To get long-lasting efficiency, specify one of these brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario



STRENGTH

Strength is a very essential quality in a wrench, but it does not depend entirely upon bulk or weight of metal. The strength and long-lasting qualities of Armstrong Wrenches are the result of skilled combination of the Best Steel, Expert Design, Accurate Machining, and Heat Treatment. All kinds and sizes.

Write for free catalogue

Armstrong Bros. Tool Co.
"The Tool Holder People"
335 N. Francisco Ave., Chicago, U. S. A.

REAL FIRE BRICK SERVICE

When you buy Elk Fire Brick we sell you a brand with the qualifications equal to the duty for which it is intended. We do not recommend the best quality brick for a certain job if a lower-priced brand will stand up just as well. Each brand of

ELK
FIRE BRICK

has some particular qualification which fits it to give better results in certain places than other brands we produce.

OUR BRAND

"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
"Keystone"
"M.D. Elk"
"Rotex"
"Elk Dust"
"Keystone Dust"
"Rotex Dust"

Try us on your next fire brick needs. You'll find both our quality and service right.

Large stocks of various shapes carried in warehouse in Hamilton.

ELK FIRE BRICK CO. OF CANADA
LIMITED
Sun Life Building, HAMILTON, ONTARIO

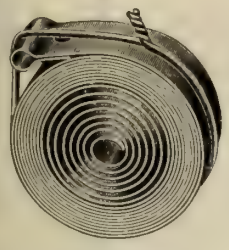
SPRINGS

WIRE BARNES CANADIAN SPRINGS STEEL



Better Springs!

For over half a century the policy of our plant at Bristol, Conn., has been—"Better than the Average." and the Canadian plant will hold to the same principle. If you require Springs for uncommonly severe duties—or for better service on ordinary work, get our quotations. All sizes for all purposes.





FIFTY YEARS OF QUALITY

The Wallace Barnes Co.

LIMITED

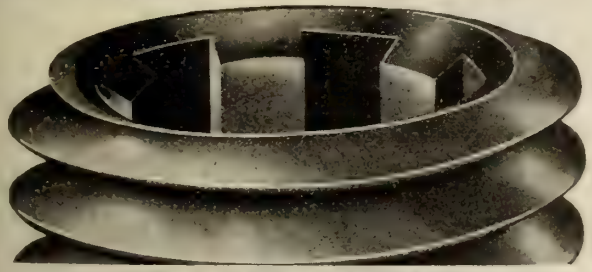
Main St. W. HAMILTON

TRADE MARK

BRISTO

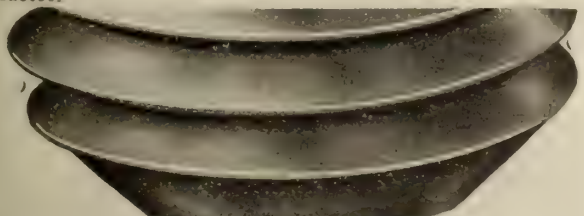
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PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.



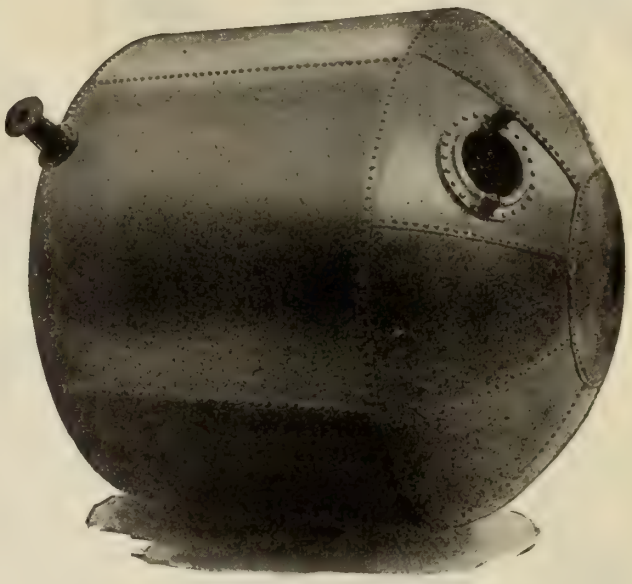
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THE BRISTOL COMPANY

Waterbury, Conn., U. S. A.

STEEL TANKS

LIGHT and HEAVY



T.I.W. STEEL PLATE CONSTRUCTION

If it's a tank or any piece of steel plate construction we can make it.

Here are a few of our lines:

STORAGE TANKS
for—
Oil Refineries
Oil Distributing Stations
Sugar Refineries
Distilleries
Packing Houses
Soap Works
Chemical Works
Asphalt Plants
Cyanide Installations
Varnish Works

PRESSURE TANKS
Filter Tanks
Air Receivers
Hydro-Pneumatic Tanks
Hot Water Tanks
Blow-off Tanks
Steam Jacketed Tanks

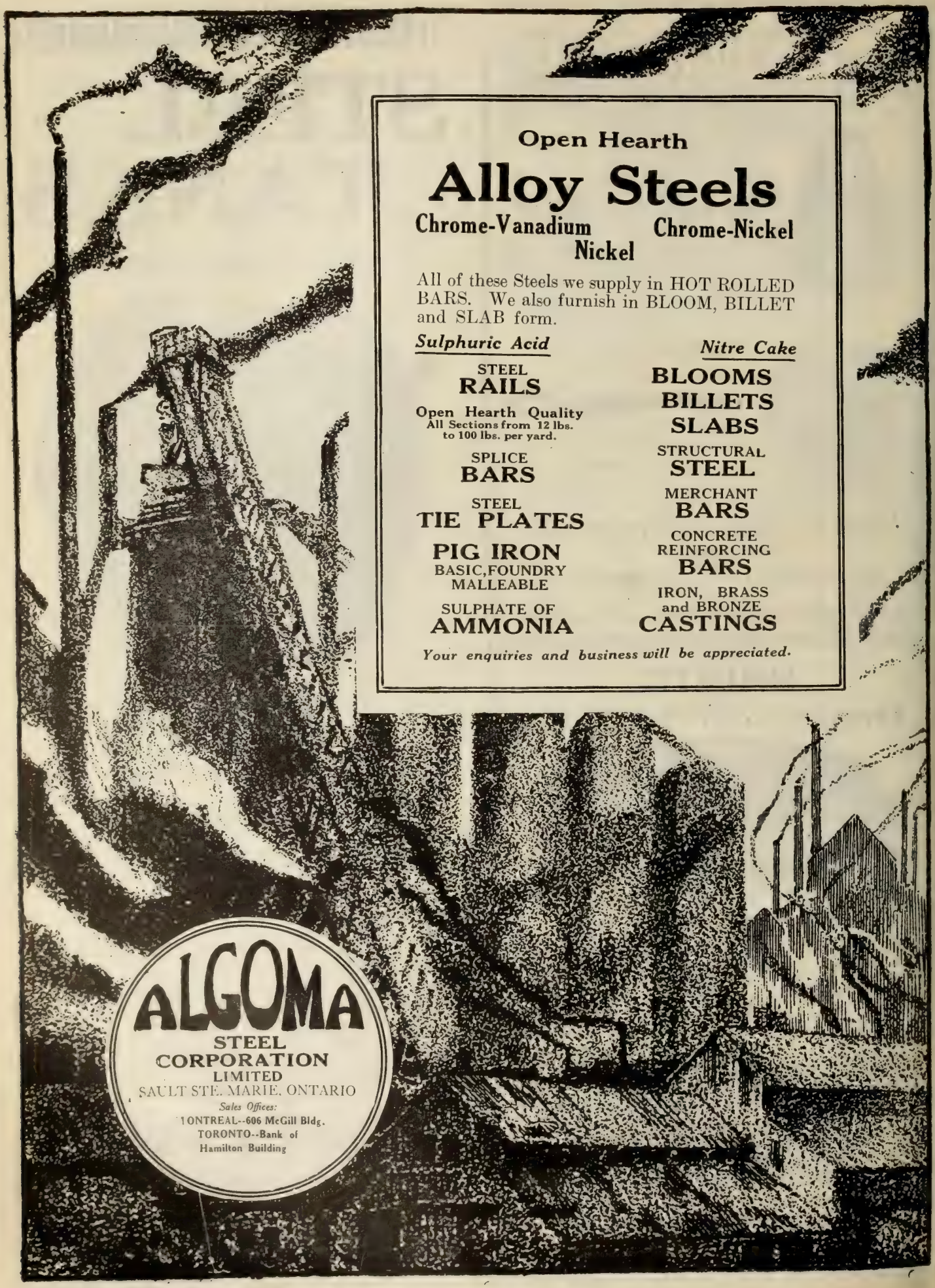
BINS and HOPPERS
for—
Coal and Ash Handling Systems
Grain Elevators
Mines and Quarries.

SMOKE STACKS
BOILER BREECHINGS
RIVETED STEEL PIPE
PENSTOCKS
CAISSONS
TANK WAGONS

Consult us about your requirements or for Acetylene or Electric Welding.

THE TORONTO IRON WORKS LIMITED

HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET


Open Hearth
Alloy Steels
Chrome-Vanadium
Chrome-Nickel
Nickel
All of these Steels we supply in HOT ROLLED BARS. We also furnish in BLOOM, BILLET and SLAB form.
Sulphuric Acid
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STEEL RAILS
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All Sections from 12 lbs. to 100 lbs. per yard.
SPLICE BARS
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BASIC, FOUNDRY
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SULPHATE OF AMMONIA
BLOOMS
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SLABS
STRUCTURAL STEEL
MERCHANT BARS
CONCRETE REINFORCING BARS
IRON, BRASS and BRONZE CASTINGS
Your enquiries and business will be appreciated.
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STEEL
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LIMITED
SAULT STE. MARIE, ONTARIO
Sales Offices:
MONTREAL--606 McGill Bldg.
TORONTO--Bank of Hamilton Building

NAMCO

"SPECIALS"



Special

Screw machine product up to 2¼ in diam.—to specifications. Hardened and ground screw product—to specifications.

Standard

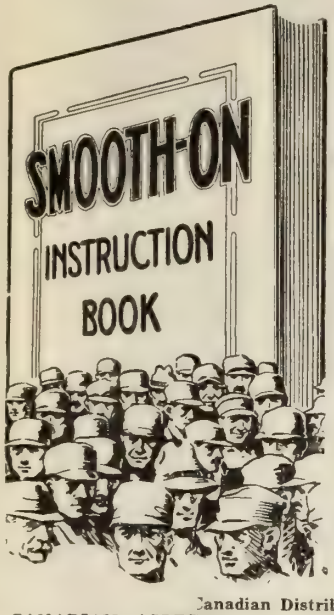
V. & U.S.S. Semi-finished Nuts.
V., U.S.S. & S.A.E. Cap Screws.
V. & U.S.S. Set Screws.
S.A.E. Plain and Castellated Nuts.

THE NATIONAL ACME COMPANY
MONTREAL, P.Q.

SMOOTH-ON IRON CEMENTS

What Other Engineers KNOW About Repair Work, This Free Book Tells YOU

It is full from cover to cover of practical ideas developed to meet actual emergencies. There is no theory in



SMOOTH-ON Instruction Book
NUMBER 18

It's 144 pages of real facts — facts that — if you knew them—might save you hours — or days — and dollars in your next repair job.

Write for it today---
It's FREE

SMOOTH-ON Mfg. CO.
Jersey City, N.J., U. S. A.

Canadian Distributors:
CANADIAN ASBESTOS C O., Montreal, Toronto, Canada

WRIGHT HOIST



Speedy — Powerful

A hoist that is built to stand the hardest service. Easy to handle—a lift that is absolute at any height. Will outlast any hoist on the market.

Start with a **Wright** and you finish right.

Let us send you a catalogue.



WRIGHT MANUFACTURING COMPANY
LISBON, OHIO, U.S.A.

Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force cannot replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every month will keep you posted on the latest developments for machinery equipment.

BANFIELD

Are Your Stamping Requirements Unusual?

WE ARE PREPARED TO SERVE YOU

We have been asked, "What don't you make" in Metal Stamping, Drawing, Forming, Finishing, Assembling?

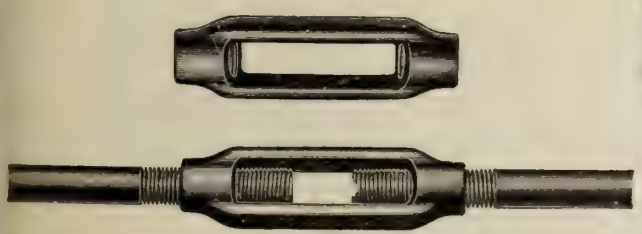
Dies, Tools, Jigs, as well. Let us quote. Your Blueprint and Specifications will bring an immediate answer.

W. H. BANFIELD & SONS, LIMITED

370-386 PAPE AVE. - - - TORONTO

CANADA FOUNDRIES & FORGINGS LIMITED

Drop Forged Steel



SOLID—NOT WELDED

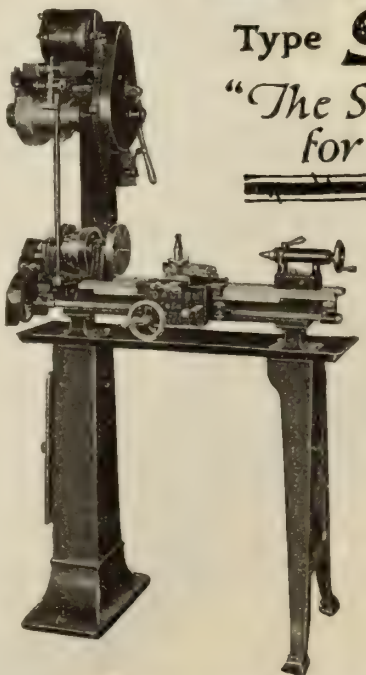
16 Sizes with / without } Stubs

Canada Foundries & Forgings

Welland, Ont.

"DALTON Type SIX" B-4

"The Small Lathe for the Big Job"



Actual Swing 7¼ inches

Motor Driven Lathe for AC or DC

Made with 30" and 36" Length of Bed

Write for Bulletin BC-672

Dalton Manufacturing Corporation
Sound Beach, Connecticut, U. S. A.
Cable Address "ALEDAL Stamford"
Also Manufacturers of Type B-6 Lathes

THE JOHNSON FRICTION CLUTCH

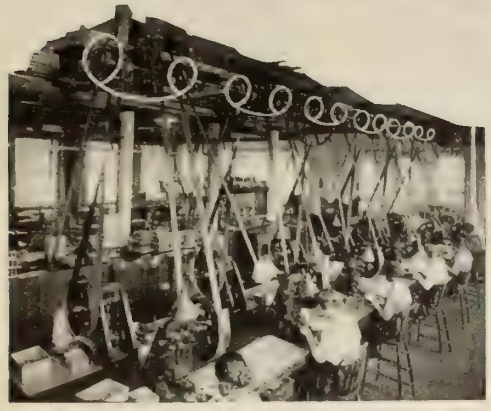


Illustration by courtesy of The New Departure Manufacturing Co., showing bench presses in operation at their Elmwood Plant.

It's a Johnson Lineshaft Drive

A battery of twelve light presses, all on a bench about 30 x 5, driven from one lineshaft with Johnson Clutches controlling the machines.

COMPARE IT FOR FIRST COST

Twelve Clutches against twelve complete counter shafts, or twelve individual motors.

COMPARE IT FOR EFFICIENCY.

Quick, smooth control against the sluggish tight and loose pulley. Or one motor consuming current instead of twelve.

COMPARE IT FOR SERVICE.

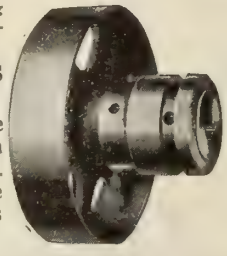
You know the failing of belts—the continual attention they require, especially when they are shifted. If you don't know Johnson Clutch Service, just give it a trial.

Write for our booklet

"Clutches As Applied to Machine Building" and our Yellow Catalog.

FRICTION CONTROL MEANS BETTER MACHINERY

We specialize in applying the proper type of friction clutch on any sort of an installation. Standard clutches available from stock, and special models developed to suit conditions.



CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



Machine Shop and Construction Supplies



THE Rice Lewis line includes Pipe Vises and Pipe Wrenches, Micrometers, Torches, Set Screws, Machine Screws, High-Speed and Carbon Drills, Files and Machinists' Tools of every description.

We also carry large stocks of Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel.

Quotations as to prices and dates of delivery upon request.

RICE LEWIS & SON, LIMITED

19 Victoria St. *Established 1847* **Toronto, Ont.**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

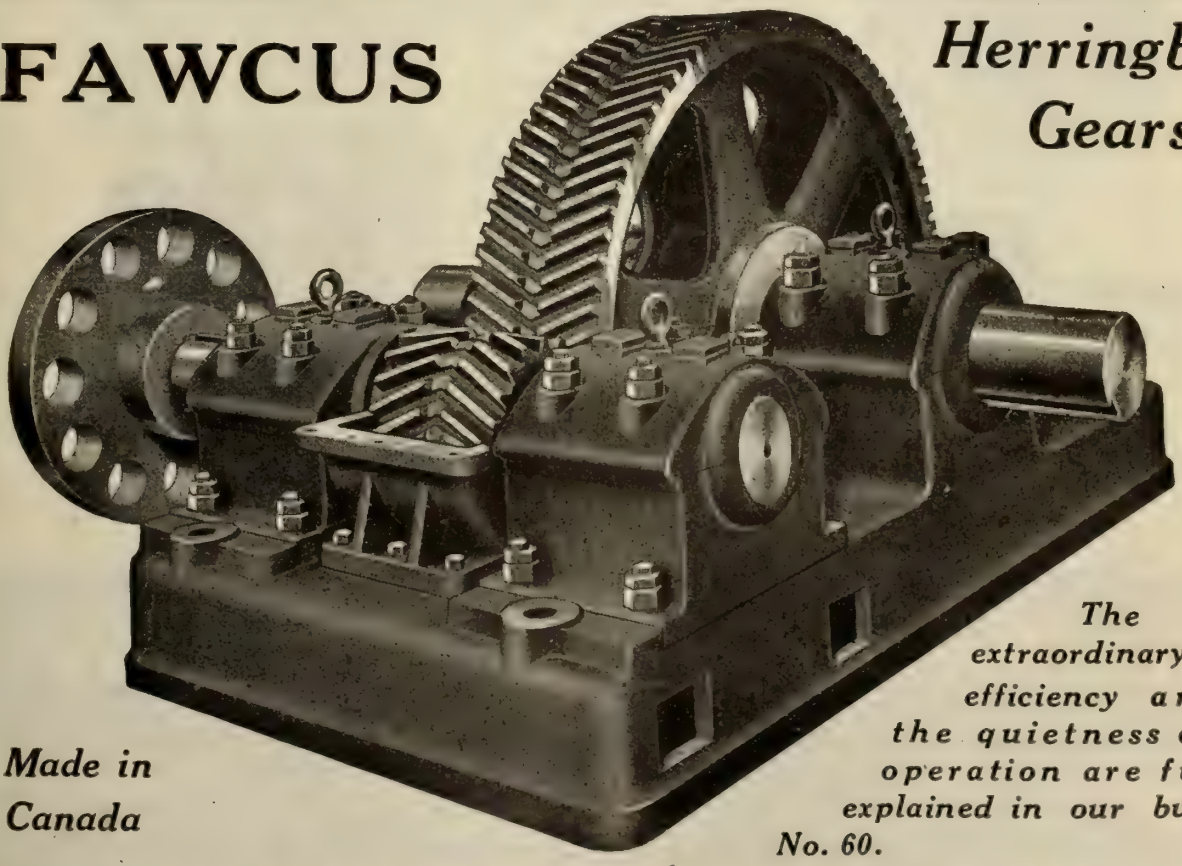
Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

FAWCUS

Herringbone Gears



Made in Canada

The extraordinary efficiency and the quietness of operation are fully explained in our bulletin No. 60.

DOMINION STEEL PRODUCTS CO., Ltd. BRANTFORD, Ont.

CUTLER - HAMMER



Magnet and Control Devices

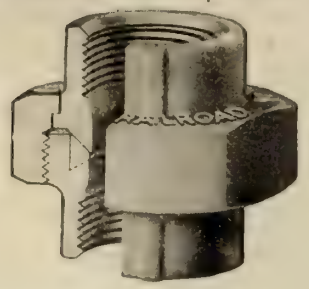
¶ Cutler-Hammer Lifting Magnets and Magnetic Separators have proved of exceptional value in the mining field, in steel mills and in many other industries for lifting and separating metals. The Magnetic Clutch and electrically operated Brake, used primarily in steel and rubber mills and for crane control repectively, are widely applicable to many industries where the gradual engagement or adequate braking of a load is desirable.

¶ In electric controlling devices of all kinds Cutler-Hammer is the recognized standard of dependability, whether for fine speed adjustment of a machine, extremely close voltage regulation, the wonderful light dimming and colour effects in a modern theatre, or the automatic control of heavy loads or other special operations.

¶ Details and recommendations of suitable Cutler-Hammer apparatus for your control problems are available at our branches.

Northern Electric Company
LIMITED

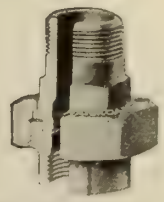
Montreal Quebec Toronto London Regina Edmonton
Halifax Ottawa Hamilton Windsor Winnipeg Calgary Vancouver



No. 519



No. 517 Reducing Pump Stud Union.



No. 519½. Male and Female Union.

CRANE

RAILROAD UNIONS AND FITTINGS



No. 594 Tee with Female Union.



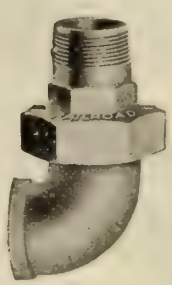
No. 595 Tee Reducing or Outlet



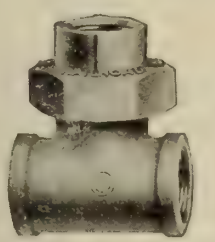
No. 596 Tee with Male Union.

Are Absolutely Leak-Proof, and Eliminate Unnecessary Joints.

THEY REQUIRE NO GASKETS AND MAY BE TAKEN APART EASILY.

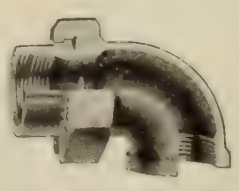


No. 592 Elbow with Male Union



No. 598 Tee Union on Outlet.

Manufacturers of Valves, Fittings and Piping Equipment and Distributors of Pipe Plumbing and Heating Supplies.



No. 590 Elbow with Female Union

CRANE
LIMITED
HEAD OFFICE & WORKS
1280 ST PATRICK STREET
MONTREAL

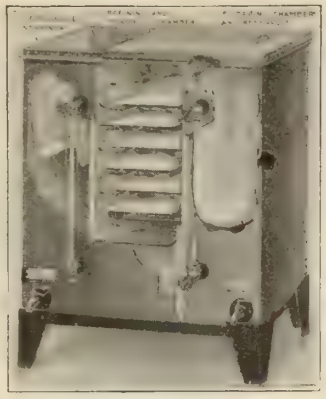
Branches and Warehouses:
HALIFAX, OTTAWA, TORONTO, WINNIPEG, REGINA, CALGARY, VANCOUVER.

Sales Offices:
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ST. JOHNS.

CRANE-BENNETT
Limited
Head Office and Warehouse:
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Sales Offices:
MANCHESTER, BIRMINGHAM.
LEEDS, GLASGOW.

31



Increase Production— Reduce Expense

Operators of Power Plants and Engine Rooms and other machinery for which Lubrication Systems are required report savings in lubrications costs of as high as 60% when they filter their oil. Filtration makes it possible for them to use the same oil over and over again.

Many have found the solution of these filtration problems in Bowser Filtration Equipment, because Bowser not only greatly reduces the necessary amount of oil used, but keeps it *pure and clean.*

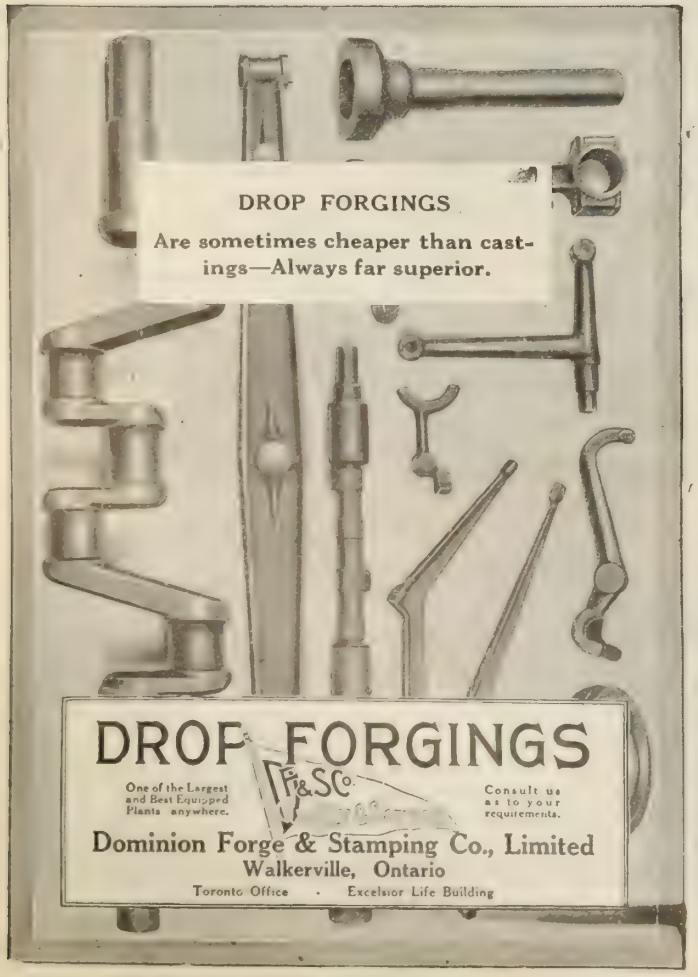
Thus the Bowser System reduces operating expenses and increases production.

That's why Bowser Equipment will be a profitable investment for you.

WRITE FOR ILLUSTRATED BOOKLET C-13

Bowser Equipment is MADE IN CANADA by
S. F. Bowser Co. Ltd., 1368 Fraser Ave., Toronto, Ont.

BOWSER ESTABLISHED 1885



STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

Bilton

GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

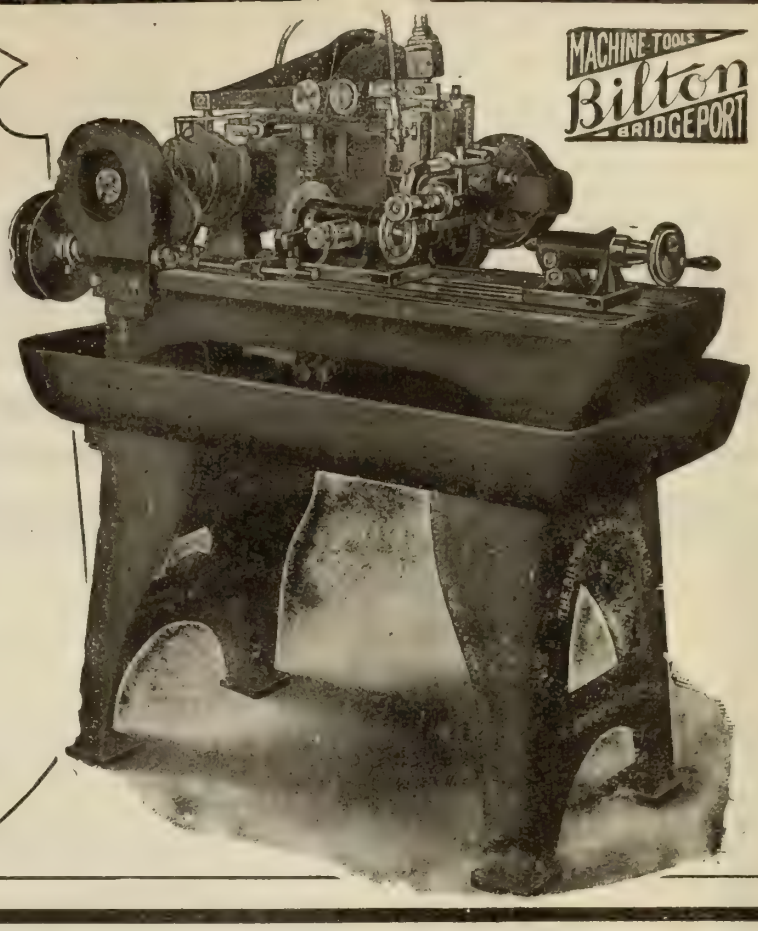
Big business everywhere is adopting the Bilton for high production on accurate work.

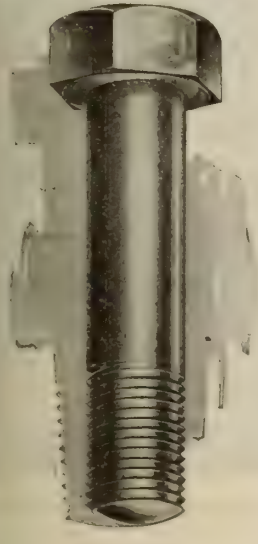
May we send you our catalogue?

Bilton Machine Tool Company

Bridgeport, Conn., U.S.A.

Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co.,Ltd.
M. Mett Engineering Co.





ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

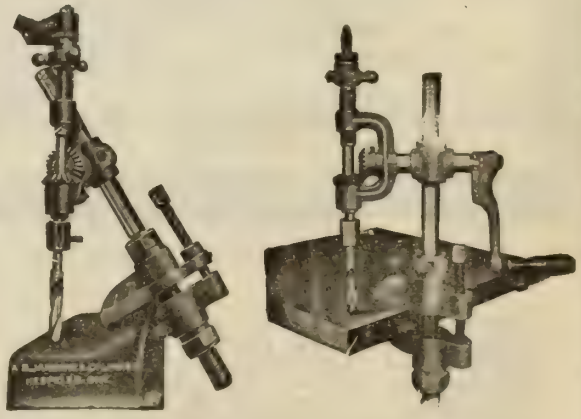
GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.

Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

TRAFFIC —
a science in itself

Only the institution operating on a major scale can maintain that type of fully-manned, thoroughly-experienced Traffic Department which best guards a buyer from shipping delays, needless freight charges and interruption of production-schedules. It is more than a man-sized responsibility—it is an organization-sized job for a specialized staff such as M. A. Hanna & Co. maintain at all times.

HANNA

M.A. HANNA & CO.

Cleveland Toronto Cincinnati
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STEEL *for*
Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.



Steel Ingots
by the
HARMET
Liquid Process

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL

Are *YOU* Represented ?

The Annual Review Number, December 29th 1921 will contain special features. Forms close Dec. 1st.

CANADIAN MACHINERY, *143 University Ave.*
TORONTO, CANADA



Save Your Steam!
Get Care-free Service!

HEPBURN
Steam Pumps

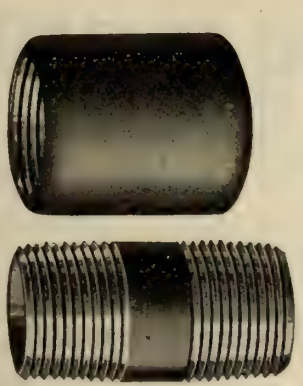
Combine two advantages so much sought after in an up-to-date pump. *They economize in steam*—on account of the long regular strokes and the absence of water in the steam cylinder. *They give care-free service*—because there are no levers or tappets to get out of order. Working parts are few, and the valves are accessible. A glance at the illustration will show this.

Whether you want Pumps or Vertical Engines, Compressors, Winches, Cranes, Power Presses, or just Castings, we can give you satisfaction. Our representative will be pleased to call and talk over your problems with you.

JOHN T. HEPBURN LTD.
Engineers and Iron Founders
18-60 Van Horne Street, Toronto.

WROUGHT PIPE
COUPLINGS and NIPPLES





Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black, or galvanized.

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL

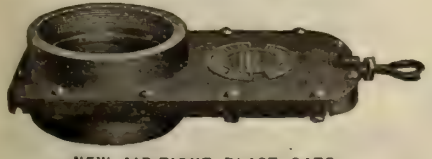
Operators Prefer New Air-Tight Blast Gate

Detroit, Mich.

Air-Tight Blast Gates are giving very good satisfaction, and our operators prefer them to either valves or cocks for the air line.

LINCOLN MOTOR CO.

There are many reasons why—Low first cost and upkeep—Easily and quickly operated—Afford full area of the pipe.



NEW AIR-TIGHT BLAST GATE
Light, Strong, Compact, Inexpensive, Quick-Acting

An ideal substitute for heavy, cumbersome, expensive and slow-acting gate valves and stop cocks.

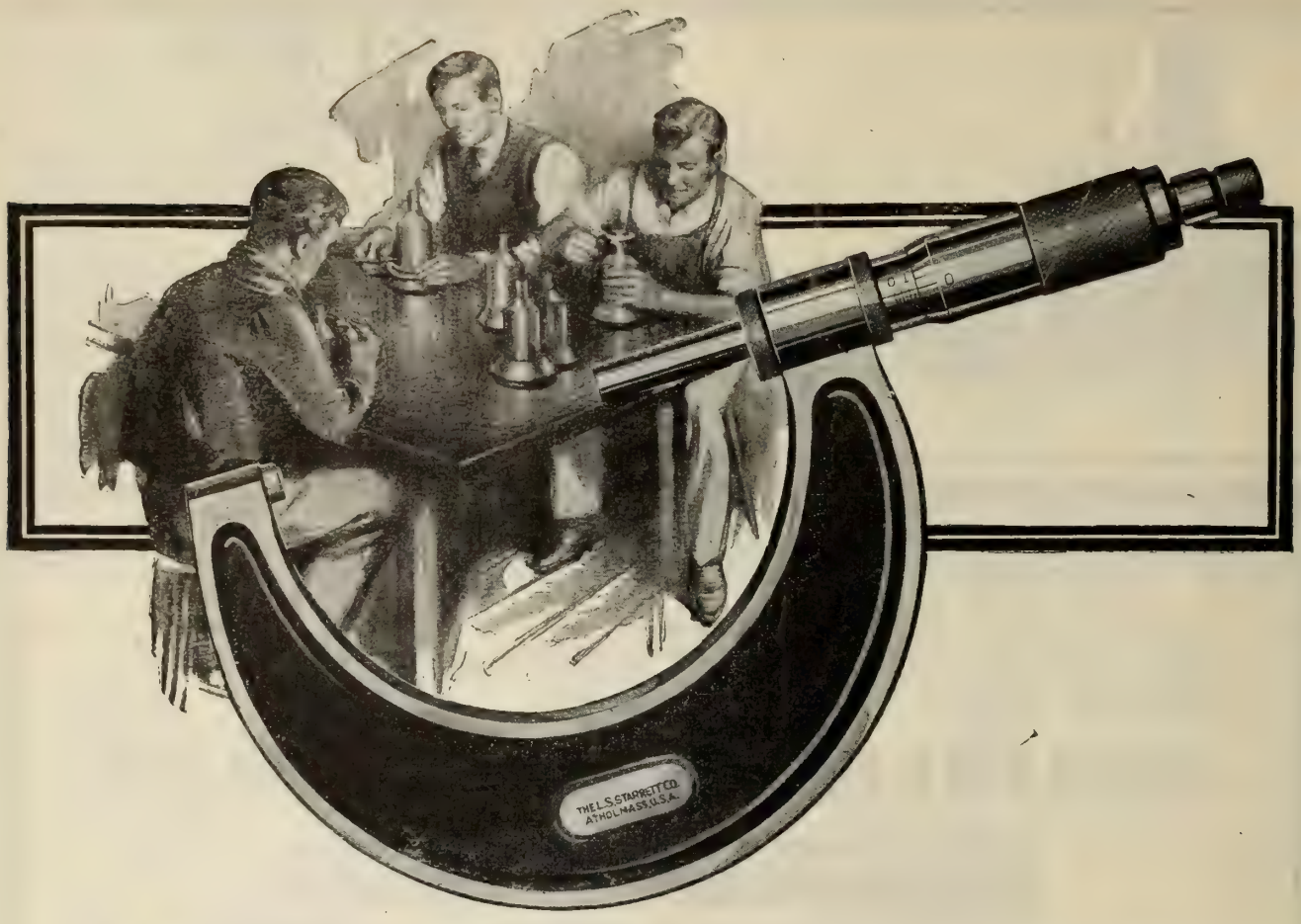
This New Air-Tight Blast Gate is made in sizes from 2 to 16 inches, threaded and flanged. Descriptive circular 210—T gives detail dimensions of all sizes. Write for copy.

"Air is Free, but not Compressed Air."

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St. (Hudson Terminal Building) New York
Canadian Distributors: **Drummond, McCall & Co., Ltd.**, Montreal



GATE VALVE
Heavy, Cumbersome, Expensive, Slow-Acting



Precision tools are more than just "tools"

They are the standards by which the accuracy or quality of the work done by other tools is gaged. A precision tool must, therefore, be a tool of the most extreme and dependable accuracy.

For more than forty years the highest standards of accuracy have been maintained in the production of Starrett Tools. By their dependable service they have earned the preference of two generations of machinists.

Write for Free Starrett Catalog No. 22"3"

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

42-249

STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

Starrett Tools

UNIVERSAL

SHAPING MACHINES

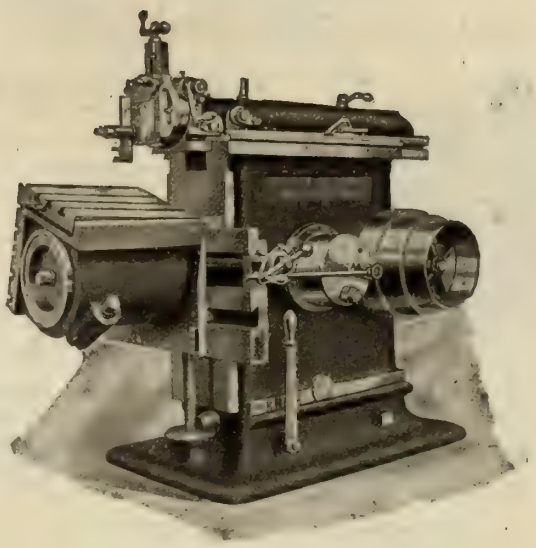
No special vises or fixtures needed; the Universal features of these machines take care of everything making them particularly adapted to—

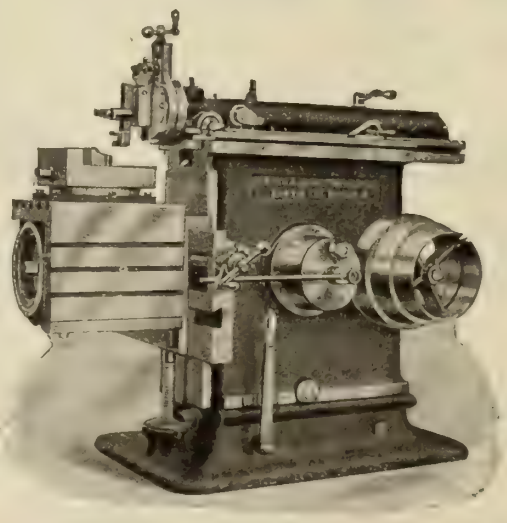
Die Work
Tool Making and
General Manufacturing.

Machines regularly furnished with—

Swivelling Graduated Table
Auxiliary Tilting Side for Compound Angles
Power Down Feed on any angle, with any variation of feed
Automatic Feed Stop
Graduated Collars on Tool Head Feed Screw and Table Feed Screw
Swivel Vise and Graduated Base
Table raised and lowered by power on 24-inch size.

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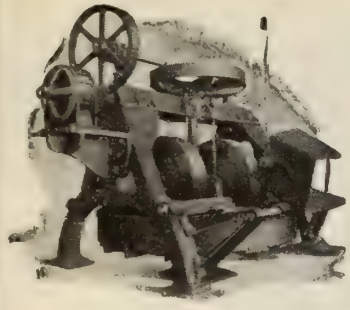
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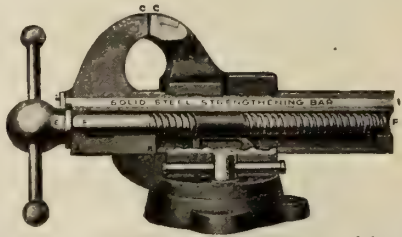
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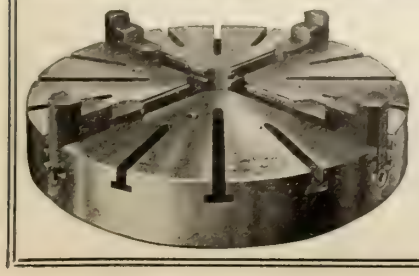
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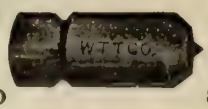
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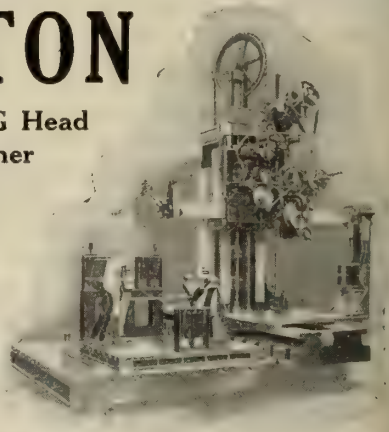
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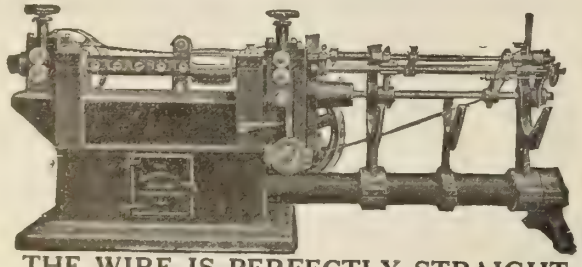
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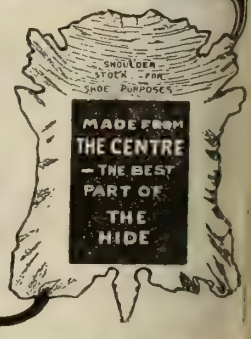
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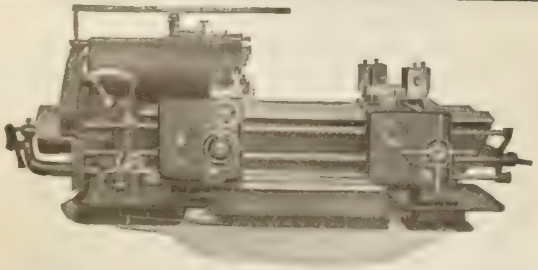
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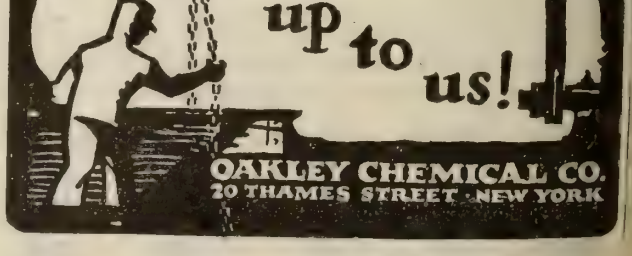
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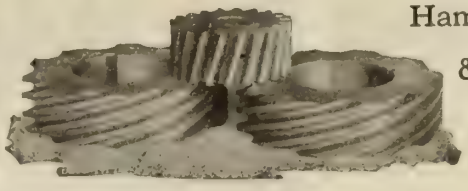
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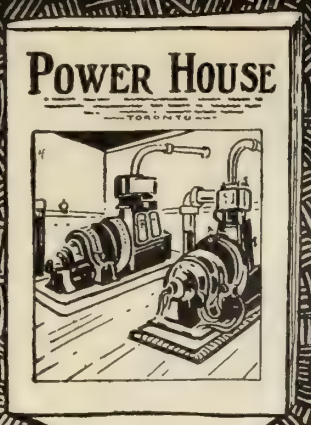
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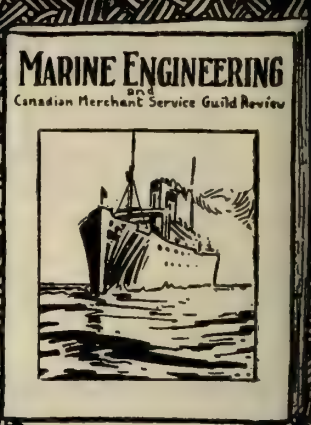
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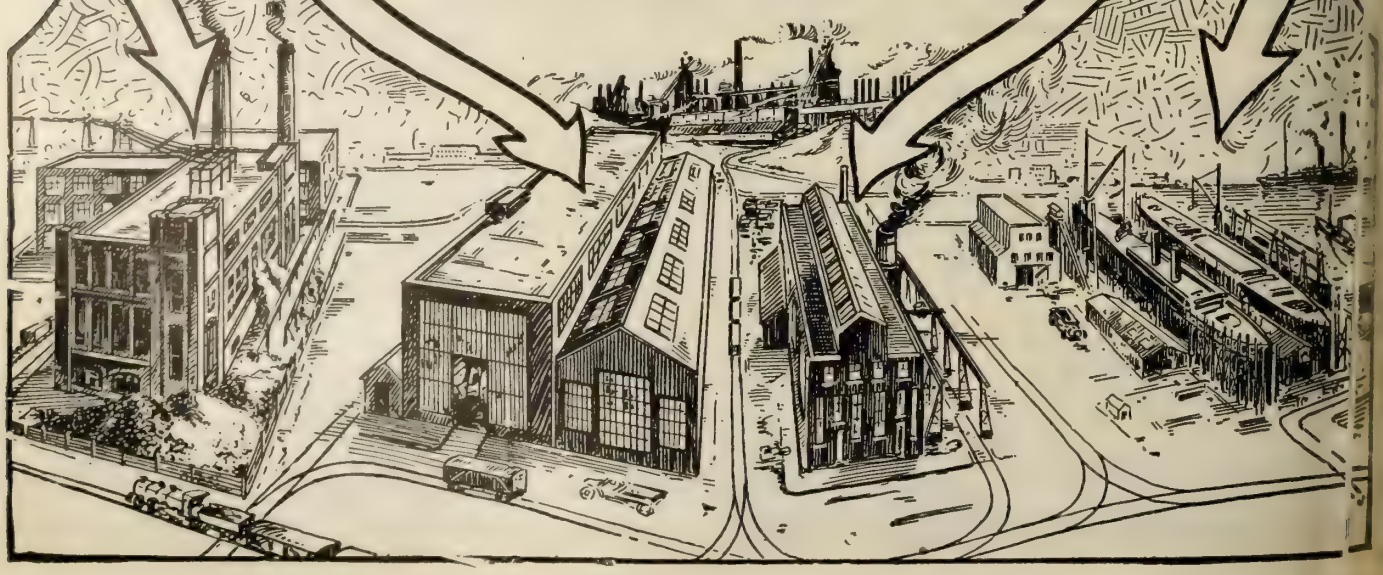
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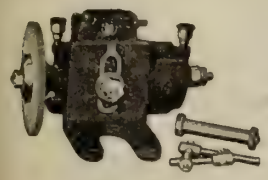
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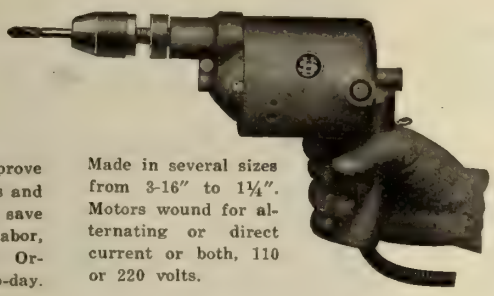
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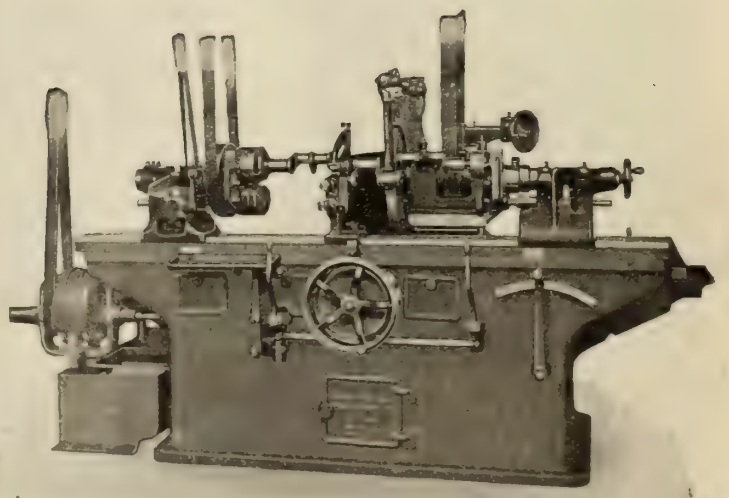
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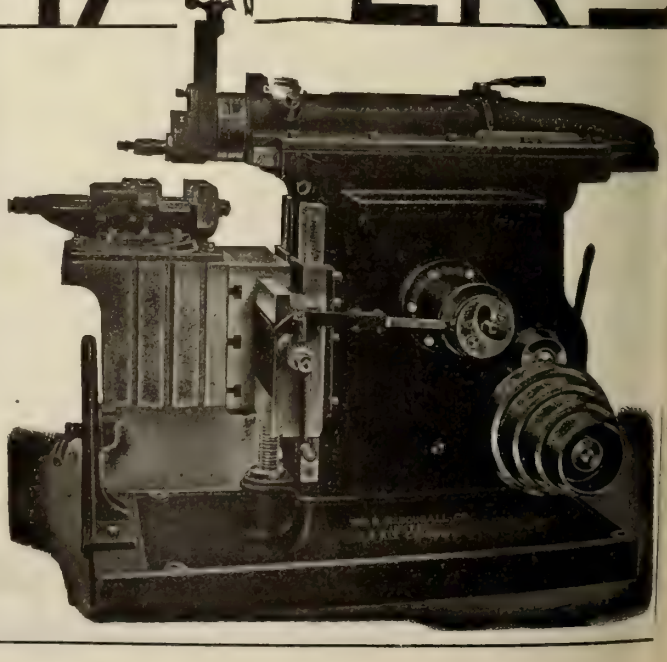
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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVI. No. 21 NOVEMBER 24, 1921

Accuracy is First Essential in a Die Head

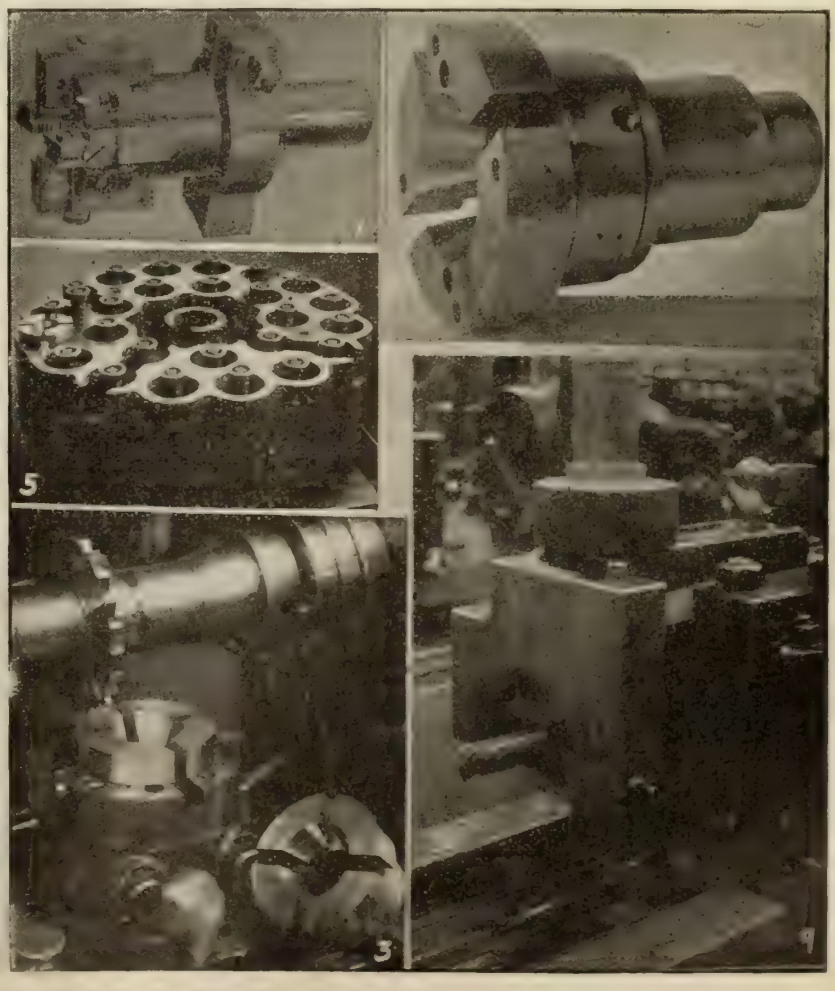
Manufacturing a Die Head Calls For Careful Workmanship—Operations Are Varied — Tooling of Work Receives Careful Thought—Improvement in Design Has Come Gradually.

THE manufacture of screws and screwed parts obtains today on a scale which is prodigious when compared with that of a score of years ago. Not only is the quantity produced larger than formerly, but more stringent limits of accuracy are demanded. The diehead whose manufacture we will touch upon, is not a recent innovation, although its full possibilities have only in comparatively recent years begun to be appreciated. The early dieheads were used on bolt and pipe screwing machines and at first were opened and closed by hand, the automatic opening feature being a later development necessitated by the use of dieheads on rotating spindles.

Fig. 1. illustrates a die designed for use in a turret screw machine, and is taken from the "American Machinist," June 7, 1894. This was known as the Tucker opening die, and was so made that when a thread had been cut the die opened and could be run back without reversing the machine. These early dieheads effected great reductions in the time required to thread bolts as compared with cutting in a lathe or by solid dies. These early devices, however, were incapable of producing an accurate and well-formed thread, the reasons being that the dies were produced by a tap, and also were made either so as to get the clearance—but with no guiding or pitch-preserving feature—or to hug the thread and so to some extent guide themselves along it, but without cutting clearance, the result in either cases being more or less rough threads. The practical result was that dieheads were never used for high-class work, but only for rough bolt and pipe work.

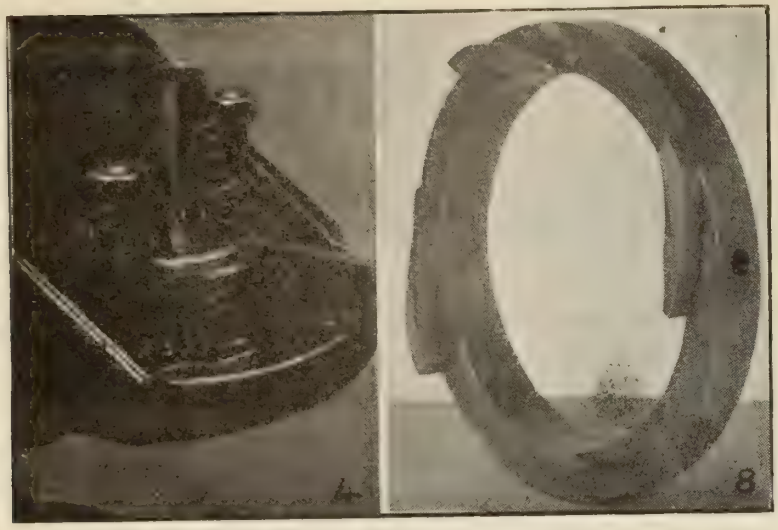
For a long period the screws turned out by automatic screw machines and turret lathes were threaded by dies which had to be reversed and screwed off the work after threading, these dies being of many varieties—some solid, and some split. All these dies labored under the disability that they had to be unscrewed from the work, taking up time and often damaging the threads. Other difficulties were absence of adjustment to obtain exactly the fit required, the practical impossibility of sharpening them and the fact that they were seldom accurate in pitch owing to distortion in hardening and original error in the master tap from which they were made. It will be readily understood that the advent of the self-opening diehead in a form suitable for use on automatics and turret lathes was eagerly welcomed. The stages of improvement in design covered quite a period of time, but now the mechanical world has dies that are marvels of accuracy, but let us get on to some of the actual operations on one particular type of die head.

Fig. 2 shows the body which carries the dies. The dies fit directly in it without the intervention of carriers or shoes, and the guide for dies is long in proportion to its width.



Figs. 1-2-3-5 and 9.—See text for description

Data and illustrations through the courtesy of Alfred Herbert Ltd., Coventry, England.



Figs. 4 and 8 — See text for description.

The body comes to the machine shop in the form of a forging of high quality carbon steel. The first operation is on a combination turret lathe, where it is rough turned, finish turned for grinding, drilled and chamfered. It is next supported on an arbor between centres on a universal grinding machine. The keyseating operation follows, which is performed on a horizontal duplex keyseater; keys are next fitted into the shank, and all subsequent operations are located in relation to these keys. The body is then taken to a horizontal miller for the milling of the slots for the dies. Fig. 3 depicts this operation. There are two milling operations at this stage, roughing and finishing. The fixture is designed for accurate indexing in four positions. The very finest limits of accuracy are called for both for width of slots and centralization; to ensure this the slots are finally finished on a broaching machine, the body being held in a special fixture, as shown in Fig. 4. The drilling of the four holes for the front plate screws is the next operation.

We now come to the surface grinding of the front face of the body, which brings to our notice a very interesting grinding fixture. This is shown in Fig. 5. This fixture will hold 25 bodies at a time, these being accurately located on the studs. The top surface of the fixture is frequently skimmed up in position on the rotary grinder on which it is used to ensure accurate location. The fixture is placed on the magnetic chuck of the grinder, and it will be noted that it is of ample dimensions to preclude any possibility of distortion. One diehead body is shown in position. After every operation a rigid inspection takes place.

The External Scroll

Fig. 6 shows the external scroll which fits over the body. Its function is to close the dies and to take their end pressure when working. The scroll surfaces extend to the ends of the dies, so that the pressure when cutting, beds the dies against the scroll and removes all tendency to tilt or to become bell-mouthed. Screwed into this external scroll is handle for closing the head by hand, and a trip peg for closing it automatically when used on automatic screw machines.

The external scroll is machined from a steel blank cut from the bar. The first machining operation takes place on the automatic lathe. The first operation is the roughing out of the shoulder to provide a true grip for the subsequent machining operations, also the rear face is turned, rough drilled and chamfered. The next machining operation is the reversing of the piece and holding by soft jaws. Here the finish turning of the scroll takes place.

The next is a milling operation. The scrolls which locate the end of the dies are milled on a vertical milling machine in a special 4-position indexing fixture which is of large size to ensure the necessary accuracy The fixture is accurately offset from the centre of the circular table to give the correct curve. Fig. 7 shows a rear view of the scroll. The annular recess will be noted for the reception of a hardened abutment or tooth; this annular slot is machined on a vertical mill. A subsequent operation is the surface grinding of the back face with the hardened tooth in position in the annular slot.

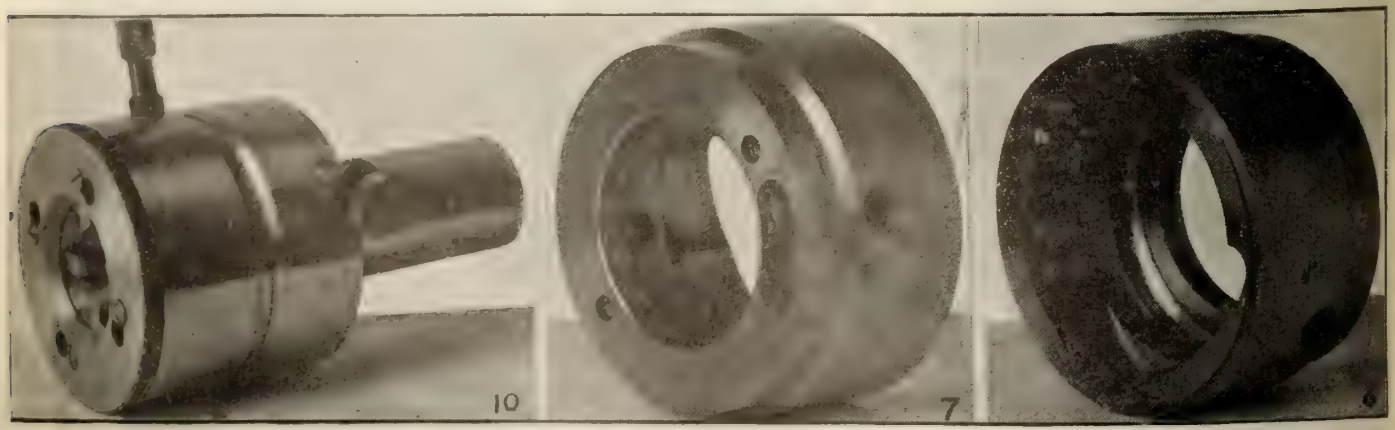
Internal Scroll

Fig. 8 shows the internal scroll which is attached within the external scroll. It is furnished with four cam-shaped projections which engage the notches in the back of the dies for positively withdrawing the dies from the work when the diehead opens. The internal scroll is made from steel bar. A bar blank long enough for a dozen rings is chucked in a capstan lathe, turned, bored (an allowance being left for grinding) and cut off. The scrolls are now placed on a mandril and ground externally on a universal grinder.

The next operation is a milling one, the "landing" slots being milled out to afford clearance for the subsequent milling of the scrolls. A special fixure is used on the vertical miller and the same fixture is also used for milling the curves on the outer scrolls, the necessary special adaptor being fitted.

The Front Plate.

The front plate is of steel, hardened and ground. It is attached to the body by four screws and the plate is furnished with elongated or bayonet holes which permit of the rapid withdrawal of the plate without completely withdrawing the four holding screws. This plate is lipped over the external scroll so as to exclude dirt, and these plates



Figs. 6-7 and 10 — The latter view shows completed die head.

are ground on the surface grinder. They are machined from pieces from the bar, one blank long enough for a dozen plates being bored and turned before cutting up into individual plates. The outside is knurled, the rear face is formed and the external diameter chamfered.

The Shank

The shank, which we will next consider, supports the whole of the die-head and also carries the tripping and size-adjusting mechanism. It comes to the lathe in the form of a good quality high carbon steel forging. The forging is chucked by the big end, and is rough turned and drilled with a special box tool shown in Fig. 9. Another box tool is swung into position and finished turning rough reaming takes place.

At the end of this sequence of capstan machining operations the job is in the condition shown at the top of the box tool in Fig. 9. It is rechucked in soft jaws on a capstan lathe, and finish machined for external grinding. A subsequent operation is grinding.

The next operation is on a thread miller, where the boss for the adjusting ring is externally threaded. Subsequent operations include drilling on sensitive drilling machines, the shanks being held in special jigs. This is followed by a slotting operation on the body for the keyways. A vertical mill with circular table is employed for milling the elongated slot through which the bush carrying the detent pin works; clearance must be provided in this slot to accommodate the full travel required for adjustment.

(To be continued).

Operations in the Manufacture of a Die Head

HAVING presented in the previous article, the making of a certain class of die head, let us touch briefly upon the operations performed on another make of self-opening and adjustable screw cutting die head. A few of the operations only are illustrated, the rest being word pictures as it were. The head described is built particularly for B. & S. automatics, but is also well adapted to other makes.

Fig. 1 illustrates the various parts in detail.

These parts, named in the order in which they are illustrated, are: skeleton, cam, cam spring plate, back part, trip lever, and various small parts. The first operation in the making of the head is the turning of the body from bar stock. This is accomplished in the turret lathe. The preliminary to the making of the head is scheduling the operations for the various parts. The schedule and order of operations are as follows:

Skeleton—turning in turret machine; milling chaser slots; truing face of skeleton; inspection; stamping size etc.; broaching chaser slots to gauge; drilling in jig; drilling and counterboring for anvil; tapping for back part screws; milling stop plunger slot; truing back face; inspection; milling keyways of chaser slots; inspection of keyways; assembling chaser keys, drilling, disassembling, hardening, and reassembling chaser keys; inspection of key alignment.

Cam—turning; drilling in jig; profiling the lugs; milling recess for segment pin; drilling for push buttons; tapping and burring; inspection; hardening; polishing of spring chamber to remove scale; assembling spring stop pins; grinding bore to gauge; grinding lugs to gauge; assembling push buttons; inspection.

Cam Spring Plate—Turning; drilling outline in jig; breaking to the outline; milling slot for trip screw; drilling in jig; finishing the milling of the outline; hardening; grinding shank; polishing.

Trip Lever—Milling to thickness, also inside and outside form; drilling in jig; form-milling ends; burring; case hardening.

Assembling skeleton, cam, and cam plate for outside grinding. Grinding outside diameter; polishing; assembling die head complete for final inspection; inspection; cutting test; testing of sample screw for lead. The rough turning of the skeleton is taken in one cut. In this particular instance about two inches of stock is removed, although on larger and special heads over three inches of stock is removed in one cut. Milling the chaser slots in the skeleton is one of the most important operations, as they must be milled to very close limits, allowing only from .001 to .0015 for the finished broaching.

A special measuring fixture is used for inspection of keyways, for the keys must be absolutely true and all must be without the slightest variation. The dif-

Data and ilustrations through courtesy of The Geometric Tool Co., New Haven, conn.

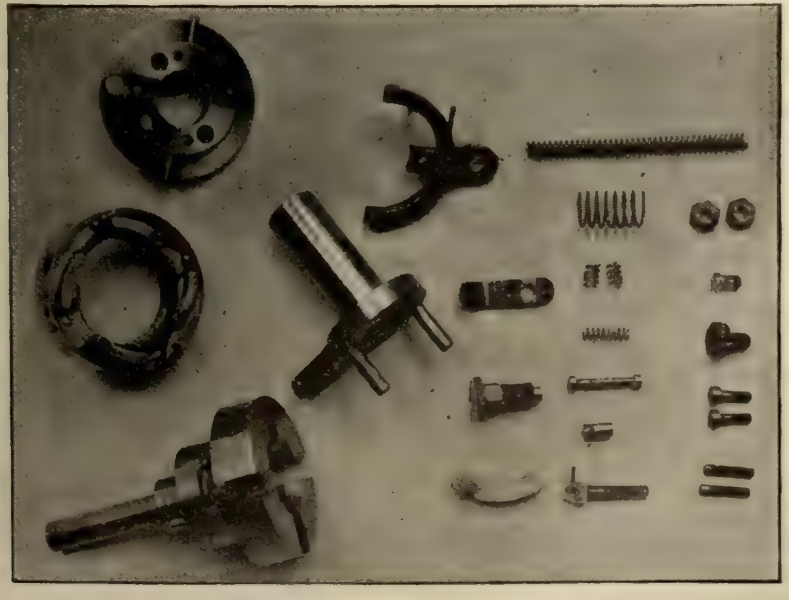
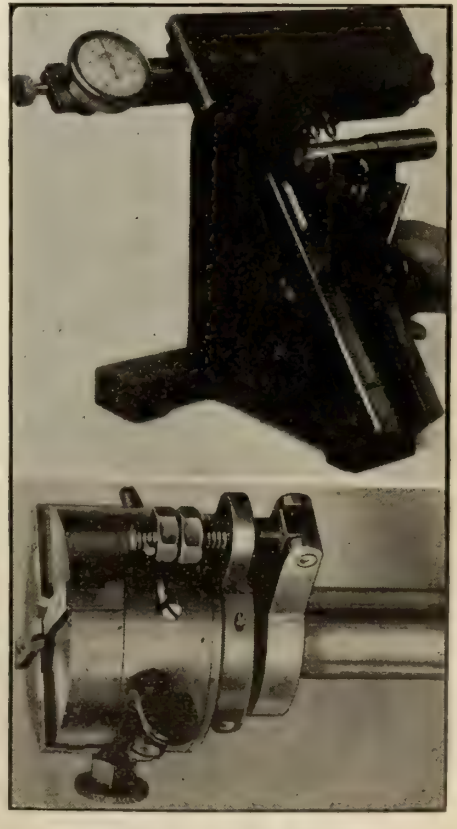


Fig. 1—Showing a die head in detail.



Testing of sample screw for lead.
Completed die head.

ficulties of hardening so exact a piece as the skeleton will be apparent to a mechanic or hardener. The method used, that of special furnaces and special hardening salts, results most successfully. By means of the Bellis Lava heat treatment a uniform heating of the piece is maintained and at the same time scaling and oxidation is eliminated. For profiling the lugs a standard profiling machine is used. Upon the accuracy of these lugs depends the entire accuracy of the operating features of the die head.

Push buttons are used to hold the chasers in place while they are being assembled in the head. Without these push buttons it would be difficult to hold the four or more chasers in position while inserting them. The trip lever as constructed and operated forms a most sensitive trip. It determines the length of screw thread so exactly as to stop the cutting of the screw at any desired point within a few thousandths of an inch. The frequency of inspection will be noted, but this is necessary in maintaining absolute accuracy, and the slightest defect in any operation means rejection. About the best way to get the most benefit of the other photographs shown would be to read the underline, then study the fixtures used, for each one is self-explanatory.



Milling chaser slots.
Drilling skeleton in jig.
Milling keyways in chaser slots.

Sixty Ton Hopper Bottom Box Cars

THE Canadian Pacific carries a huge amount of grain from the Western Provinces to the head of the lakes and the Atlantic seaboard. This grain has usually been transported in box cars of design not far removed from the ordinary type. These cars when carrying grain were always fitted with temporary grain doors made from rough lumber. In addition, unloading operations were attended with more or less difficulty and apparent waste of time. To overcome these conditions they have developed and built in the Angus Shops a hopper bottomed type of car, which has recently been placed in service on the western lines hauling grain.

Railroads carrying a heavy merchandise traffic usually consider the cubical capacity limits the load in a box car and therefore a 40 ft. car with a limit load of 45 tons is most economical. The new car is 40 ft., 6 in. long, 8 ft. 6 in. wide and 9 ft. high, inside dimensions, and the limit load is 60½ tons. The ratio of the load to the gross weight is 71.4 per cent. Now as a great deal of grain and coal is carried in box cars on the C.P.R. the extra cost of the heavier car is, no doubt, more than offset by the higher ratio of load to total weight in a fully loaded 60 ton car.

Construction

The cars are provided with steel under frames, steel side frames, corrugated steel ends and outside metal roofs. The centre sills are made up of two 12" channels continuous from end to end of car. The bolsters and cross bars are pressed steel diaphragms with top and bottom cover plates. The floor frames are also pressed steel diaphragms. The wood decking is 2¼ in. thick. It is secured by bolts to the centre and side sill flanges. The side frames consist of 9 in. channel sills 6 in. by 3½ in. by 3-8 in. angle plates, 4 in. Z-bar door posts and U shaped pressed steel posts and braces. The side sheathing is of wood 1½ in. thick. It is bolted to the flanges of the door posts, pressed steel intermediate posts and braces, and to the flanges of the corrugated steel ends.

The pressed steel posts and braces were chosen in preference to the rolled sections, because the ends have area for rivetting, without the use of gusset plates, and the ends of the braces can be brought much closer to the ends of the posts. In addition the pressed shapes provide superior supports for the sheathing boards. The ends of the cars of pressed steel, each end being in two sections. The roof is of the flexible outside metal type supported on steel carlines. All car-line flanges are covered with strips of wood, arranged to prevent the accumulation of dust that might be shaken down from time to time and possibly damage the loading.

Hoppers of the Burnett type are located at the side door opening on each side of the car floor. When used for freight that cannot be dumped through the hopper, the car has a solid level floor, the same as an ordinary box car. When grain, coal or similar commodities are carried, the specially constructed sections of the floor over the hoppers are swung up against the side door posts. This arrangement permits the load to go directly into the hoppers, thus increasing slightly the cubic feet of available space, and at the same time saving considerable temporary door lumber. When it is desired to unload the car, it is only necessary to remove the pin that locks the hopper doors. The doors then open quickly by gravity and a large percentage of the contents of the car discharges automatically through the hoppers. The balance of the load may be shovelled to the middle of the car by hand. However, if an unloading plant is near which is equipped with power shovels, as is the case in most elevators today, the floor door on one side of the car may be swung down and the cables can be taken through the door as usual. The hopper doors have no operating mechanism, the closing being done by hand and secured by a simple locking bar arrangement.

Special care has been taken to obtain a side door of satisfactory design. The interlocking front and back edges afford exceptional protection against both weather and pilfering. The top edge is thoroughly waterproof, yet so designed that it cannot become blocked with ice. The bottom of the doors are fitted with turned rollers that fit on a substantial and rigidly supported track. This latter track is not likely to get blocked with ice but in case it should be, the interference is plainly visible and easily removed. The location of rollers at the bottom of door does away with the binding of cramping so common in cases of doors hung from the top.

The brake arrangement includes a manually operated slack adjuster, which is a double safety device, as it enables inspectors to adjust the brakes to compensate for wear on brake shoes without going under the trucks, and as no truck parts are disconnected, the possibility of trouble due to oversight in replacing connection pins is eliminated. As the time required to adjust the brakes by this device is much less than with the old arrangement it enables inspectors to go over a largely increased number of cars in a given time, a result which tends to better maintenance and less detention. The hand brake arrangements are especially designed to be free of climatic conditions. Snow and ice on top of the pawl, ratchet, etc., will not interfere with their operation. The

Continued on page 36

Use and Abuse of Wedges in Fixture Design

Slow, Unhandy and Laborious Tasks Can be Made Easy Through the Proper Use of Wedges—Production Can be Increased and Better Work Turned Out

By WALTER ROWLANDS

IN CONNECTION with the use and abuse of wedges we will first consider the illustration at Fig. 1 which shows a method of overcoming the slow unhandy, and laborious task of driving and removing wedges. I say laborious not so much because of the work of putting them in place, as the hard job of removing them afterwards.

The fixture shown was designed to hold the frame at Fig. 2 while being riveted. The previous method was to drive 8 or more tapered wedges, these ranging from ¾ to ⅞ in. and 3 in. wide. Each wedge had a gib, this being to help pry them out after the frame was completed. To say the least, the method was a slow one and required the services of a sledge hammer and pinch bar.

The writer had the fixture, or buck made as shown, and as will readily be seen the wedges are always in position never requiring any attention or handling. The two pins depicted are required to locate and hold the holes in the frame members in perfect position. These pins are never required to be taken out of the hole in the lug on buck which is about 2¾ in. thick for two reasons:—1st the hole being a neat fit for pin always keeps it in perfect alignment; 2nd it avoids the necessity of taking the pin entirely out of the lug, and often saves considerable time from the pin rolling off the block and becoming hidden under the buck or otherwise causing a delay to operators. The two handles marked A A are equipped with loose toggles pivoted on the top of lug and only requires a slight movement to hold the ends of the frame in position. The rivets are ½ in. dia. with oval heads, excepting one which is a flush countersunk rivet. This is handled by taking out one snap with a very small pair of tongs, and substituting a flat faced snap. This is done in a jiffy as the last operation on the buck.

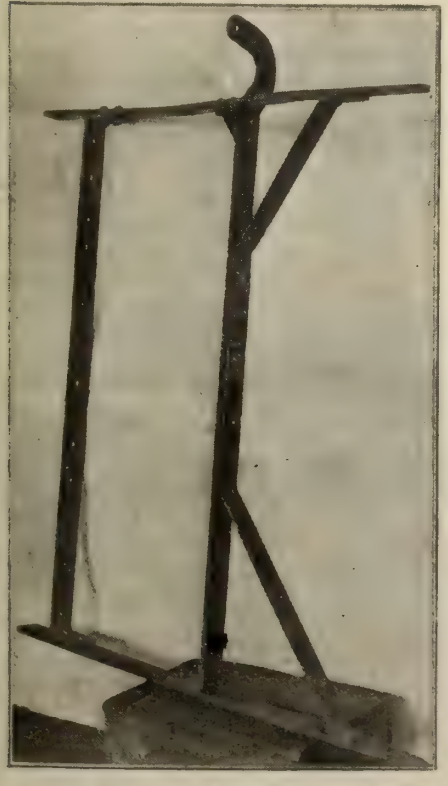


Fig. 2—Showing the frame which had to be riveted.



The fixture which was adopted with great success.

The photo shows clearly how the wedges are manipulated. An air cylinder moves the carriage on which are fastened the incline planes, over which and between two links, are the rollers. The movement of the carriage pushes up the wedges fastened between the two links into position. By moving the small lever over in the opposite direction it fastens all members to the buck and accomplishes the work in quicker time than it takes to describe. It is also positive, and admits of a clear buck on top, not littered up with wedges, pins, loose parts, etc.

The air riveter, as will be seen in the illustration is equipped with a device which enables the operator to obtain the proper adjustment to suit the various heights of the rivet centres. Considerable time was saved by designing the riveter to suit the job of frame riveting, as it enabled us to rivet the two gusset angles on the goose neck member (before being riveted to the other portions of the frame) on a power riveter. With a suitable jig to hold the gusset angles in proper position this riveting was formerly done after the members of the frame were riveted together and required to be turned over in order to head up the last 2 rivets in the angles. Anyone conversant with this kind of work will readily understand how slow and uncertain the job was; having to locate and hold the frame and riveter to put in 2 rivets in such awkward and close quarters. The writer was informed that a satisfactory job could not be done by riveting these angles on the goose neck

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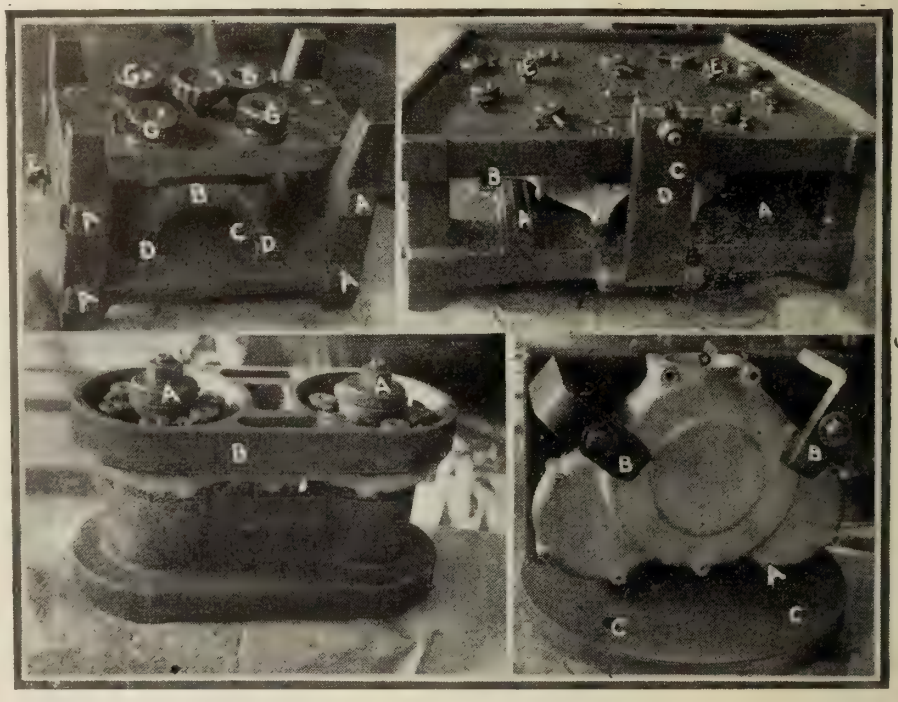
Machining Elements on Marine Engines

Drilling and Reaming Main Bearing Cap—Drilling Cam Shaft Driving Gear Housing—Facing Off End of Same Part—Machining and Grinding Camshafts.

By ROBERT MAWSON

IN MACHINING the various elements on marine engines it is often advisable to use special tools, fixtures, etc., for such procedure lowers the cost of manufacture. Murray & Tregurtha Corporation, Alantic, Mass., who manufacture such engines have found it wise to spend considerable money on special tools, and some of the interesting fixtures used will be described in the next portion of the present article.

At Fig. 1 is shown the jig used when drilling and reaming the main bearing cap for the crank case. This casting has been previously machined on the parting in a milling machine. The jig is first placed with the surface A resting on the drill table, and the cap B is placed on the steel pads C, the tool being provided with four, two on each side. The cap is pushed back against the two steel stop pins D, and a knob screw is tightened which forces the element back to the adjustable stop E. The knob screw F, is then tightened the action of this medium being to hold the cap casting down in the jig. The tool is then placed on the drilling table in the position shown, and four 43/64 inch holes are drilled, these afterwards being reamed to 11/16 inch; slip bushings G, being provided to suit both sizes of caps.



Figs. 1 to 4—See text for details.

Machining Gear Housing and Cover

Fig. 2 shows the jig employed when drilling one of the sections of the camshaft driving gear housing. This casting has been previously machined on the parting surface in a milling machine in order to obtain a smooth and accurate join. The casting is then placed in the jig, being slid along the steel ways A, against stop pins at the rear of the tools. Steel pins B, are also provided to insure the correct alignment or position in the tool. The swinging strap C, is next placed as shown, and as this is fastened against the housing, a fixed pin D, coming in contact with the element forces it back to the stop pins used when drilling the mating section of the camshaft driving gear housing. Twelve 17-64 inch holes are next drilled, also the holes in the upper part, the drill being guided through the bushings. shown in the upper cover of jig.

This casting has also been machined at the parting or joint surface in a previous operation, and two large holes have also been bored. These holes mentioned are employed as the locating medium for the casting in the jig, two turned plugs A being provided that fit into the holes thus bringing the piece into the correct position for the drilling operation. The cover B is dropped down over the casting and held by means of two nuts and washers, which can be seen in the illustration. The following holes are then drilled, eight 17-64; two 5-16; and four 13-64 inch, these being guided through bushings in the jig cover in order that the correct position may be obtained and maintained.

The fixture shown in Fig. 4 is used when facing off the end and boring the large hole in the camshaft driving gear housing and cover. The castings are

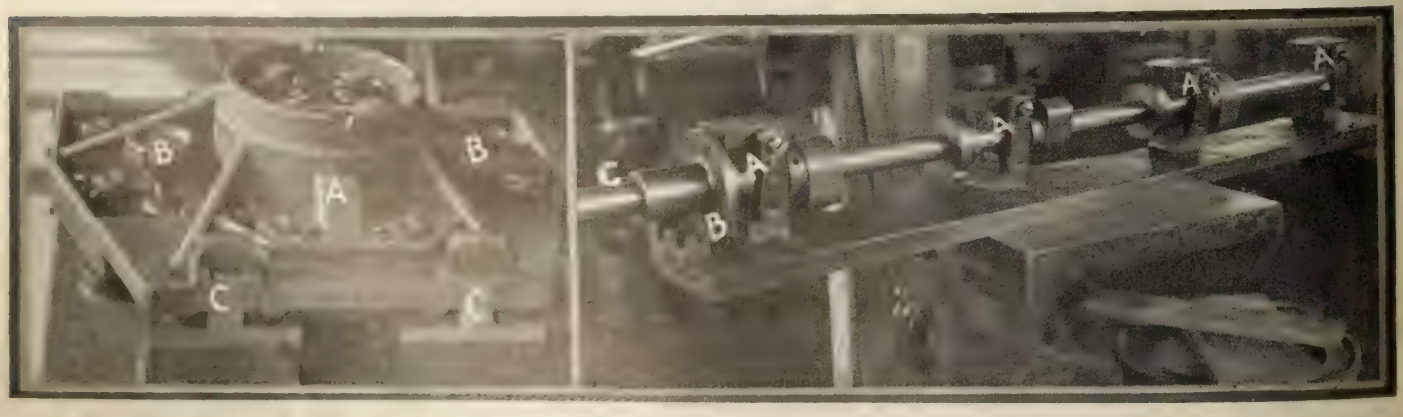


Fig. 5 — Drilling driving gear housing cover.

Fig. 6 — Drilling pin holes in ram.

located by means of pins A, which fit into holes machined in a previous operation. The two straps B are then fastened against the two castings, these holding them firmly in position. The fixture is held to the face plate of the lathe by means of bolts that fit into holes in the face plate, also, the holes C of the fixture. When the tool is in position the large hole D which is 2-11/16 inch diameter is bored, and the end faced off squarely. This operation is standard machine shop practice and needs no further description.

Fig. 5 shows the jig used when drilling the camshaft driving gear housing cover. The casting has been previously milled on the parting line surface and is located in the jig by being pushed back against stop pins at the rear. Guide pins are also provided on each side, the casting passing between them dropped down the knob screws B, are tightened down onto the piece and hold it firmly in position. It will be noticed that the tool is arranged with steel tongues C, and when the cover drops down these fit into machined slots thus locating the two elements of the tool in the proper alignment. The following holes are then machined; nine 17-64 two 5-16; and four 1-4 inch, these latter holes being afterwards tapped with 5-16 in. taps. The jig is provided with guide bushings for each hole.

Machining the Camshafts, Drilling and Grinding

The common practice of automobile companies when machining a camshaft is to make the cams integral with the shaft, these being ground from the rough forging. This concern however makes the various cams separate from the shaft, the reason being that when any cam is badly worn and requires replacing, it is much cheaper to make a single unit than to purchase an entire camshaft.

Fig. 6 shows the fixture used when setting up the cams and camshaft for drilling also the pin holes that hold them in their correct positions. The shaft is held in supports A, and an index dial B is fastened by means of a set screw at the forward end. The various cams have been previously slid onto the shaft, and each cam is marked with an index line that passes through its central section of the large diameter. to hold the cam from moving.

The man then places this index line central with the center of the shaft by using a height gauge. A headless set screw is next tightened which passes with the shaft, this being used merely and first cam aroung a certain number of degrees as desired by the particular engine design, this being performed with the index pin C, fitting into the correct hole in the index plate B. The second cam is then lined up by means of the height guage and index line on

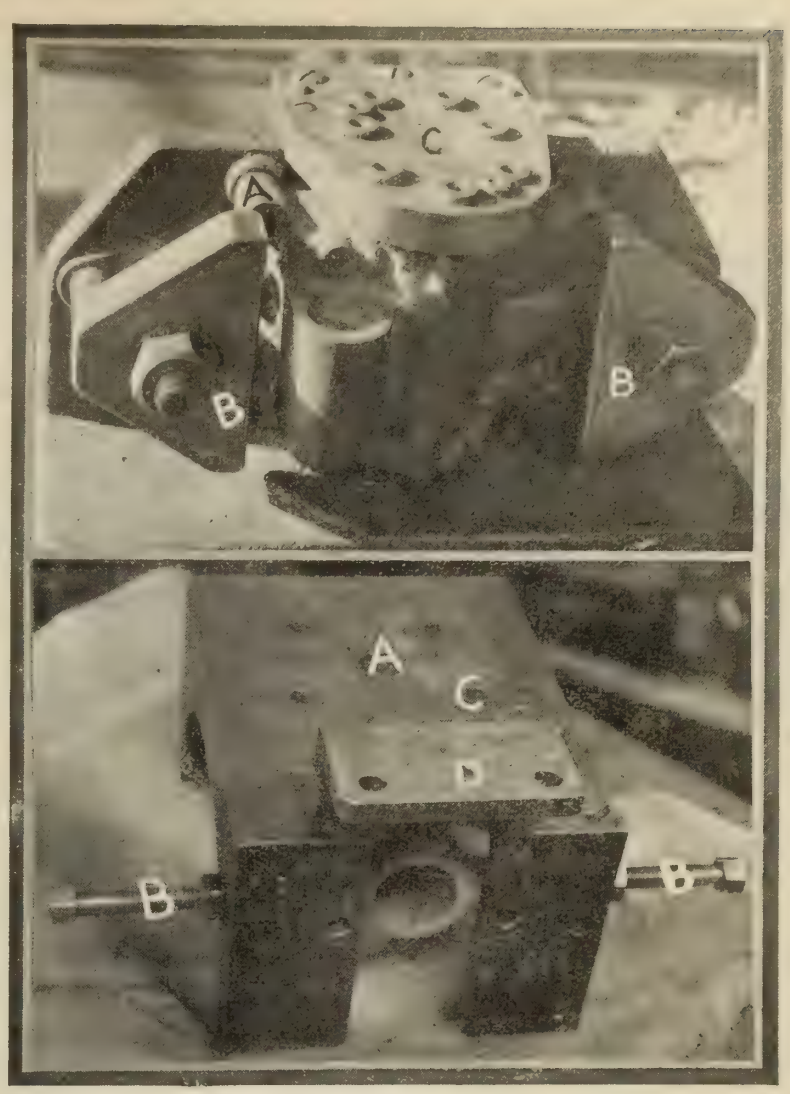


Fig. 9 — Drilling small holes in pump body.
Fig. 10 — Drilling inlet valve body.

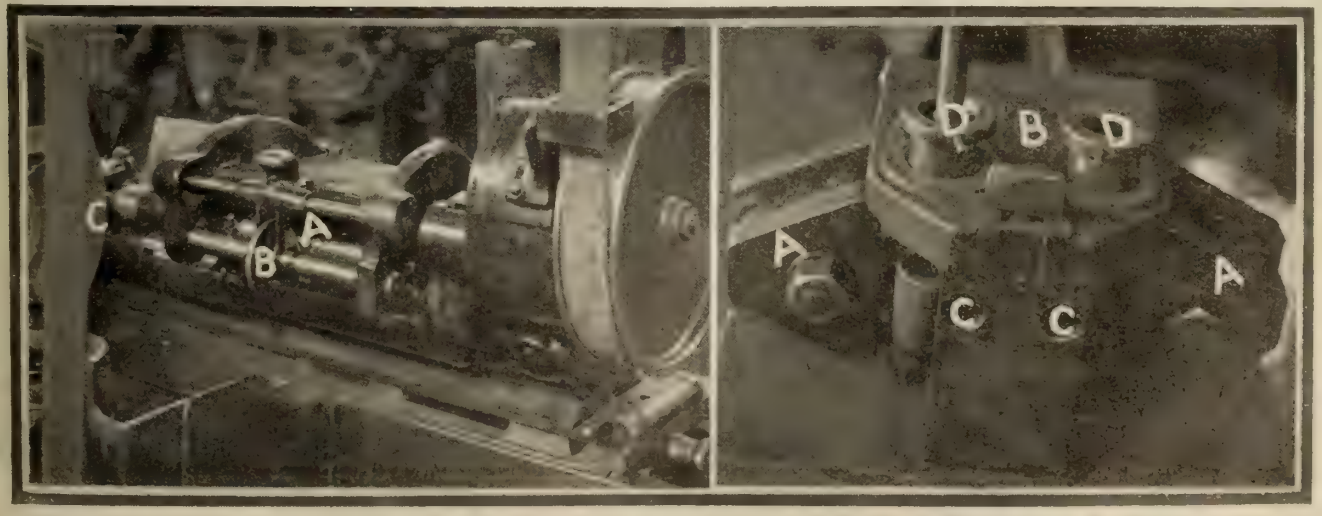


Fig. 7 — Grinding the cams.

Fig. 8 — Machining large holes in oil pump body.

the cam surface as previously noted, and when the cam is in the correct alignment it is pinned in a manner similar to that already described. A similar procedure is followed until all cams have been located on the shaft the distance between the various cams being easily determined by means of a scale. It can be easily seen that this method is accurate as it leaves nothing to guess work, being similar to indexing on a milling machine. However any slight discrepancies which might occur are removed in the next operation which is grinding and will be next described.

The machine used when grinding the cams on the shaft is illustrated in Fig. 7. The shaft is carried on centers and driven by a dog which is common practice for grinding operations. The high place on the cam is first placed in the same plane as the large diameter on the cam former A. The machine is now started and as the revolving guide roller B, comes in contact with the former A, the shaft is forced outward a similar distance. The shaft is then fed against the revolving wheel C, and the cam is accurately ground with a similar contour to that of the former. It might be added that the former is made of two different diameters the first roughing out, and the second finishing, thus not only producing a smoother contour, but also avoiding any resetting as when the shaft has been once set as regards contact with the wheel a number may be ground before feeding in, or until the wheel has worn perceptibly. The next cam is now set as noted and the operation repeated until all cams have been correctly ground. They are then tested by means of micrometers and gauges.

Machining the Oil Pump Body

Fig. 8 shows the jig used when machining the large holes in the oil pump body. The casting is located in the tool by means of two pins that fit into holes drilled and reamed in a previous operation. The two clamps A, are now fastened against the element by means of the bolts and screws as shown to hold it in position. The clamp B, is then dropped down and this it will be noticed is located with a tongue to obtain the correct alignment. The latch bolt being fastened, holds the cover down onto the piece. The importance of this tongue is apparent when it is noticed that the guide bushings are in the cover. Two holes are now drilled to 29-64 inch, using the hole C, to guide the 15-16 inch, using the boring bars D, guided through the bushings shown.

The jig used to drill the small holes in the oil pump body is illustrated in Fig. 9. The casting is again located by means of pins A, these fitting into machined holes. The strap B tightened onto the piece with nuts and bolts to hold it securely. It might be added that the casting has been also machined on the parting or joint face, so that the element rests against a smooth outline. The following holes are next machined; seven No. 3, and two No. 31 drill sizes, the various bushings in the plate C, guiding the drills.

The remaining illustration, Fig. 10, shows the jig employed when drilling the inlet valve body. The casting is located on a large plug at A, that fits into a hole which has been bored in a previous operation. The joint surface has also been machined in a milling machine to obtain a smooth contour. The two screws B, are then adjusted against the casting until the ears of the element are central so that the holes drilled will be in the best location as regards appearance. Four 29-64 inch holes through the bushings in portion D. This tool may appear somewhat of a makeshift design but was found advisable and has proved well worth the cost of manufacture. Readers will notice that much thought has been put in the design of these various tools and the result is that the elements produced are not only interchangeable in their nature but are obtained at a much lower initial cost.

THE USE AND ABUSE OF WEDGES

By WALTER ROWLANDS

(Continued from page 29)

first on account of the very close inspection limits allowed, but these never was any trouble. The whole arrangement was the means of turning out considerably more work with less help and needless to say when the proper appliances are furnished the average man, he will take more interest in and do far better work for his employer.

The inspection limits on this frame averaged 1-16 in., with some parts closer. This is considered close work for common bar material. In the various members, some of which had 90 degree bends to go between the side members, these were punched hot, the same heat as the bending operation. The writer however intended changing this hot punching operation and doing the job on an ordinary punch press, having two holes or trenches in the floor at the base of press, thus being able to punch two members at one time.

In summing up the subject of the use and abuse of wedges, the writer believes that the principle of a buck with carriage arrangement as described can be used to very great advantage for a large number of riveting or assembling jobs when made in considerable quantities with close competition.

LOOKING TO THE FUTURE

Some support for the predictions being made by busines men that an improvement in business is to be expected in 1922 was given by Roger W. Babson, head of the Babson Statistical Organization in a recent address in Montreal. On this occasion Mr. Babson outlined twelve periods which he claimed formed a business cycle. He showed how the country had experienced three such cycles, each requiring about fifty years to complete. In these cyles commodity prices rise for about twenty years and decline for thirty years. The twelve periods are as follows;—

1. The peak of prosperity, large profits, high wages; 2. Period of inefficiency, declining bond prices; 3. Period of dishonesty and profiteering, declining stock prices; 4. Periodical crime wave, declining commodity prices; 5. Lack of confidence resulting in unemployment; 6. Decline in real estate due to curtailment of living expenses and doubling up of families. This ends the general decline and improvement commences. 7. Thrift more evident, declining interest rates, banks loan money for building, 8. Greater efficiency in labor due to unemployment, increasing bond prices. 9. Fairer prices existing. Dollar reaches normal buying value. 10. Renewed religious interest, improved confidence, greater buying with firming of commodity prices. 11. Greater activity in all lines, labor fully employed. 12 Extravagance again in evidence, high interest rates. Cycle is completed.

It was the opinion of the speaker that we are now entering the sixth period and that the rapidity of recovery would depend upon districts and trades, those trades that were affected the earliest being the first to recover.

PAINT SPRAYING MACHINES

Tests carried out on paint-spraying machines have shown that spraying requires approximately 10% more paint than brushing when the surface being treated is an iron roof, while brushing requires approximately 200% more labor than spraying. Exterior brick wall spraying requires 7% more paint than brushing, while brushing requires 109% more labor than spraying. On interior ceilings and walls of plaster spraying requires 40% more paint than brushing, but gives a better hiding in one coat. On similar work brushing requires 160% more labor than spraying, and gives a poorer hiding in one coat. Although it has not been possible as yet to arrive at a definite conclusion confirming the relative durability of spraying as compared with hand painting, it is claimed that the investigations so far made tend to support the belief that the spraying work will last longer. —Mechanical World.

TESTING TIRED METALS

It has been known for some time that metals are like human beings in getting tired after a prolonged exertion. A piece of metal, for instance, which is subject to constant vibration will gradually lose its strength, but will recover it again if it is allowed to remain quiet. Engineers, therefore, attach great importance to what is called the "fatigue testing" of metals. Previously such a test took considerable time, but with up-to-date apparatus, it can be done in a few minutes.

Methods of Reducing Fatigue in the Tool Rooms

Conveniently Placed Shelves and Drawers—Orderly Arrangement of Tools—White Surfaces Improve Conditions—Shelves Should Not Be too High—Sunlight is Important

By F. B. and L. M. GILBRETH

ELIMINATING unnecessary fatigue in industrial plants is assuming more and more importance and many plant executives are beginning to realize that investigations carried on for the purpose of correcting conditions which contribute to fatigue, are productive of worth while results. The by-products of fatigue study invariably are worth as much as the direct benefits, yet the latter are sufficiently impressive to amply justify the effort expended.

Fatigue study is a first step in motion study and is so closely allied and interwoven with accident prevention that for best results each must be considered in relation to the other. Fatigue study also is related to personnel problems and the reduction of absence and labor turnover; it solves intensive output problems and leads to proper lighting and a better quality of resulting workmanship. Many more examples could be cited, but they all emphasize that fatigue study cannot be properly considered alone. Its by-products alone warrant its intensive application.

Tool Room Ideal for Observation

The tool room offers an unusually good opportunity for the investigation of fatigue problems. It is more or less common to all workmen, enlists the interest of all, and anyone can be taken to see what has been accomplished there without any possible misunderstanding being aroused. Having witnessed a new method in the tool room, employees can adapt it to their own activities.

From a paper presented at the annual fall meeting of the Society of Industrial Engineers, Springfield, Mass., Oct. 5-7, 1921. The authors are consulting engineers, Frank B. Gilbreth, Inc., Montclair, N.J.

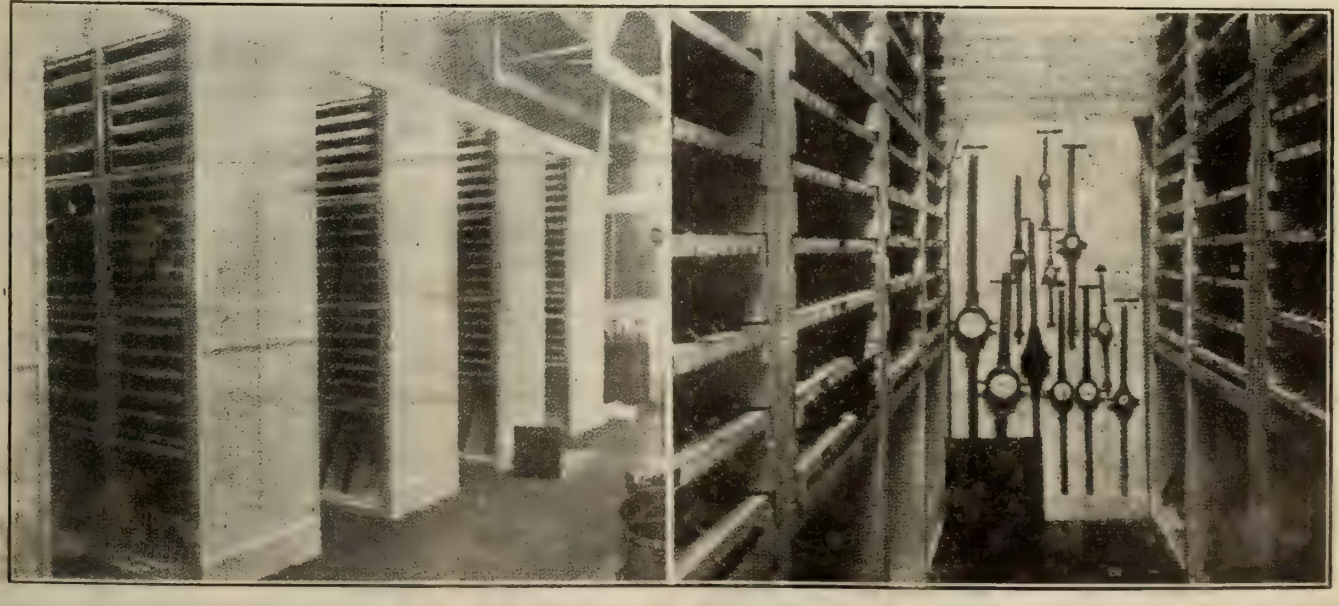


Another view showing value of sliding shelves

The tool room, part of which is shown in the accompanying illustrations, was especially designed, and every advantage possible has been taken of the available daylight. The aisles are laid out so that all daylight can be utilized and the best artificial lighting provided. The switches or buttons for turning on and off the light are located so that the person using the light can put it on with the least expenditure of effort possible, on entering an aisle, and switch it off just as conveniently when leaving. There is a standard location as well as position for the light switch which eliminates as far as intensive standardization can the effort of "search," "find," "select" and "grasp." As in all other motion study work, we considered here the 16 subdivisions of the motions in designing the tool room, placing the switches, and working out other details. Great effort was made to place the tools no higher than was necessary. The available amount of space was calculated, and no shelves or other equipment for holding tools were placed any higher than was absolutely requisite for holding the supply necessary at the time. However, provision was made for an unexpected excess in alphabetical order of the tool symbols in case such unexpected excess should occur. This eliminated unnecessary reaching and also accidents that might have occurred from the falling of tools.

The tool room was especially design-

Continued on page 35



Showing the neat shelves, all painted white, also the neat method of storing die stocks.

Adapting Machine Tool Plants to Slack Times

Although No Special Plan Is Suggested, Many Hints of Value Are Embodied—In Making Special Machinery Certain Things Must Be Avoided

By H. L. FLATHER

SPEAKING before the New York meeting of the National Machine Tool Builders' Association recently, H. L. Flather, who is treasurer of Flather & Co., Inc., Nashua, N. H., brought out some interesting points as to how machine tool plants could adapt themselves to slack times.

"Some thirty-five or forty years ago when I was a boy," he said, "I spent an occasional vacation with an uncle on a farm. Now while this uncle was one of those men whom children love to visit, he was not what others would call successful, especially in his line of work. In fact, he had all he could do to make a living. However, regardless of his faults, he possessed one faculty or talent, and that was, the ability to see and point out the mistakes of his fellow farmers. He could show, theoretically at least, their every fault, and also how if they would only follow his advice they could not help but be successful. Some of my friends who know me best have at various times intimated that I resemble my uncle in some respects.

"If anyone expects me to divulge a plan that will change an idle shop into a busy one, I am afraid they will be disappointed. After careful thought I have concluded that about all I can do it to copy my uncle and point out the faults and mistakes, as they appear to me, of what has been done in the past, not only by our company, but by some others with whom I have been more or less acquainted, hoping that by taking the negative side that something may develop that will be of real benefit to the machine tool manufacturers in times like the present.

"My first experience with a business depression came in 1893 and I haven't missed one since. I also feel more or less acquainted with the depression of the seventies through hearing it talked over and discussed by the founders of our company. On account of the many hardships endured and the ways and means used to keep our company in existence, the panic of the seventies was ever a live topic in our family, and although there were only about six lathe manufacturers at that time, the problem of how to keep alive was just as serious then, possibly more so, as it is today. The same difficulties existed then as now, so there is in reality nothing new to face, except to find a better way of overcoming them, and it is regarding these that I have theories of what we as manufacturers should and should not do. You will notice I say theories, because after having been actively engaged in making machine tools for over thirty years, I only know two things, the rest is all theory. The two things referred to, are, first—that in dull times it is next to impossible to make money, and second—you can make a tremendous loss unless the greatest care and foresight are exercised.

"Speaking for my own company, I can say that in the past we have done about everything to keep the wheels moving. Some years ago our company purchased from a manufacturer located in a small city some distance away, a single purpose machine and I was sent there to learn to operate it. Not knowing anything about hotel accommodations, inquiry was made of a friend who traveled that territory as to which was the best one, and he replied, 'There are six but whichever one you go to you will wish you had gone to the other,' and it is the same way with dull times, whatever we do we wish we had done something else. We have run on short time with practically a full crew, we have run full time with a reduced crew, and we have shut down entirely. We have built up stock when we wished we had not and we have kept our money in the bank when we wished we had it in stock.

"We have made an endless number of mechanical contrivances, including the first type of bicycle, familiarly known as the "bone-shaker," have made many patented articles, including flat-irons, horse shoes, even jack-knives with a blade for every conceivable use, designed many original machines for special purposes and also built them from designs furnished us, but I think without exception that in the long run each venture was a mistake and money loser. In all such cases a great deal of time and energy must necessarily be consumed which can not be acounted for in preparing to manufacture something greatly dis-similar to one's regular line, and unless the manufacturer is exceptionally fortunate in having executives of unusual ability, the probabilities are that many of the ways first tried to produce the new product will not be successful, necessitating starting over again, at least once, if not more times. If it were possible to use the same energy and ability in improving one's regular line, the financial benefit would be much greater.

Special Machinery

"Many manufacturers take on special machinery and sometimes this works out to advantage, other times, not. I will cite two examples, one of which was a success, the other a failure. For a successful example I have in mind a manufacturer who commenced years ago to make some special machinery used in a food industry and due to a combination of unusual circumstances has made a success of this business; first, owing to a universal and constantly increasing market for this particular food, the demand for this special machinery is practically constant, and second—to being located where he has no competition. In this one case the side line has outgrown the original. The tail has wagged the dog. On the other hand, I know of instances where the building of special machinery has lost to manufacturers business in their regular line, because the machines have not come up to the customer's expectations and regardless of the fact that they were not at fault the machine tool builder was held responsible. It is needless to add that in such cases the manufacturer would never again receive from such customers consideration in the placing of future business, either for standard or special machines. My unsuccessful example is that of a machine tool builder who by hard work had established himself a fairly good name for his particular line when one of these depression cycles swept over the country. Not being any too strong financially, it was necessary for him to keep his shop in operation if possible. A plausible inventor happened along about this time and the shop owner was persuaded to undertake to manufacture a machine which, according to the inventor, would revolutionize a certain industry. As is usual in nine out of ten of these cases, the machine turned out to be fundamentally wrong in design and became a failure. Nevertheless the builder was blamed by the inventor, payment was withheld and a long law suit resulted.

"Eventually the machine tool builder won the law suit but it practically cost him his business for these reasons. During the time the law suit was on he had to neglect his regular line. Meanwhile normal conditions returned in the machine tool business and he was unprepared to take care of his agents and customers and by the time he was, they had gone elsewhere. Further, when he came to the actual manufacture of the special machine he found that his regular machinists were not adapted to new work and he had to hire some that were, and by the same token, when he returned to making his regular line he had to change once more, and his old men having found positions elsewhere, it was with great difficulty that a new set of competent men was secured. The final result was that although the machine

tool builder recovered the cost of the special machines, the amount did not offset his losss in other directions and he became financially embarrassed and forced to liquidate.

In considering these two cases the critic may say that success or failure was simply a matter of foresight and business sagacity, but I do not think that is the correct answer, because I happen to know that in the case of the successful manufacturer the special machinery was taken on simply to tide over during a slack time and the future expansion was not in any way due to ability or foresightedness. In the case of the manufacturer who failed I also happened to know that he did not depend on his own judgment but sought the advice of others. The consensus of opinion of them all was that the invention apparently had great possibilities and if it made good there was a fortune in it. Some may even reason that it is best to distribute your eggs among many baskets, but personally I agree with Mark Twain who said, "Put all your eggs in one basket, but watch that basket." If you once decide to make machine tools stick to them.

Unprofitable Work

My own conclusion is that doing work foreign to one's regular line is unprofitable. There is, however, one exception which I wish to make and that is, the taking on of comparatively simple work, requiring little or no supervision, at a fixed rate per hour. This enables a manufacturer to keep his organization together and cuts down the overhead. The fly in the ointment in this proposition is to first obtain the business. In dull times there is very little of it to be had and what there is, is most generally given to contract or job shops who make a specialty of doing this work in good times and bad. Still, our firm has always been able to secure some and in thinking the matter over, I recall that most of this kind of outside work has been confined to planing. Such being the case, I would suggest that our members look into this and see if they cannot develop something locally, especially those who have unusual planer equipment, such as exceptionally long or wide planers. Because of our firm happening to have an extra wide planer we were able recently to secure on an hourly basis some work right in our own city that amounted to about two thousand dollars.

Every depression occurring in my generation has been brought about by a different cause; over-speculation, politics and the world war all playing their part, and no two depressions have come about from the same cause, so that the lessons we learn from one cannot be applied to another. If the present depression were caused by the same conditions as the one of 1893, or if the next one will be the result of the world war, I am sure we could apply to advantage the knowledge gained in the past, but as each depression was the result of entirely different causes, the lesson we learned in '93 is of very little value now.

You may think that I am straying from my subject, and perhaps I am, but the point I am trying to bring out is what we should do with idle shops in dull times depends a great deal on the cause of dull times. For example, if world conditions today were similar to those existing in '94 and '95, I should advocate running our plant to capacity and stocking, if necessary, all the machines we could make. On the other hand, if there should be another world war and I am unfortunate enough to be alive at that time, I should commence to curtail with the first rumors of peace and not stock a single machine.

As I said earlier in this article, my actual knowledge of what can be made to advantage in a machine tool shop during slack times is very limited, my experience has grown only a crop of theories. I do think, however, that if you take on outside work or special machinery, it is much better to confine the new work as closely as possible to the line in which you are already engaged. Sometimes, even what seems like a small change from the regular, will cause a lot of trouble, as perhaps the following illustration will show.

During a semi-slack period some years ago a firm in a nearby city placed their order with us for what seemed to be nothing more than an ordinary lathe with a turret on the ways and another on the carriage, it being thought by all that a machine of this kind would handle a certain part to perfection. After the machine itself was made the job of tooling it up and testing it out was given to me. Of all the deceitful things which I ever encountered, that piece of work was the limit. I worked on the job for months until I fairly hated the very sight of it. Finally we hit upon a new scheme for tooling the work up and by hard work I finished the tools the night before I left on a vacation, sure in my own mind that they would be a success. Upon my return, almost the first words my father said were, "Son, I am glad you are back, those last tools didn't work and the machine is waiting for you to try something else." Eventually, after we had spent in experimenting several times the original price, the machine was accepted and we charged the loss up to experience. Having expounded my theories regarding what shouldn't be done in slack times, possibly you are wondering if I have any theory as to what should be. I have one, but I hesitate to tell it, as it may be thought idealistic and visionary.

To operate a shop successfully in dull times you must be able to do so in good times. That statement may sound like pure nonsense at first, but before passing judgment let's analyze it for a moment. What constitutes successful operation? Does the mere ability to secure orders sufficient to make a profit when business is good constitute successful operation? I claim that that is only partial success. We all know without my going into the whys and wherefores that the machine tool business can be operated at full capacity only at certain periods or intervals of more or less duration. That every so often we are confronted with a cycle of depression, caused by conditions beyond our control. That in spite of ours being a fundamental industry, the one in fact, on which the world today is dependent as it is on no other, yet it is also a fact that what profits there are, are only made during good times, and to make ends meet at others it is necessary to resort to extreme measures.

My theory is that the price at which machine tools are sold when there is a market should be sufficient to return a profit great enough to pay a reasonable dividend annually, good times and bad, on the capital invested, and in addition take care of the ordinary expenses during the dull times. Hence my idea of operating a shop successfully in good times is to see that we obtain that price, and if we do, we shan't have to worry so much about the dull times.

METHODS OF REDUCING FATIGUE IN THE TOOL ROOMS

Continued from page 33

ed along lines of combining efforts on fatigue elimination and safety work, or accident elimination and sufficient lighting to insure tools in the best condition with least effort of inspection. It was found that fatigue and safety work could be carried on at the same time with no extra expenditure of money and energy.

Tool Room Painted White

Every possible surface in the tool room is painted white, as the illustrations show. Tools are arranged in the most orderly manner possible. This was done in accordance with a predetermined standardization, the theory and practice of which had been a gradual growth, before, through and after the experience of F. W. Taylor, and finally as a result of micromotion study of the accepted traditions and standards of highly standardized tool rooms and tool cribs of modern plants. The result, as was to be expected, emphasized that the motion study and fatigue study cannot be separated, and to omit the full consideration of either one reduces the final quality of the results of the other.

Sliding trays are used where possible for certain tools, so that workmen can examine each piece without disturbing the others. The packet principle was incorporated, and the tools are placed in such position that they can be handled with least amount of fatigue and greatest safety. The ladders used have steps which project inside to allow the foot to have a firm and comfortable position and the shin to touch upon the outside nosing of the step above, thus eliminating fatigue and accidents.

White paint is only one factor in the reduction of necessary fatigue and accidents in tool rooms, but it is the outstanding feature to the casual visitor and is the emphasized feature in tool room shown in the illustrations.

Industrial Diamonds—Their Pedigree Essential

Little Thought is Given by Operator Engaged in Trueing Wheel As to Work Entailed Before An Industrial Diamond Becomes Fit For Use—Interesting Service Plan

WHEN an emery wheel operator, say, in a motor car plant, is engaged in the trueing or dressing of a wheel by means of a diamond tool, very little thought enters his head as to the amount of service which the little implement represents before it actually comes to his hand. Nor is he aware that the complete history, grade and purpose of the stone set therein has become a matter of analytical record. This record or pedigree has come to be regarded as so essential in the marketing of diamonds of this class, that manufacturers today should know not only the exact cost per dressing but the details as to the actual life of a diamond of given quality.

In analyzing diamond service, the Wheel Trueing Tool Co., Detroit and Windsor, for example, have developed a record system in which as direct diamond importers and tool workers they may be said to keep in constant contact with their industrial diamonds—from the cradle to the grave. Not only is every stone a matter of careful record—how mounted, when used, and of what grade—but a table of comparative costs per dressing has been worked out. Pointing to the thoroughness that has been developed by this particular company as an object worthy of ambition in any business, and as a potent factor in advertising and selling, Printers' Ink further reviews some interesting facts relative to industrial diamonds. Here is what they say:

"Industrial diamonds come out of the same mines as those cut for gems. The diamond is a natural formation and is found in river beds, on the surface and in mines to a depth equalling approximately that of any mineral deposit. Between 90 and 95 per cent. of all diamonds come, in normal times, from South Africa.

"Diamonds are mined, primarily, for the purpose of securing stones suitable for cutting into gems. The by-product, which is given the general name of Bortz, is the grade obtained after sorting for gems, generally after six sortings. For the purpose of this article we will consider that Bortz is the synonym for industrial diamonds, or diamonds not suitable for cutting into gems. Bortz is divided into many classes, the principal one being enumerated as follows: Names describing color: white, grey, black, light brown, brown, dark brown, canary yellow, pink and green. Names describing quality: Perfect selected, finest and fine. Names describing shapes: Octahedrons, rounds, flats, ballas, irregulars and cleavages. Names describing classifications and purposes for which used:

"Crushing Bort (which is crushed into diamond dust and used for lapping purposes), Saw Bort (stones from which saw teeth are made and which are used for sawing stone and marble. Drilling Bort (used in rock drills for mining purposes, Glaziers (used for cutting and etching glass), Splints (sharp, pointed splints of diamond used for small drills, for turning jewels for watches, engine turning, engraving, etc.), Slabs (for making shaped turning tools), Flats (the crystals or parts of crystals into which holes are bored so that they can be used as dies for wire-drawing work), Tool Borts (which are set in holders and used for trueing grinding wheels).

"Brown, grey, and black borts, which are further subdivided by the terms "Selected," "Finest," etc., are very hard stones, but are apt to shatter if not properly set in the holders, due to the fact that there are very distinct cleavage lines in their structure. These stones are very frequently found in the natural state in the form of octahedrons and many users insist on this shape when purchasing stones, as it is considered that a more positive grip may be obtained in the setting.

A Job For a Service Department.

"These diamonds are found in many shapes, variations of the octahedron and in squares and flat triangular form. Some claim that the stone having the greatest number of sharp points will give the most service. Others argue that the round or Ballas-shaped stone will give far greater service if frequently reset, as the points of an octahedron wear down very rapidly, causing a greater reduction in weight for the amount of work accomplished.

"The Ballas differ from other stones in their formation in that there is no direct cleavage line to be found in them, the crystals being built up around the centre and following no regular lines of formation, resulting in an irregular, knotty stone which is hard and tough. As there is a vast difference in industrial diamonds, so, too, there is equal complexity in the selection of diamond tools. Unless used as diamond dust for a grinding or lapping agent all industrial diamonds must be mounted in a tool to perform the function for which they are purchased. The design of diamond tools is a science, the mounting of diamonds in these tools is an art.

"Assume the position of a buyer of industrial diamonds, diamond tools, or both. It is quite out of the question to consider that this buyer can study the quality of diamonds or the value of diamond tools to the extent that he is an absolutely competent purchaser. He must rely on the advice of those who do know in order to buy with greatest economy. This condition holds true of the majority of the diamond buyers in the country.

"Thus it is a logical thing for this company to advertise service since it has something to sell far more important than diamonds and tools—a service with a foundation of most economical diamond use for all of its consumers.

"Most industrial diamonds look alike to the untrained diamond man. Consequently, the industry presents opportunity for selling inferior diamonds at a low price, just to get the business. Minimum cost per dressing is the only guarantee given with diamonds or diamond tools. However, it is an all inclusive guarantee. If the stone is too small for its work the cost of dressing will be too high. The same is true if the stone is of the wrong grade, is defective, or is in an incorrect mounting or tool.

"Yet another angle which ties up the service argument is the fact that diamonds wear away in use. These stones may be relapped and reset—the delicate work of diamond experts. Each reset diamond is reweighed and the tool stamped with the weight of last resetting. This permits the cost department of the factory to inventory the diamonds and determine their shrinkage in value by wear at a glance."

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60 TON HOPPER BOTTOM BOX CARS

(Continued from page 28)

entire arrangement is located overhanging the end of the roof so that it is impossible, even in the deepest snow, to have it pile up underneath. The ratchet pawl is of the gravity type, and therefore the trainman is not required to use his feet for the purpose of holding the pawl in position. The trucks are of the standard arch bar type with improved truck columns, spring plank and truck column fastenings, pinless brake beam hanger brackets, and four point brake beam suspension.

Brown Copper & Brass Rolling Mills, New Toronto, report improvement in trade conditions as affecting them. Their sales have shown a steady increase each month over the preceding one, and Mr. Brown looks for the new year to bring business back to normal or better.



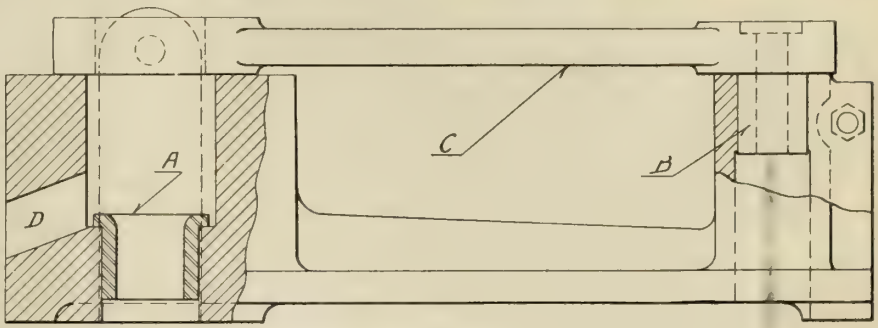
WHAT OUR READERS THINK AND DO



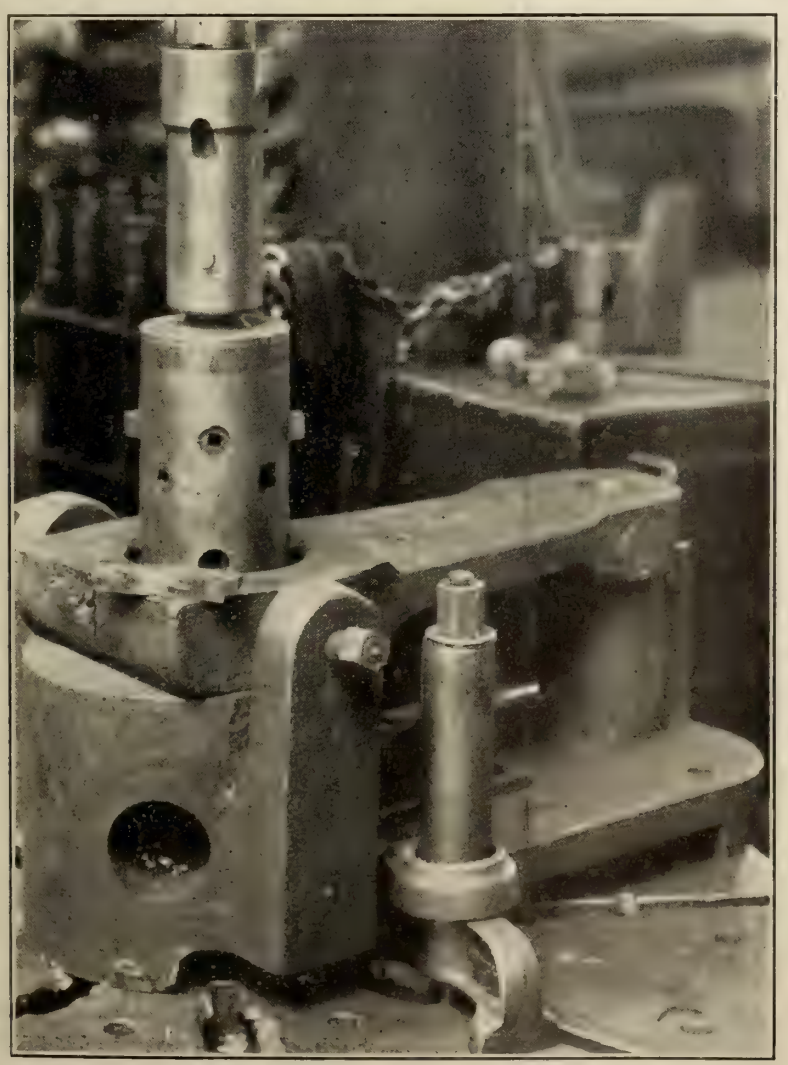
BORING ON THE DRILLING MACHINE

By J. H. Rodgers

An accurate and time saving jig for boring holes in locomotive crank arms is shown herewith. As will be seen from the illustration the machining operation is performed in an ordinary drill press and very effectively. The jig is self-centering and the boring operation is completed at one setting of the bar. The bar is of special design, carrying roughing, finishing and filleting tools, all being of the expanding type. The roughing tool precedes the finishing tool and the former has completed its work before the latter comes into action. The filleting tool is inserted ofter the bore is finished.



Sectional view of the jig.



Showing the jig in actual operation.

The line drawing shows a sectional view of the holding fixture. The jig is centrally located when the pilot end of the boring bar enters the hardened bushing A, and it is then clamped to the table. The trunnion B on the end of the arm C is inserted in the hole in the outer end of the jig. This end is slotted to provide clamping facilities. When the work is in position the crank pin end is adjusted to equalize the cut in the cored hole, the central distance of the holes remaining constant. Holes D are provided for the escape of cuttings.

HANDY BELT RULES

By W. F. Schaphorst

Practical men are always on the lookout for the best and simplest rules. They hate complexity. They prefer simplicity. That is why it is desirable to condense belt rules to as simple a form as possible, do away with formulas entirely and use them as "rules of thumb." For several years past I have made a special study of belts, have collected all manner of data, have investigated the "fancy formulas" developed by scientists, and I always come to the same conclusion—that our simple rules of thumb are usually preferable to the complex formulas, and they are generally safer. Besides, if a belt isn't attended to, if it isn't dressed once in a while and is allowed to get dry, hard and slippery, the best formulas in the world won't keep it on the pulleys and won't stop slip.

I have just finished checking figures in a catalogue of a well-known manufacturer of pulleys. In this catalogue, tables are given which state the horse power transmitted for all sizes of pul-

leys, all speeds and all thicknesses of belts—single, double, triple and four-ply. Each figure is computed separately, taking into account the effect of centrifugal force. And it is assumed that driven and driving pulleys are equal in diameter. I find one thing in my checking which I consider an error, viz, that with increase in speed, a given belt will transmit less power. It has been demonstrated time and again in actual tests that large pulleys and high speeds, up to about a mile a minute, are desirable for most efficient transmission of maximum power. The best leather belts with cemented joints, may be operated to advantage at 6000 ft. per minute.

Basing my conclusions on past personal experience and on present good belting practice, I will say that the following rules of thumb are generally good and safe to use:—For single-ply leather belts, 3-16 inch thick, each inch in width will transmit one-horse power when running at a speed of 800 feet per minute. Pulley should not be less than six inches in diameter. For double-ply belts, 3-8 inch thick, each inch in width will transmit one-horse power when running at a speed of 500 feet per minute. Pulley should not be less than ten inches in diameter.

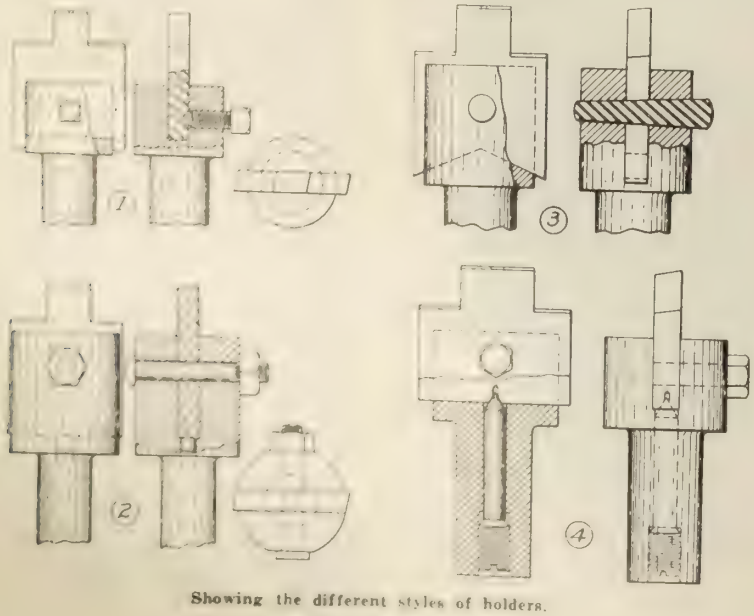
For triple-ply belts, 9-16 inch thick, each inch in width will transmit one-horse power when running at a speed of 300 per minute, pulley should not be less than three feet in diameter. The four-ply belts, 3-4 in. thick, each inch in width will transmit one-horse power when running at a speed of 300 feet per minute, pulley should not be less than four feet in diameter. The above rules will give very satisfactory service where the belt is kept in good shape. Do not allow the belt to dry or harden. Keep it dressed with a good grade dressing.

HOLDING FLAT CUTTERS

By Harry Moore

The four sketches shown illustrate various ways in which flat cutters can be quickly and conveniently located centrally and firmly held in the holder. Fig. 1 shows rear of cutter cut away so that a short lug on either side fits closely over the diameter of the holder. Set screw point enters countersink inside of cutter, the countersink being located a little forward to force the cutter back against the seat.

Fig. 2 shows a round tit turned on the back of the cutter, said tit fitting into center hole at the bottom of the slot. Bolt pasing through holder clamps cutter securely. Fig. 3 shows cutter wedged on opposed tapers by means of tapered pin, while Fig. 4 shows method of locating cutter by means of center pin, adjusted to position by headless screw.



Showing the different styles of holders.

ANSWER TO THREAD CUTTING

By J. DAVIES

In the Oct. 27th issue of Canadian Machinery, writes J. Davies, I notice an article on thread cutting by Cecil H. Smith, in which he propounds a system of finding gears for thread cutting which, in his opinion, is simpler than the one you published in your issue of August 25, which was written by myself. I believe Mr. Smith's criticism is a friendly one and I know a candid exchange of ideas by your readers on various subjects will be beneficial to all concerned. In looking up the issue of August 25 and referring to article mentioned, I notice this statement the first thing. The ratio of the driving wheels to the driven wheels must be the same as the lead of the screw to be cut is to the lead of the lead screw. It is quite true that this can be expressed by simply putting down, as Mr. Smith suggests, the number of threads per inch in the lead screw as a numerator, and the number of threads in the screw to be cut as a denominator. This expresses as it were, the ratio at first hand. But unfortunately, this has a limited application. Try it out on one of the examples given in article mentioned.

Suppose we want to cut a thread .654 lead with a lead screw 3 threads per inch.

$$\frac{\text{3 numerator}}{\text{? denominator}} = \text{Ratio.}$$

The method shown in your issue of Oct. 27 is a good one for common threads such as are usually found in a workshop, but for all purposes, I think the one under discussion is best as, by using it, any train of gears that is possible can be found. Also metric leads can be cut with an ordinary lead screw or vice versa.

NEW PROCESS

The production of synthetic petrol for fuel purposes has another method to its credit. Prof. Mailhe of the science department of the university of Toulouse, has reported to the French academy of science a process for the extraction of petrol combinations from ordinary plants. The new fluid closely resembles Borneo petrol, which, in the early days of the war, provided the French government with the bases for high explosives, as it contains a large percentage of both benzine and toluene.

Not only can the new petrol be mixed with ordinary alcohol, thereby providing a possible motor fuel, but the cost of production, inasmuch as thousands of common weeds can be used in making it, is very low. Moreover, in the process of manufacture of this petrol an inflammable gas is given off which was said to have produced 20,000 heat calories and which, if captured, would alone pay for the installation of large plants.

NEW TORCH

An improved form of oxy-acetylene torch has been evolved in the French Navy in the process of salving vessels lost during the war. A small bell-shaped vessel surrounds the oxy-acetylene flame, and is kept supplied with compressed air. After the flame is alight, and the stream of compressed air established, the torch may be plunged into water without being extinguished. If by accident the original form of blowpipe was extinguished, it was necessary for the driver to ascend to the air to light it again. A tube containing an alkaline metal and an oxidiser is now attached to the torch, and can be moved to the mouth of the bell. On removing the cap from the end of the tube the chemical action of the water on the mixture produces a flame which relights the torch. The addition has greatly increased the number of underwater uses to which the torch can be put.

E. E. Sawyer, formerly factory manager with Dominion Abrasive Co., Mimico, has been appointed factory manager of the new abrasive factory of J. R.



Welding Hint of Value

SPEAKING on the subject of aluminum welding, a writer in the Journal of Acetylene Welding, says that in welding such work as aluminum crank cases, etc., the following idea can be used to advantage.

He says that oftentimes it is required to weld a large hole, in which case a chill of galvanized iron is provided, backing up the hole and welding against this when filling the hole with aluminum. Galvanized iron is preferable to any other material, such as tin or iron, since it peels away from the aluminum quite readily, and can therefore easily be removed after the weld has been completed. This is undoubtedly due to the zinc content of the galvanizing composition. The chief value of the use of the chill is that it causes the filler to cool and harden prematurely, thereby preventing it from contracting after the weld is finished. It also prevents the heat of the weld from spreading, which might cause the job to crack back. The chill is fastened in place by a wrought-iron scrap, made in the shape of a boiler crab, which arches the hole. A hole is then drilled through the strap and a similar one through the galvanized-iron plate, the two being fastened together by means of a bolt and nut. In making the weld, the metal is first aplied to the inner corners and the space filled up by working toward the center. Just before the center is reached, and when it is impossible to add any more metal without touching the bolt, the strap should be loosened, the bolt removed, and the hole filled with the molten metal. Greater success will obtain if the work is done quickly, handling as large an amount of molten aluminum as possible at a time and covering the entire surface of the galvanized chill in a few minutes. The chill causes the added metal to cool almost as fast as it is connected to the edge of the break. After the weld has been finished and cooled, the chill can be removed by gently prying it away from the weld by means of a cold chisel. The flame of the torch should be kept in motion while performing the work, and should not be pointed toward the weld, but rather across the melting portion; otherwise it is almost certain that the flame will not only injure the metal, but will also burn away the galvanizing if pointed directly toward the weld.

Why Does Iron Rust?

SPEAKING on what it pays to know about "Corrosion," G. A. Van Brunt, in a recent issue of "Factory," says that there are three theories of corrosion, the best of which is the "Electrolytic Theory." In explaining this theory he says that it offers a satisfactory explanation for a greater number of observed facts. He continues:

Ferrous salts, especially in solution or freshly precipitated, are rapidly oxidised in the ferric state by atmospheric oxygen; so that all the electrolytic theory must do is account for the solution of the iron in the first place. According to present views the reactions which take place between different substances in the presence of water are accompanied by certain readjustments of the electrical state of the irons. Thus, when metallic iron is put into a solution of copper sulphate, or blue vitriol, the copper is precipitated in metallic form and the iron goes into solution, the ions of this taking the electrical charge of the copper ions. Chemically, hydrogen behaves like a metal and has a lower solution tension than iron; therefore if we place a strip of iron in a solution containing hydrogen ions, the iron ions will assume an electric charge and the strip will be dissolved, as it was in the copper solution, while the hydrogen will give up its electric charge, changing from the ionic to the atomic condition and escaping as a gas.

It has been shown that iron is slightly soluble in pure water, but if oxygen is not permitted to act on the solution no sign of corrosion can be seen. When it is admitted, however, the red ferric hydroxide soon settles out. A little reflection will show that before iron can rust it must first go into solution, at the same time that hydrogen is set free, and oxygen must be present to oxidize the ferrous salts formed. An exchange of electricity between the reacting ions is therefore demanded and the case may be considered to be one of electrolysis, as the disappearance of a hydrogen ion, the hydrogen going off as gas, means the appearance of a ferrous ion somewhere else. We may consider, then, that corrosion is due to the iron being attacked by hydrogen ions and taken into solution. Since hydrogen is the characteristic ion of acids and hydroxyl that of bases, we should expect acids to stimulate corrosion and alkaline substances to retard it, which is in accord with fact.

Taking a bird's-eye view of corrosion according to the electrolytic theory, we see that it lines up about as follows: When iron and water are in contact a certain amount of the metal goes into solution. Remembering that hydrogen acts like a metal, it is seen that its ions will tend to collect around the negative poles and exchange their electric charges with the iron so that the latter will go into solution and the hydrogen escape as a gas. Ordinarily, however, the concentration of the ions is low and the action proceeds very slowly. Iron goes into solution, nevertheless, as a ferrous salt; the oxygen of the air then acts on the ferrous salts and changes them into the ferric state, in which form they precipitate out as the familiar red rust. And so the process is repeated indefinitely.

A Scientific Institute

ACCORDING to information received, Baron Edmund De Rothschilds, administrator of the Eastern Railway of France, has given ten million francs to found a scientific institute, the object of which is to encourage students to take up research as a career. Particular attention is to be given to researches looking to the application of science to industry and agriculture. The institution is to be managed by a council, two members of which are elected by the Academy of Science and the French Museum.



DEVELOPMENTS IN SHOP EQUIPMENT



ADJUSTABLE BED PUNCHING PRESS

A punching press designed for work requiring a long stroke and an unusual height between the bed and the ram, has recently been placed on the market by Ferracute Machine Co., Bridgeton, N.J. The machine is equipped with a bed that is adjustable vertically. As the bed and frame are separate castings it is necessary that their connection be strong and rigid. To obtain this condition, the bed is attached to the frame by heavy steel bolts and the bed is supported on a steel adjusting screw four inches in diameter. A projection on the back of the bed fits into a planed vertical guide in the frame, and keeps the top of the bed parallel with the bottom surface of the ram. The press may also be used for horning operations by inserting a horn in a 9 1-2 inch hole in the frame. The bed is hinged on a vertical rod at the left-hand side of the machine, which enables it to be swung out of the way when the machine is used for horning. The ram has a maximum adjustment of three inches, and the bed nine inches.

The distance between the bed and the ram when the former is adjusted to its lower position, and the ram is at the top of its stroke and its highest adjustment, is 30 inches. The ram stroke is 8 inches. The press exerts a pressure of 70 tons and its weight is approximately 13,200 lbs.

BENCH HAND MILLING MACHINE

The Pratt & Whitney Co., Hartford, Conn., have added another machine to their line of hand millers. It is known as the No. 3 hand miller. The spindle and draw back are identical with that provided on their No. 3 bench lathe. Therefore all spindle attachments on these machines are interchangeable. The table of the milling machine is of a design suitable for the mounting of attachments, and it accommodates head stock and tail stock of the No. 3 bench lathe. All screws are equipped with micrometer dials graduated to 0.001 inch. The spindle is of tool steel hardened and ground, and has a conical front end. The front spindle bearing has a double taper and is also made of tool steel hardened and ground The rear spindle bearing is of "Non-Gran." Both bearings are adjustable for wear A three step cone drives the spindle. The special equipment that can be furnished with this machine includes a swivel vise graduated in degrees, an index quill centre, a tail stock, arbors for saws, a right angle adapter, and a vertical milling attachment. The latter attachment is mounted over the spindle nose and is driven by a plug placed in a draw-in collet.

HEAT-TREATING FURNACE

An automatic heat-treating furnace of the conveyor type has been placed on the market by Alcorn Blockhouse & Co., Philadelphia, Pa. The furnace is designed to handle such articles as crank shafts, cam shafts, automobile rear axles, and miscellaneous small pieces such as gears. The conveyor has a vertical motion and such pieces as crank shafts, etc., are revolved while undergoing treatment. The important advantages claimed are uniform heating of the pieces and the elimination of skilled labor, also an increase in fuel economy and a lowered cost of upkeep. The length of treatment is automatically controlled by means of a variable speed motor that operates the conveyor. The temperatures are controlled by Leeds and Northrup instruments, which includes a temperature recorder. The furnace can be heated by electricity, gas, oil, coal, or any kind of fuel that will give the necessary heat.

VERTICAL SHAPER ATTACHMENT.

Mr. L. E. Rhodes of Hartford, Conn., has developed a vertical attachment that can be quickly applied to any of the standard types of crank shapers, and which will enable operations usually performed on shapers of the vertical type to be performed on horizontal shapers. The housing which contains the vertical ram and its necessary mechanical parts is made to fit in the ways of the regular horizontal ram. This housing is capable of adjustment to the desired position with reference to the work and held in that position by the regular gibs. The installation of the attachment is very simple. All that is necessary is to remove the driving arm and attach two steel leg plates that remain on the machine permanently, screw in a connecting rod and insert a pin. This attachment is also provided with a rotary work table equipped with standard index plates.

QUICK-CHANGE-GEAR ENGINE

The South Bend Lathe Works, South Bend, Indiana, have introduced a new lathe which is made in eight sizes, ranging from nine inches to twenty-four inches swing. These machines can be equipped with either of two types of bed, the straight or the gap. The quick change gear box is the same as that provided on Flather lathes, and has 48 changes of feeds and threads. It has been arranged so that all these beds are available for the cross-feed. The gears are made of steel forgings. The changes in feed are operated through a plunger and index plate and the crank lever above the box which operates an inside clutch.

Three V's and one flat-way are provided, for guiding the head stock, tail stock, and carriage. The spindle is hollow, made of special steel and accurately ground. The headstock is provided with an improved reverse. The tail stock is offset to allow compound rest to be swung around parallel with the axis of the bed. Tail stock is also arranged with a set-over to permit of taper turning. The tail stock centre is self-ejecting. The carriage is equipped with T slots for clamping work to be bored or milled. Both the automatic cross feed and automatic longitudinal feed of the carriage are operated from the front of the apron. Only one of these two feeds, however, can be engaged at one time. Both feeds are driven by a splined screw and worm, so that it is only necessary to use the leadscrew thread, when cutting threads. The compound rest is graduated to 180 degrees, and the cross feed screw has a micrometer graduated collar reading to 0.001 inch. The lathe is sold with the following regular equipment, large face plate, small face plate, graduated compound rest, follow rest (on all but 9-inch and 11-inch sizes) adjustable stop for thread cutting, semi-machined chuck nut, gear guards, wrenches, and double friction countershaft.

SMALL-SIZE ENGINE LATHES.

A line of small lathes have recently been brought out by the Monarch Machine Tool Co., Sidney, Ohio. The lathes are of nine and eleven-inch swing with lengths of beds varying from two and a half to five feet. They are known to the trade as the "Monarch Junior." The lathes are provided with bench legs, or

with chip pan and floor legs. The headstock of these machines is of the solid full webbed bowl type. The spindles are hollow, having 1 1-6 inch holes through them, and are made from crucible steel accurately ground. The spindle drive is through a three step cone and single back gears. The base of the tail stock is graduated for taper turning and is so designed that it can considerably overhang the bed, giving greater distances between centres. Full quick change or semi-quick change gear boxes are provided. This permits of a wide range of thread changes for screw cutting and feeds for ordinary work. The countershaft is equipped with two Edgemount friction clutches, cast iron hangers and ring oiled bearings.

A compound rest gibbed throughout is provided. The tool post is equipped with a "Mac-It" non-breakable screw. Lead screws are thoroughly tested for accuracy. The carriage is drilled and tapped for taper attachment, chasing dial, and chasing stop. Regular equipment furnished is double friction countershaft, face plate, dog plate, center rest, follow rest, centers, compound rest and wrenches. Other accessories can be furnished and applied without any machine work or fitting.

HEAVY-DUTY GRINDING MACHINE

The Van Dorn Electric Tool Co. of Cleveland, Ohio, have recently placed on the market a heavy duty, electric driven, ball bearing, grinding machine. It is equipped with two grinding wheels 14 inches in diameter and two and one-half inches face. These wheels are mounted directly on the ends of the one and one-quarter inch motor shaft. Provision is made on the wheel guards for connection with exhaust directs when required, and a lug on each guard permits an eye-shield to be attached. The tool rests are capable of both vertical and horizontal adjustment over a wide range. An aluminum water pot is conveniently located so that a short arm movement only, is required. The pot is removable.

The motor was designed specially for this machine and is rated at 4 h.p. for normal continuous operation, and can take care of a momentary overload of three horse power. Standard motor is three phase, 60 cycle—220 or 440 volts. Special windings are also provided. The standard motor has a speed of 1200 r.p.m. The motor is completely enclosed in a dust proof housing which is smaller in diameter than the grinding wheels, which gives ample space for the operator's hands and clearance for grinding long pieces.

A fan within the motor furnishes normal ventilation, but under extreme conditions of excessive dust a supply of fresh air may be piped to the intake of the housing. The arbor or shaft is set in large ball bearings amply supported by the housing. Lubrication is accomplished by means of a grease gun inserted in grease ports. The pedestal serves as a cabinet for the switch, fuses, and connections. The cable conduit enters at the rear and no electrical apparatus is anywhere exposed. Stopping and starting is through the medium of a pedal switch located at the base of the pedestal. The spindle centre is 39 inches above the floor and the grinding wheels are 25 inches apart.

CAR WHEEL BORING MACHINE

The Betts Machine Co., 400 Blossom Road, Rochester, N.Y., have placed on the market a new car-wheel boring machine incorporating some novel features. The bed and frame are one casting. The whole machine has been designed to withstand high stresses. Simplicity of operation is also a predominating factor. The machine is driven by a single pulley or it can be direct connected to a constant-speed or variable-speed motor. There are four face plate speeds to one constant pulley speed. At the recommended pulley speed the face plate speeds are 10.2, 13.9, 20.4 and 30.7 revolutions per minute. These speeds are obtained by means of hardened steel sliding gears running in oil. The two levers used are interlocked so that no two sets of gears can be placed in mesh at the same time. The table revolves on a wide bearing. The large spindle runs in a bronze bushed bearing, and has a special collar on it to prevent lifting.

The table is equipped with a five jaw chuck that is both independent and universal. Five stations are provided for operating the chuck so that one will always be convenient to the operator.

The machine is provided with a friction clutch and a brake for quick starting and stopping. Six automatic boring and facing feeds are obtained by means of a two step cone pulley and sliding gears with instantaneous change. Facing operations are provided for regularly on the machine. The boring ram is counterweighted by a weight hung inside the frame. The machine is regularly equipped with a quick acting air operated crane for loading and unloading car wheels. This crane can also be driven by individual motor or by belt.

NEW DRILLING MACHINE

Baker Bros., of Toledo, Ohio, have added a new Light Heavy-Duty Boring and Drilling Machine to their well-known line. The new machine is known as their No. 121, and is intended for driving drills from ⅜" to 1½" in diam., as well as for boring and facing. The machine is finished either as a single purpose or a quick change drilling machine. The single purpose drilling machine can be made into a quick change machine by simply adding the gear box and some minor parts, the head being completely bored and drilled for them. It is operated through broad face, tight and loose pulleys mounted at the back of the machine on a shaft running in roller bearings. This feature of the design allows wide-faced pulleys to be used and still, if required, the machines can be operated in gangs with spindle distances, centre to centre, of 18½ in. Control levers are very conveniently located. All gears in the speed train are hardened. A wide range of feeds and speeds to suit special jobs can be obtained. The power of the machine is shown when it has been stated that a 4" pipe tap has been successfully driven by it.

The spindle is over counterweighted and a device is provided which absorbs the inertia of the return of the spindle to its top position. This device withdraws the drill automatically from the work and together with the break which is automatically applied when the belt is shifted to the loose pulley, makes for greater production throughout. A special spring device holds the belt in pace on either the fast or loose pulleys. By the use of slip gears almost any speed up to the maximum can be obtained. The single purpose standard speeds are from 144 to 468 r.p.m and for the quick change machine 38 to 632 r.p.m. Feeds on the single purpose machine vary from 0.006 inches to 0.1 inches per revolution by using the slip gears, but the standard feeds are 0.008 to .025 inches per revolution.

The quick change machine is ordinarily provided with ten changes of feed varying between 0.008 inches and 0.094 inches.

The table is of the plain box knee type raised and lowered by a telescoping screw. Compound tables having screw adjustments can be furnished. Various attachments can be furnished, such as a tapping reverse, multiple spindle head, motor drive, oil jump, gang assembly, etc. The floor space is 22" x 36", and the weight 2.100 pounds.

ALIGNING LEVEL

A sensitive machine aligning level has recently been put on the market by the Universal Boring Machine Co., Hudson, Mass. The frame, which is 27 inches long, is of cast iron, with a "truss" construction. The vial is produced from specially ground Jena glass of the best quality. It is set in a brass japanned case, mounted, and adjusted by, two brass lacquered studs. The bubble in the vial has a guaranteed sensitiveness of 5 seconds of arc, per graduation, which means that the bubble will indicate per graduation difference of about three ten thousandths of an inch.

The frame casting is insulated from the heat of the palm of the hand by a handle of non-conducting material. Great care is taken in manufacturing. After being machined the casting is thoroughly seasoned. Subsequently the base is hand scraped and tested, after which it is again subjected to a seasoning process and a further test made. Then the vial is mounted and adjusted. The weight is about 9¾ pounds.

St. Thomas.—The Monarch knitting plant is operating at more than 90 per cent. of its 1920 capacity, and a continued improvement is expected. The spinning departments are particularly busy.

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B. G. NEWTON, Manager
J. H. MOORE, Editor
T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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Competition Between Manufacturers

BANKERS and technical journalists should be the best advisers in times like the present. Unfortunately only a limited number of them here are real authorities. The Canadian and British branch banking system tends to make machines out of bank managers. The study of big problems is done at the head offices. But, too often, when a man arrives at the head office as a result of successful promotions he is more of a detail man—more of a clerk than an executive, more accustomed to study the bank's present internal problems, than the future of the big questions—national and international money and business.

Technical journalism in Canada is still in its infancy but it is making very satisfactory progress and there are some able men engaged in our specialized newspapers and as revenue permits these papers will become stronger leaders. When you do find a real authority his advice should be carefully considered. One such man is the head of the National Bank of Commerce, New York. Here is what he said last week:—

"In the period immediately ahead, manufacturers will face the most severe competition in a generation. It is now clear that many important industries are seriously overbuilt, when measured in terms of effective demand here and abroad. There is no method by which competition can be avoided, but there are methods by which it can be successfully met. Overhead charges should be rigidly examined and cut to the lowest point consistent with production efficiency. Costs should be critically studied and such examination should include not only factory operations, but the entire producing organizations. In periods of high profits, useless frills are certain to be introduced into the best systems. Simplicity is now of necessity the watchword and much careful but courageous elimination is necessary.

"In many lines, labor costs must be further reduced. Such reduction can in part be attained by lower wages, and in part by increased efficiency in organization for production. A considerable part of labor inefficiency is at times due to actual defects in plant and organization. Business has two duties, first, to provide the best means for efficient production by its labor, and second, to insist on a day's work for a day's pay."

A Study In Patience

"THERE is no reason why a blind man with a normal brain cannot work and enjoy himself as well as the man who can see." These words were uttered recently by a blind man in Grand Rapids, Mich., who daily performs his tasks in the machine shop. This gentleman, whose name is Gerald Ensing, operates lathes, drill presses, grinders, shapers and planers with good success and according to the shop foreman of the plant in which he works, performs his tasks very efficiently.

In the Sept. 30th, 1920, issue of Canadian Machinery, we published a story showing how blind workers in Cleveland, Ohio, shops had proved efficient in machine shop work and how over sixty operations were being performed with great success. Some of these operations were completed on a piece work basis, and the blind employees could, in many cases, make just as much as men in possession of their sight. A peculiar point which has been proven in connection with blind workers, is that they are very careful, few accidents occurring.

Have you ever tried to shut your eyes, then start to perform some task in that condition? If so, you no doubt know what a poor attempt you made of it the first time. However, if you are of a patient nature, you tried again and again, until at last you found you could actually accomplish the task. True, you were slow about it, yet you felt within yourself, that if you practised long enough, you could attain speed. This is exactly what these blind workers have had to do. It has no doubt been slow and tedious work, but in the end the joy of accomplishment is quite a fine thing to feel. Truly it is a study in patience.

We were once privileged to watch a blind operator assembling small discs for a vacuum cleaner. The speed and precision with which he performed his work was amazing, and all the time he worked he smiled. Perhaps it was a smile of tolerance, to think we were so amazed at something which had taken years of patience to attain. Let us help the blind wherever we can. Help them become independent as far as earning power is concerned, and wherever possible, let employers find an operation for some sightless one in his particular locality.

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MARKET DEVELOPMENTS



Railroads Have Extended the Buying Arena

American Railways Are Into Market to Limited Extent—Five Thousand Cars Have Been Ordered—Others are Being Enquired For—Local Market Brighter—Montreal Shows No Change

CONDITIONS have improved considerably during the past week. Pittsburgh reports resumption in a limited way of railroad buying. Orders for more than 5,000 freight cars have been closed during the week, and enquiries are out for more than 10,000 additional cars. Prices have been an important factor in this resumption of business.

Production of steel has tapered off a trifle from the 44 per cent. rate shown for October. Tubular goods show a slight increase, and a week ago one concern blew in a third furnace. Steel prices exhibit a sagging tendency, but this is natural, for producers are anxious to secure orders in order to maintain operations. However, it is not expected that prices will sag to any great extent.

Judge Gary and Chas. M. Schwab have placed themselves on record as strongly favoring discontinuance of the manufacture of armament. They claim that the naval program of the U. S. would have involved only a fraction of one per cent. of the steel making capacity. They believe that economic conditions will improve if it is decided to discontinue the making of armament.

Montreal reports no marked improvement over last week. No change in prices on steel lines has taken place, and the machine tool and scrap markets remain dull. The supply market is about the best of the lot, a satisfactory volume of business being closed.

In Toronto a better feeling exists. Things have picked up quite a bit during the week and dealers feel more confident. The steel market takes the lowest position, business being very poor in this line. Small tools are selling at a fair rate of speed, while the scrap metal market shows signs of life for the first time in months. The machine tool business has brightened up, one dealer claiming that so far, November is the best month he has had this year. Confidence in the future of the market, is the feature, so far as Toronto is concerned.

FIVE THOUSAND FREIGHT CARS ARE ORDERED—MORE ENQUIRIES ARE OUT

PITTSBURGH, Nov. 24th. — The increasing dullness of the steel market is relieved to an extent by resumption in a limited way of railroad buying, orders for more than 5,000 freight cars being reported in the last week, as well as inquiries for more than 10,000 cars in addition.

The gradually improving financial condition of the railroads is no doubt responsible in part for the appearance of this business, but this is not the whole story, for liquidation in prices asked for rolling stock is a necessary and important factor In the fore part of 1920, prices of $3,000 to $3,500 were being asked for ordinary steel freight cars, and such prices were altogether prohibitive. Railroads were neither able nor willing to pay any such prices, for even if the funds could be found there were no conceivable rates of freight that would enable cars to earn their keep at such cost The first steel cars cost a trifle over $1,000, and gradually the price went down until in 1914 cars were bought for less than $800. The ineradicable increases in costs would prevent such a price from being duplicated now, but to pay four prices was another matter altogether. The largest factor in making the high quotations last year was the fancy prices quoted on appurtenances of various sorts, bought by the car shops, though labor costs at the shops were very high also, on account of high rates and inefficiency. High cost of steel was also a factor, though that influence was frequently exaggerated. It is not known precisely what prices are being quoted now, but the probability is that the price for a standard car is less than double the price late in 1914, when $800 was shaded.

The Santa Fe has contracted for 2,500 refrigerator cars and the Illinois Central 1,000 of the same type. The Chicago & Illinois Midland has ordered 725 gondolas, while the Rio Grande has taken 700 cars and the Tennessee & Northern 300 cars, making a total of 5225 cars. Inquiry now out includes 3,000 cars additional for the Illinois Central and 7,300 freight cars, 127 passenger cars, and 55 locomotives for the Burlington.

Mill Operations

Production of steel appears to have tapered off a trifle from the 44 per cent. rate shown for October, and this would be a natural sequence to the quieter steel market that has been observed since the middle of that month. However, there is no great decrease, for in two respects, apart from the influence that may be exerted by the car buying reported above, operations have been increasing, the increases being in tubular goods and in tin plate. In tubular goods there has been a slight continuous increase, in both standard pipe and oil country goods. A week ago the National Tube Company (Steel Corporation) blew in a third blast furnace at the Lorain plant and the company is now putting in a third at the McKeesport works.

In tin plate the development is that the leading independents are securing specifications from large customers against their first quarter requirements, the intention being to make the tin plate at mill convenience in the next few weeks, shipments not being started until after January 1 so that the tin plate will not appear on the buyer's inventory. With this business added to current business the tin plate mills are likely to average an operation above 75 per cent. in December.

Steel prices naturally exhibit a sagging tendency when producers are anxious for orders to maintain operations and there is not enough tonnage to go

around, but now and then a halt is called at one point or another. Thus a few weeks ago a leading wire interest intimated it might advance prices in the near future, and this seems to have arrested the declining tendency that was beginning to be manifested. In sheets there is a stiffening at the present moment. At the beginning of last week shading of 3.00c for black and 4.00c for galvanized, the prices resulting from the $5 a ton advance in September, had gone so far that now and then a mill was quoting the old prices of 2.75c and 3.75c, but beginning last Saturday mills have been calling in all quotations under 3.00c and 4.00c and it looks as if the market is stabilized for the time being at those figures, which are the prices the leading interest has maintained right along since September 22nd.

In bars, shapes and plates 1.50c has been done more frequently in the past week than formerly, but this is not yet a regular quotation applicable to medium or small size lots, unless perhaps in the case of plates. It may be merely a coincidence, but the fact is that steel prices have shown more sagging tendency since the Steel Corporation's earnings report for the third quarter came out late in October. It had been believed in many circles that steel prices were in general below cost, but the corporation was found to have had profits of about $15 a ton, even with its limited rate of operating while in 1912 and 1913, when the independents made money as well as the corporation the latter's ran at about $10 a ton. The natural assumption was that after the mills had liquidated inventories and made other adjustments it would be possible to have profits at existing prices, and rather large profits if operations should increase.

Disarmament

At last Friday's meeting of the American Iron and Steel Institute the steel industry through Judge Gary and C. M. Schwab as spokesmen, went on record as strongly favoring discontinuance of the manufacture of armament, predicting that success in the conference at Washington would greatly improve the economic situation. No details were given as to the amount of steel involved, but it is a fact that the naval program of the United States has involved, and would have involved, only a fraction of one per cent. of the steel making capacity. The amount of steel used in naval construction has been exaggerated in many quarters, such exaggeration being apparently a natural tendency. Now and then it is said that the railroads consume 40 to 50 per cent. of the steel. The automobile industry is frequently credited with consuming a large percentage, and if the public estimates of the percentages of steel that go into railroads, skyscrapers, automobiles, war vessels, etc., etc., were added together one would get several hundred per cent.

The pig iron markets have been soft for several weeks with extremely light demand, and nowadays the appearance of any competitive business of importance sends the general price down a trifle. Southern iron has dropped from $19 to $18, Birmingham. Valley foundry, on a sale of a few hundred tons, is off 50 cents to $20.50, valley. Bessemer remains at $20, valley, and basic is still quoted by furnaces at $19, but there is resale iron in the hands of middlemen that could be bought at less.

Connellsville coke has weakened farther, due to operators blowing in too many ovens a few weeks ago as they over-rated the increase in demand. In the past three weeks ovens have been going out, but a good bit of coke is left on track and prices have weakened so that one could readily buy furnace coke at $3.00 to $3.15 depending on grade. Foundry coke is off 25 cents, as ordinary brands can be had at $4.00 and some very good brands at $4.50.

POINTS IN WEEK'S MARKETING NOTES

American railways have come into the market, orders for more than five thousand freight cars having been placed during the past week. In addition to this enquiries are out for over 10,000 additional cars. It is claimed that the price offered was an important factor in the closing of this business.

Steel production has tapered off since October, but the decrease is not much. Operations in tubular goods and tin plate have increased. Steel prices have exhibited a sagging tendency, but this is natural as the mills are anxious to secure orders, and there is not enough tonnage to go around. The sagging tendency is not expected to go far.

Judge Gary and Chas. M. Schwab have placed themselves on record as favoring discontinuance of the manufacture of armament. They believe that such a move would improve the economic situation. They claim that even if the U.S. naval program went through it would only involve a fraction of one per cent. of the steel making industry.

The market in Montreal is poor. No improvement over last week is shown, and apart from the supply section, there is not much stirring.

Toronto markets are better this week. For the first time in months the scrap metal market shows signs of life. It isn't much, but what little exists, is welcome.

Machine tools are more active, one dealer claiming that the first two weeks of November are the best he has had this year. The steel market is the quietest of all, so far as local activities are concerned.

THINGS LOOK BETTER THIS WEEK

TORONTO, November 24th:—There is a better feeling on the market this week, although business as a whole is not quite so good as it was last month. Take for example the steel market. Last month, dealers were quite pleased at the demand for steels and constructional material. The good weather was in their favor, builders were rushing work along, the result being satisfaction all around. But things have changed. The market is featureless. Orders are few and far between, and the size of the ones that do come in are nothing to boast about. One dealer says that he very much doubts if things will pick up to any great extent until after the new year. There has been no change in prices, nor is there likely to be any until the close of the present year. What will happen at that time no one cares to prophesy. One thing however, that dealers are agreed on is, that this week's business has been the worst for some time.

Small Tools

In the small tool market we find dissatisfaction because business has fallen off somewhat during November. Some dealers say that they cannot complain, while others again are fed up with the way their prospects are buying. One dealer who was rather peeved, remarked that if manufacturers would spend as much on tools, as they do on Christmas presents, he would be more than satisfied. Buying is practically all of the hand to mouth variety. Nothing seems to be purchased until actually needed, and then only enough to tide them over. Up to this month the small tool market has been the steadiest of all, but November seems to have been a Jonah. No decide improvement is looked for immediately, and some say that things will sort of drift along until the start of the new year.

Machine Tools

So far the story has been rather blue in tone, but good news comes from an unexpected quarter, viz, the machine tool market. Although some dealers say that conditions are still as poor as ever, the majority feel that there is no cause for grumbling. One dealer has had more orders this month already than the number received during the last two months. Lest there be those who run away with the idea that this dealer has a corner on the market let us explain that although he can report such good improvement, the number of orders closed is by no means sensational. The fact remains however that his business has picked up splendidly during the last two weeks, and he has good reason to believe that conditions are improving at last. This dealer has followed up his prospects carefully, with the result that each customer is sold on the idea and buys as soon as he can see his way clear. "We have other prospects that look good, mighty good," said this par-

ticular dealer, so that the machine tool market, so far as he is concerned, is coming out of the trough.

Other dealers in varied lines report somewhat better business, although in no case is it anything like normal. "We have faith in the market," remarked another dealer, and to prove his statement, told us of several new machines he was bringing from the factory to put into stock.

It looks as if Toronto will have a new Machinery Hall at the exhibition grounds next year. For some time past, the committee appointed to look into this matter has been working hard to line up a definite proposition to submit to the directors of the exhibition. A meeting of the manufacturers interested was held last week and the enthusiasm displayed speaks well for the future. According to Mr. Hollinrake, who is chairman of the committee, enough space has been pledged to make the building almost a certainty. "We will have more to tell you later," he said, "as soon as we have talked the matter over with the fair directors." No location has been decided upon, for the grounds are to be resurveyed and laid out differently to allow for the new radials which will later be in operation. One thing sure, a better location will be chosen than the site on which the present machinery hall stands.

The Scrap Market

A little movement has been noticed lately in red and yellow scrap metals. Some small sales have been made to consumers whose stocks have become depleted. The volume of business closed however is nothing to get in a fever about, although the promising aspect is that the movement for light buying is general throughout Canada. It is firmly believed that the time is not far distant when consumers will have to come into the market in order to buy sufficient material to keep them going. It is not expected that this demand will increase prices, for the amount required will only be limited. Such a condition arising however would be very welcome, as a stimulation of business is the first consideration. The scrap iron market is also looking for slightly better times in the near future, and as soon as foundries get a little busier, this hoped for condition will become a fact. Apart from this slightly upward trend there is no change of importance.

GENERAL BUSINESS CONDITIONS SHOW NO MARKED IMPROVEMENT

MONTREAL, Nov. 24th.—General business conditions do not show any marked improvement over that of last week. In a few instances, there are rumors that certain lines are moving rather more freely but this is not a general condition. It would appear that the business moving from week to week during the last 6 or 8 weeks, is representative of the activity of the country. There appears to be many distracting influences at present. Elections are receiving a great deal of blame in connection with the slump in general business activity. The activity co-incident with the close of navigation has about spent itself, as in the course of a few days the regular sailings from this port will be discontinued for the season. Yet with all these real and apparent difficulties the volume of business done locally by the iron and steel industries has not appreciably diminished. Withal, it would appear to be in a very healthy condition. One concern reports that the last week's business was the best they have had in 1921. This was due, not to an increase in business in any general way, but to the fact that several large orders which they had been working on for some time were closed during the week. No doubt, a similar condition of affairs takes place with some firm every week. This we can assign as the reason for market letters that tend to conflict, and with business conditions as reported from various sections of the country. During the week there has been no events of outstanding importance, such as we were able to report last week.

Steel Market

There has been no change in the prices quoted on steel lines. There was a slight drop in base prices in Montreal last week, but new prices have not resulted in any marked increase in business. Structural shapes are very quiet, and bars, are also weak. The business in sheets and plates still maintains a steady volume that has been slightly influenced on one or two occasions by reason of seasonable or local conditions, but appears to drop back to the old normal level. The rolling mills are very aggressively looking up business. The next few months appear to have little or nothing to offer, and at present the mills hope to be able to close sufficient business to enable them to operate one shift until the spring requirements commence to improve the situation, which is expected about February 15th. The recent C. P. R. and C. N. R. orders for rails are keeping the mills fairly busy but after these are filled there are no more on the books.

Machine Tools and Shop Supplies

The machine tool situation has not changed a great deal in the last few months. The idle equipment in the large shops is all that is required to answer the question of why manufacturers are out of the market. The sales reported from time to time show that a large percentage of sales are sales of rebuilt and remanufactured tools. The small shop, today, with the light overhead is reasonably busy, as these shops have gone out and cornered a great deal of the small contract work, as well as taking everything in the way of general jobbing and repairs that their equipment would permit them to handle. A rather large number of these small shops have come into the market and have purchased a miscellaneous lot of machine tools of the smaller variety. This channel has been about the only outlet for new machine tools that has presented itself to local dealers in the last few months. The prices of machine tools have all along been regarded as too high. A number of large manufacturers have from time to time reduced their prices, and some are claiming that they are selling at cost. These concessions do not appear to have produced anything in a big way in the line of business. There is no doubt that the machine tool purchaser today is getting a great deal more for his money than he has been for some time past. The supply business is in a very healthy state. Ever since liquidation has been completed this department of the trade, along with small tools, has been enjoying a very satisfactory volume of business. Prices have been from time to time reduced and now are on a very fair basis. Manufacturers have been producing an ever increasing quantity and thus have been able to reduce prices as their overhead is spread over a larger production. No special item of interest has occurred during the past week, but it can be truthfully stated that the small tool and supply business is well established on its post-war footing, and the present situation has every indication as being representative of a permanent recovery.

Pig Iron

The quiescent state of the pig iron market still continues. The volume from week to week does not change a great deal, and prices have not been altered. The foundries are not showing any inclination of coming into the market for anything more than their actual requirements. The producers show no inclination to reduce the price to a point lower than that prevailing as it would not be a profitable move for them. Thus the matter rests and from week to week the same small volume of business is moving.

Non-Ferrous Metals

No special activity is noted in the non-ferrous metals this week. The New York market is a little stronger and the London market is unchanged as far as copper is concerned. The other metals have not changed in price and in addition very little business is moving. In the local market the large consumers are not operating at anything like full capacity, and owing to certain customs regulations are able to purchase direct from the States to an advantage. This leaves the local market rather colorless. It is expected that as soon as the brass foundries resume operation on any scale that business in this line will improve. At present nothing in the immediate future suggests that the present conditions will alter very rapidly.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 50
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh	1 75
Tank plates, Pittsburgh	1 75
Structural shapes, Pittsburgh	1 75
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross Montreal	Gross Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	34 00	37 00
Spelter	7 25	7 50
Lead	6 25	7 50
Antimony	6 75	8 25
Aluminum	27 50	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$4 00	$3 75
Plates, ¼ up	3 50	3 50

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 28	14 71	17 77
½ in.	6 50	8 03	7 95	9 48
.....	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 25
Cut nails, base	4 85
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	50
Can. carbon cutters, plus	10
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	50
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	Net
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	55	68
Class B	23	33
Class C	15	23

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$5.00	$4.75
Sheets, blue ann., No. 10	4 25	4 25
Canada plates, dull, 52 sheets	6 00	6 00
Can. plates, all bright	8.50	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	7 75	
Flerur-de-Lis, 28 B.W.G.	7 25	
Gorbal's Best, No 28		
Colbornes Crown, No. 28.		
Premier, No. 28, U.S.	6 45	6 35
Premier, 10¾ oz.	6 85	6 75
Zinc sheets	8 50	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$26 00	$.....
1¼ in.	27 25	.....
1½ in.	26 25	
1¾ in.	29 75	
2 in.	29 25	19.00
2¼ in.	33 00	22.50
2½ in.	44 75	22.50
3 in.	49 25	27.50
3¼ in.	.....	34.00
3½ in.	63 50	30.50
4 in.	85 00	40.00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	12½	Popular	.10
Standard	.11	Keen	9
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White 20 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Beaver Truck Corporation, Hamilton, Ont. are planning extensive developments.

Metal Products Ltd., Ottawa, Ont., has been incorporated with a capital of $300,000.

The Dominion Thresher and Implement Co., New Hamburg, Ont., has been incorporated with a capital of $1,000,000.

Canada's total exports for the six months period ending September 30th 1921 amounted to $335,677,131.

The McFarlane Mfg., Co., Toronto, has been incorporated with a capital of $100,000 to manufacture Woodenware.

The National Fibre Co., Neepawa, Ont. has been incorporated with a capital of $100,000 to manufacture Hemp, Flax, Sisel, Romie, Jute, etc.

The Ontario Foundation and Engineering Co., Toronto, has been incorporated with a capital of $50,000 to carry on the business of structural and mechanical engineers.

The British Columbian Electric Railway Co. have ordered ten new one-man safety cars for use on its lines in Victoria, B. C. The order was placed with the J. G. Brill Company, Preston, Ont.

Excavation for the new $150,000 addition to the Hospital in Windsor, Ont., was begun November 14th. This new addition will increase the facilities and allow more space for patients.

Construction figures in the Dominion for the month of October 1921 showed an increase over the same period 1920. The total of the 1921 figures is $18,997,200 as compared with $18,169,500 in 1920.

Summerside, P. E. I.—The town of Summerside are installing some centrifugal pumps for town water service. The water supply is from artesian wells. The pumps will have a capacity of 250 gallon per minute against 250 ft. head.

Glace Bay, C. B.—The Dominion Coal Co. have purchased two 1,000 imperial gallon centrifugal pumps from the Canadian Ingersoll Rand Co. They will be driven by 150 H. P. Crocker Wheeler motors.

Sydney, C. B.—The Sydney Foundry & Machine Works, Ltd. has received a crown grant of all the water areas fronting their properties on Sydney harbour. They will proceed at once with the construction of wharves and slips on their harbour properties.

Moncton, N. B.—The Moncton Tramway have recently purchased two Cooper gas engines of 154 h. p. each. The engines are to drive two 150 K. V. A. generators in operation to take care of the winter load.

The Bathurst Lumber Co., are building two kilns of large capacity. The construction is being done by their own engineers. The MacKinnon Steel Co., of Sherbrooke, Quebec, have received the contract for supplying the structural steel for this development.

The wage agreement known as the Montreal agreement has been renewed or extended for one month from Nov. 30 and will terminate on Dec. 31. This arrangement is to enable the United Mine Workers and the Coal Operators to further discuss the proposed wage cut of 20 per cent.

The Hydro-Electric Power Commission of Ontario has awarded a contract to the English Electric Company of Canada for traction equipment for the new Hydro Radial Cars at Windsor and Guelph. It is understood that the entire order will be manufactured in Canada at the St. Catharines plant.

The Britannia Mining and Smelting Co., Britannia, B. C., has placed a contract for machinery in their new mill which will cost $120,000. The plant, it is understood, will have a capacity of 2,500 tons of ore daily, and will cost about $1,000,000.

St. John, N. B. — The Jones Electric Supply Company have recently equipped a new department for rewinding motors and dynamos. The department is under Mr. Thos. Dowie who has had wide experience in electrical repairs in Scotland and Canada.

The Canadian Lever Spring Ltd., has been granted a Dominion charter and will manufacture in Peterboro Ont. The products of the company are springs for automobile trucks and other vehicles. They hold patent rights for Canada for a lever spring now manufactured in the United States.

James K. McNutt, secretary treasurer of the George W. Reed Co., Montreal, states that the company has done to date in 1921, approximately 65 to 70 per cent. of last year's business, which makes 1921 equal to any year in the history of the company with the exception of last year.

According to records at Prince Albert, Sask., over 5,000 cars of wheat have already been shipped out of Northern Sack. This is estimated to be 50 per cent. to 60 per cent. of the whole crop. The average yield will run between 30 and 35 bushels per acre of wheat in the Prince Albert district.

Kitchener, Ont.—The plans of Architect Franklin, of Toronto, for remodeling and enlarging Sudaby School at an estimated cost of $135,000 have been accepted. The work is to be begun in the new year. The new building will contain 21 classrooms and assembly hall, as compared with 12 in the present building.

The Michigan Central Railway reinstated 30 mechanics in the engine department at St. Thomas this past week. The Marquette Railway also reinstated about the same number of men this week, and officials report that more men will be taken on in the course of the next ten days. A general improvement in traffic departments is reported from many cities.

Gordon G. Thompson, of the firm of Morton & Thompson, Halifax, died a few days ago after an illness of four days. He was only 40 years of age, and it is thought that the operation for appendicitis which was performed a few days ago was too much for him, as previous to that he had only recovered from pleurisy. Mr. Thompson was well known in Halifax, and was engaged in many kinds of welfare work.

Bathurst, N. B.—The city pumping station, formerly steam operated, is being replaced by the latest type of centrifugal pumps. The new installation will consist of two Cameron pumps of a capacity of 600 gallons per minute each. They will be driven by 60 H. P. Weeks motors and the pumps will be so arranged that they can be operated in parallel, or series. Power will be supplied by Nepisequite River Power Co.

A new factory will be started in North Bay next spring according to A. T. Stone, of Detroit. About 100 men will be employed, and about 28 different products of rock will be turned out, these rocks being all found in Northern Ontario. The other industrial prospects for North Bay are the British Chair, Seat & Panel Engraving Co., which uses hard wood, and is thinking of leaving the Old Country and establishing here, owing to the high price of hardwood in England and a firm which uses waste wood pulp to make fibre for wooden containers.

The Board of Education, Dundas, Ont., contemplate the erection of a high school at the cost of $100,000.

Additional contracts have been granted for the addition to the W. C. T. U. building, Toronto, costing $125,000.

Contracts for marble and tile for an apartment house costing $250,000 to be erected in Montreal, Quebec, has been placed with a firm in that city.

The Erie Hotel Company has secured a charter to erect two summer hotels in Port Dover at a total expenditure of at least $100,000. The hotels when completed will take up 132 feet frontage.

Mr. W. G. Fallen, manager of the Galt Arena, Limited, has awarded a contract for an 80 x 200-ft. arena to the Tory Factory Co. The cost is estimated at $80,000.

The Ontario Show Case Co. have received a permit to build a 3-storey brick warehouse at 624-626 King St. W. Toronto, Ont., to cost $25,000.

The October statements of the industrial department of the Harbor Commission shows that 15 firms are considering locating on the sites owned by the commission, while a number of outside firms have definitely decided to establish plants in Toronto.

Gross earnings of the C. N. R. for the week ending November 14 amounted to $2,572,439. Gross earnings for the year to date total $95,372,799 against $92,909,656 last year.

Nearly two million dollars have been expended in the province of Saskatchewan this year in the construction and repair of highways, bridges, draining, etc., according to a summary made by the department of highways.

The International Harvester Co., Hamilton, have resumed operations in their malleable iron foundry. Thirty-five men have been taken on, and it is expected that the grey iron foundry will open up in about a month's time.

The Kinleith Paper Co., St. Catharines, are in the market for a 24-in. lathe, with 15-ft. bed. This concern is considering the building of a new paper making machine for their own use, and in the event of this materializing, additional equipment would be required.

The total value of building permits in 56 Canadian cities during September last was $9,988,147 as compared with $9,654,095 in August and $9,174,181 in September of last year. Nova Scotia, Quebec, Ontario, Alberta, and British Columbia registered gains over the three preceding months.

F. W. Hudson, assistant to the general manager of the National Iron Corporation, Toronto, gave an address a few days ago before the Toronto branch of the Engineering Institute of Canada on the new method of casting pipes by the centrifugal process. Moving pictures were shown of both the old and new process.

A new technical school to cost $200,000 is contemplated for the eastern districts of Toronto. The old Technical school situated on College street has been sold to the city by the board of education for $232,000. The old Technical school will probably be used as a police administration building.

City Architect Price of the city of Toronto has stated that building is showing unprecedented activities for this time of the year. He goes on to say that up to Nov. 17 they will have issued permits to the value of a million and a quarter this month. He further states that in November, 1920, the amount of permits total $1,800,000.

Excellent progress is being made on Ottawa's new $2,750,000 civic hospital on Carling avenue. The stone work has been completed to the top of the fifth storey and it is expected that this part of the construction will be entirely completed by Christmas. There are 125 men employed on the job at the present time.

The contract for the construction of the plant of the Red Arrow Tires, Limited at Peterborough, Ont., has been awarded to John E. Hayes & Son of that city. The contract calls for the completion of the plant within 120 days. The first unit, when in operation, will employ between 400 and 500 men according to a statement made by the company.

A new company is being formed in Toronto to manufacture Contraflo boilers. The new type of boiler is composed of separate sections, the number depending upon the heat required. The chief advantages claimed are: The use of slag, or soft coal as fuel, small upkeep, and portability. No brick walls are demolished to get such boilers into place, but one man can carry the parts to desired location and erect in sections. Fuller description, with story of installation will be given at a later date, probably in the next issue.

The Mayor of Sydney, Nova Scotia, who has been in Ottawa this past week interviewing the government officials with the object of securing business for the Dominion Steel Co., thereby relieving unemployment, telegraphed to the citizens committee that he had a satisfactory interview with the Hon. J. A. Stewart, Sir Joseph Flavelle, chairman of the Grand Trunk Railway, and D. B. Hanna, president of the Canadian National Railways, the result being a definite promise of an early further order for 20,000 tons of rails with a strong possibility of a further 15,000 tons.

The eighth annual meeting of the Ontario Associated Boards of Trade and Chambers of Commerce was opened in Brantford on November 17th. President John Elliott in his chairman's remarks sounded the note of optimism by saying that present indications in trade and commerce justified the assemblage. He believed that Canada has passed the crisis of her affairs and that all the present business activities pointed to a renewal of industry and a return to normal conditions. He said we had learned that in the fiscal year 1918-1919 the total trade was over $70,000,000. Exports being $36,700,000, and imports $33,300,000. It is surprising to note that of the total turnover of $70,000,000 Great Britain's share was only $5,000,000, Canada's share $15,000,000, where the United States had $23,000,000.

The recent shipping, engineering and machinery exhibition which was opened at Olympia, London, on Sept. 27th, has proved a decided success, according to information received from overseas. Good crowds attended, and a larger amount of actual business was closed than was believed possible in the present depressed state of the market.

The Nova Scotia Power Commission have completed the part of Hydro development known as the St. Margetto Bay development, and will test the system shortly. The substation at Halifax for receiving power from the Hydro system is complete, and all that remains to be done is the settlement of the dispute about distribution in the city which has been on for the past 6 months. In 10 days time the power commission will be in a position to deliver power at the rate of 20,000,000 k.w.h. per year and with the future development which is now well in hand the total capacity will be 30,000,000 h.p.

SAFETY CAMPAIGN PROVES SUCCESSFUL

The safety campaign which was launched over a year ago by the Algoma Steel Co., has shown remarkable results. For the year previous to the campaign, the general plant accident record stood at 1.64 per 100 full time workers, while for the first year of the campaign, the rate figure dropped to .60 per 100 full time.

The economic saving for the year to the men themselves is remarkable. Conservatively estimating wages at $6 per day, in 1920 the men lost $62,396. For the first year of the campaign, the loss in dollars has been found on the same basis to have been reduced to $15,312, less than one quarter of the former total. Director McGue reports that certain of the operating departments have been making records for themselves. For instance, the coke ovens, recognized in any steel plant as one of the most dangerous departments, from the viewpoint of acicdent, ran for seven months without a single lost time reportable accident, three months and 18 days of this period being continuous. This makes the Algoma coke ovens considerably lower in accident rate than the average figure of all the other coke ovens in America.

The accident rate in the Algoma ovens is 55.3 per 1000 men working 300 days or 0.55 per cent. per month. The lowest rate for all coke ovens in the United States is 86 per 1000 working-

men, working 300 days or 0.86 per month. The fine showing is due to the effective personal work of Supt. William Seymour, Asst. Supt. A. E. Davies and their foremen. The merchant Mills looked upon as the accident "bete noir" of the whole plant also made a great showing under Supt. James Lycott. The mills went five months without a single reportable loss time accident, three of these months being in succession. The records just made up for the first year have proved very convincing to the Algoma Steel executive and to the 3000 employees of the plant. The moral loss from accidents, the suffering endured both by the individual man and his family, the impairment of the individual's working ability and his efficiency, and the maiming of men have been reduced almost to the minimum by the safety campaign, the result of which in one year has been of incalculable good to everybody

EXPECT TO EXPORT HEAVY TOOLS SHORTLY

The machine tool market in Great Britain is burdened at present by an excess of machine tools used for war purposes. According to F. W. Field, H. M. trade commissioner at Toronto, this condition has largely prevented the trade from making a satisfactory recovery from war conditions. He says that the period of reconstruction of other industries now being largely over machine tool manufacturers are looking round for fresh fields. It is perhaps not too much to say, he continues, that almost every industry leads back to the machine tool as the beginning of its operations, and consequently any revival in trade must affect the machine tool industry. Modern agriculture, for instance, is conducted largely on the lines of mechanical operation by means of tractors and motor ploughs, etc., in the production of which machine tools play so important a part; and similarly with other industries.

A reduction in the cost per ton of machine tools exported is now assured as a result of recent negotiations between manufacturers and employees, by which wages are to be adjusted to the [illegible] cost of living, and also on account of the great reduction that has recently taken place in the cost of material. It is stated by those intimately in touch with the industry that British manufacturers will be able in the next few months to maintain their exports of heavy machine tools, with an addition of lighter machines. Exports of machinery are at present stemming the fall in general exports and the outstanding items in this connection are machine tools, boilers, electrical machines and textile machinery .

SHIPBUILDING TAKES DROP

The report of Lloyd's register on shipbuilding returns in England for the quarter ended September 30 shows that the depression in the industry has become still more acute. The merchant tonnage nominally returned as under construction in the United Kingdom at the end of September, 1921, amounted to 3,282,972 tons, which in itself represents a reduction of about 250,000 tons from the June quarter. The figures, however, as on that occasion, include a considerable amount of tonnage on which work has been suspended owing to the decline in demand, and a further quantity, the completion of which has been postponed owing to various causes. As the former amounts to 731,000 tons and the latter to 457,000 tons, an amount totalling no less than 1,188,000 tons, or 36 per cent. of the whole quantity, must be deducted in order to reach the real result, namely, the reduced total of 2,095,000 tons, a heavy falling off from the 3,731,098 tons which was being actually constructed on September 30, 1920.

Similarly there has been a considerable reduction in the tonnage launched, and although this was only 14,000 tons less than the June quarter, the great falling off is apparent when it is stated that the vesels launched during the same quarter a year ago aggregated 478,361 tons.

The tonnage commenced during the quarter under review only amounted to 51,343 tons, and similarly, while the diminution from June is comparatively slight, the figures a year ago totalled 519,065 tons.

The depression in shipbuilding is, however, to a certain extent universal. The total merchant tonnage building abroad has fallen to 2,260,006 tons, which includes 375,000 tons of suspended work, mainly in the United States and Italy.

New Catalogues

The Adriance Machine Works, Inc., Brooklyn, N. Y., have sent us some interesting catalogues on their line of presses. This includes the straight side, and inclinable power presses, etc.

The Shore Instrument & Mfg. Co. have forwarded us two bulletins, one on their scleoscope model C1, also on their pyroscope. Both bulletins are well illustrated and contain considerable data regarding both products mentioned.

The H. A. Drury Co., Montreal, have issued a very useful book entitled "Hints on Steel." This has just been completed by their principals, Messrs. Sanderson Bros. & Newbould, Ltd., Sheffield, England. It starts off with a brief history of the company, shows the styles and grades of steels produced, then goes on to give several valuable hints in the treatment of steels. Hints are also given to drill users and various tables are embodied in the book. The pages are well illustrated and number over a hundred.

The V. & O. Press Co. Brooklyn N.Y., have sent us a catalogue of loose leaf form, which really comprises many bulletins on their varied line of presses. Over 100 pages is taken up with description and specifications of these lines, the variety ranging from the small bench press to the heavy floor types.

The Precision and Thread .Grinder Mfg. Co., Philadelphia, have issued a seven-page circular on their thread lead variator. This booklet gives full description for setting and operating the variator and gauge blocks. A diagram questionnaire also explains how the variator may be used on different lathes by merely supplying extra units and ways adaptors.

"It's a Thor" is the title of a new 16-page, 3 1-2 by 6 1-4 inch pocket size booklet which is being issued by the Independent Pneumatic Tool Co., Chicago. This booklet will show the complete line of portable electric drills and grinderrs, handled by above company, giving uses for same, specifications and prices. Among the new tools shown will be some slow speed electric drills for driving screws, portable electric drill stand, portable electric grinder stand, and portable electric grinder having an 8-inch emery wheel. This new booklet will be ready for distribution Dec. 1st.

The Dodge Mfg. Co., Toronto, Ont., have sent us a complete and carefully prepared catalogue B10, which describes in detail their varied lines. They start off with shafting, then proceed to show all lines of transmission machinery and supplies. This includes safety collars, couplings of all kinds, clutches, all types of bearings and hangers, wall brackets, wood split and iron pulleys, tight and loose pulleys, friction clutches of patented design, transmission tension carriages, cotton driving ropes, pull back sheaves, hoisting cables, mule stands, all sorts of belting, belt clamps, take-ups, elevator boots, detachable chains, riveted chains, elevator buckets, spiral conveyors, etc., etc. Various handy tables are included, and over 30 pages are taken up describing the many and varied lines.

JAPANESE RAILWAY ELECTRIFICATION

A comprehensive plan has been adopted for the electrification of the Japanese Government railroads and a special bureau has been established to carry out the work. The first sections to be electrified will be the Tokaido line, 408 miles, from Tokyo to Kobe, and a portion of the central line between Tokyo and Kofu. It is propsed to supply power from a hydroelectric plant on the Shinano River. Electrification of the seven-mile section now in operation over Usui Pass, between Tokyo and Nagano, has been highly successful, according to Commerce Monthly. The substitution of electric for steam locomotives has done away with the smoke nuisance in the 26 tunnels which make up more than 40 per cent. of the line and has permitted also the hauling of heavier tonnage on the steep grades.

Large Variety of Products Were Displayed

Woodworking Tools—Metal Working Machines—Pumps—Screw Products—Brass and Other Metal Castings—Milking Machines—Ventilating Apparatus—Knives, etc.

A MADE-IN-GALT exposition which was a revelation to citizens and visitors alike, as to the industrial development and potentialities of that city, was held in the curling and skating rinks there, Nov. 12 to 19.

When it was decided, at a meeting of manufacturers, just two weeks before, that Galt should participate in its first exposition, there was some occasion for doubt that the required amount of work could be done in that time. But the organization was completed with Col. A. J. Oliver of The R. McDougall Co., as chairman; Beverley Neill, of The Canada Machinery Corporation, as secretary, and Chas. Webster as manager, backed by committees, and it was not long before an enthusiasm developed that guaranteed results. The rinks were divided into 140 units, each 7 feet square, flags, bunting and evergreens transformed the scene and lighting and heating arrangements perfected.

When Mayor Charlton opened the show, Nov. 12, there were 70 exhibits in position, the majority of which had taken two or more units. One of the surprises was the fact that there were several displays representing industries of which some of the oldest inhabitants had known nothing. It was an exposition which, for diversity of industries, evident standard of quality, and general tone of long-established merit apparent in well known trade marks and names, one could easily imagine difficult of duplication. Galt has a population of 16,000, and her independent and inter-dependent development of industries has given her a place in the forefront of Canadian manufacturing centres. Others cities might make grand showing of few specialized industries, but in the matter of variety of specialty, Galt is unique.

It was further evident that many industries represented were outshoots of older ones, thus giving some force to the saying that one good industry begets several others. Thus has Galt thrived, retaining for her purpose operatives, who by reason of their experience in Galt shops, have everywhere recognized reputations for efficiency.

There were displays of metal and woodworking machinery, pumps of many types, fire and burglar proof safes, taps, dies, gauge and other small tools, machine screw products, brass, bronze, aluminum grey iron and malleable castings, edge tools, hand and machine; saws in great variety, motor accessories, milking machines, washing machines, talking machines, knitted underwear and knitted fabrics and outer garments, kimona cloths, buffalo robes, silk yarns, gloves, hats, ornamental wood and metal work, furniture, closet and bathroom equipment, tacks and nails, elevator equipment, ventilating apparatus, power fans for industrial purposes, products of the confectioner and baker, boots and shoes, stoves, furnaces and electric lighting fixtures, account registers and counter check books, stokers and grates and specimens of welding, metal finishing and polishing. In connection with many of the exhibits there were interesting demonstrations.

The exposition was open from two o'clock and on into the evening and was well attended not only by citizens but also by people from the surrounding country. Among the visitors was W. K. George, former president of the Toronto National Exposition. He expressed himself as greatly impressed by the extent of the show, and stated that a special Galt building at the National Exposition was worthy of serious consideration. Something further may, in fact, develop from this idea. Certainly this is not Galt's last exposition.

Of those exhibits calculated to be of interest to readers of Canadian Machinery brief descriptions are here given:

Galt Stove & Furnace Co.—Kitchen ranges and coal and wood heaters in seventeen different types. Also two hot air furnaces of the pipeless variety.

Canadian Potato Machinery Co.—Potato planters and diggers, shade and fruit tree sprayers, pen and stall sidings and other stable equipment.

K. T. Foundry Co.—Grey iron castings, plumbers' standard and special pipe fittings, cast iron plumbing specialties, builders' and hardware castings, repetition castings for phonograph, washing machines and electric motors.

St. Clair Bros.—Concrete mixers and other contractors' machinery, vertical steam engines, drop and hand forgings

Victoria Wheel Co.—Poles, shafts, rims, spokes and other bent goods.

Dominion Tack & Nail Co.—Display of tacks and nails in 600 different varieties.

Galt Knife Co.—Edge tools and heads for woodworking machinery, door heads, matcher heads, profile heads, sash heads and shiplap heads.

Peter Hay Knife Co.—Edge tools and attachments for woodworking machinery.

Geo. C. Kaiting & Sons—Power and hand-operated washing machines; also sun glare shields for motor cars.

Langley & Austin—Products of brass, bronze and aluminum foundry, including large bronze bushings for rubber mills, weight 213 pounds; aluminum square ham boilers, ornamental electric fixtures, trolley wheels, etc A unique item was a cup, saucer and spoon in a one-piece brass casting.

Canadian Brass Co.—Bathroom and closet fixtures, seats, tanks, taps and valves representing the B. O. T. line.

Galt Brass Co.—Perfecto brass goods, oil regulated flush valves. Vitro closet tanks, and other closet and bathroom equipment.

Shurley & Dietrich—Large wall display of crosscut, circular, band, hack and hand saws, including a hand saw made in Galt in 1873 and used by an Ottawa carpenter for 40 years.

Cut Soles, Limited—Machine for cutting leather shoe soles in pairs, right and left, in high speed operation.

Stevens Company—Hand miller, universal tool and cutter grinder, drill, miller and bench vises, parts of special machines used in motor car production.

Galt Welding Co.—Luggage carriers for motor cars, factory stools and specimens of welding, with the sign "We can weld anything but a broken heart." Welding demonstrations during the exhibition.

Galt Foundry Co.—Sprinkler stokers, dumping grates and MacNaughton sectional grates.

Galt Edge Tool Co.—Carpenters' chisels, axes and knives for woodworking.

Perfect Machine Co.—Machine tools, sixteen in all, including two tool room lathes 18" x 8', and 12" x 6'; grinders, 6" x 24"; buffers up to 26"; hacksaws in three different sizes including a high speed machine and vertical drills in different sizes, the arrangement suggesting adaptability for general machine shop or modern garage equipment.

Preston & Schwartz—Taps, dies and also small tools.

Roelofson Elevator Works—Warehouse elevators, dumb waiters and elevating drums, motors, guard doors and other equipment.

The Goldie & McCulloch Co.—Rees Roturbo pumps, showing details of construction; a vertical, enclosed, forced lubrication steam engine; a 200 h.p. Wait steam turbine, 3,600 revolutions per minute with steam pressure of 175 lbs. per square inch; photo of engine No. 1, installed 62 years ago and still running in the plant of Chas. Barber & Son, Meaford; boiler heads with gauge equipment, and a display of safety vault doors; standard fireproof safe and a burglar proof safe with time lock, two combinations on the outer door and two combinations controlling the three-compartment interior. This safe was sold to a financial institution during the exhibition.

An effective feature of the Goldie & McCulloch display was the illumination of a large Rees Roturbo transparency sign by means of violet lights behind a sheet of water falling into a tank from a horizontal pipe about eight feet above the floor. The steady flow of water was supplied by a small Roturbo pump, with 3 inch intake, attached to a five horsepower motor. The pump, at 1,400 revolutions per minute, had a capacity of 200 gallons with 60 foot head, and demonstrated the adaptability of Roturbo pumps, even in the smaller sizes, for shop circulating systems, or the general range of purposes. The pump stood on a light wooden frame without vibration or oscillation, and apparently motionless though in operation

The R. McDougall Co.—Display in two sections—one of machine tools, including their 20 in. crank shaper, 16 in. engine lathe and 20 in. vertical drilling machine, and the other section, of different types of cistern and well hand pumps and power pumps for all purposes, including contractors' pumps, rotary pumps for dairy, creamery or cheese factory purposes and their new electric house service pumps in operation. This is a late addition to the McDougall line. It is of the double-acting type with a capacity of 180 gallons per hr. The installation is equipped with automatic controllers which are set for a minimum pressure of 20 lbs. and a maximum of 40 lbs., with other ranges of pressure possible. The display included an old time well and

pulley bucket, supplying an interesting contrast in comparison with the latest water pumping equipment, and considerable interest centered in a tilted glass pitcher attached to a house service pump, from which ran an unending stream of black liquid concealing a secret feed pipe.

Sheldon's Systems—Keith fans, cupola fans, disc fans, air purifiers and oil separators, ventilating, heating, exhausting and drying equipment. A model factory building with equipment in position was used in demonstrating a heating and ventilating installation in operation.

Cowan & Co.—Woodworking machinery, including pony surface planer, hollow chisel mortiser, scroll saw, chain saw mortiser power feed rip saw, and automatic knife grinder for planer knives.

Canada Machinery Corporation—Machine tool display including 26" x 30" crank shaper, the largest and heaviest machine of this kind made in Canada; 20" x 30" x 12' quick change gap lathe, weighing 5,600 lbs.; single spindle high speed ball-bearing shaper with spindle working speed of 8,000 r.p.m.; ball bearing band saw with single string transmission operation from a sixteenth h.p. motor and a self-feed rip saw of the latest type. This is a new machine having a capacity for saws as large as 20" diameter and maximum cut of 6½" and stock 18 in wide may be ripped with the standard machine but the end of the mandrel is extended to allow the use of gang saws or dado head and to give a nipping width of 24 in. The construction is such as to give an equal distribution of weight from the centre on the infeed and outfeed rolls, thus adding to the strength and rigidity of the machine.

Galt Machine Screw Co.—Machine screw products, including hexagon, slotted and castle nuts, cap and set screws, coupling bolts, planer bolts, taper pins, boiler patch bolts, special parts for motor cars, also a display of instruments and gauges used in the manufacture and inspection of machine screw products.

Greenfield Tap & Die Corporation — "Little Giant" sets taps and dies, and an elaborate display of screw plates, reamers, gauges, wrenches and screw cutting tools in different sizes and assortments.

Elliott & Whiteall—Milling cutters, reamers, dies; also display of Gill water taps, a new type of tap which does away with washers of either flat or plug variety.

Galt Malleable Iron Co.—Railroad, motor car, transmission and farm implement castings.

The Sturtevant Co. of Canada—Planing mill exhausters, multivane electric exhaust fans, auto-force ventilator, ventilating sets, gas boosters, electric vacuum cleaners, cupola forge blowers and other ventilating exhaust and blower equipment.

Board of Works, Galt—Crushed rock from city stone quarry; also samples of asphalt concrete pavement, such as has been used in extensive street improvement in Galt during the past year.

The Galt Art Metal Co—Booth finished in art metal with display of metal refrigerators, sash, ceilings, walls and garage model.

Important Light on Canadian Patent Act

JOHN Munnoch, division court clerk of the Sault Ste Marie district, who has made a study of the Canadian Patent act, and its operation for the past six years, declares that from the standpoint of bringing new industries into Canada, the importance of the Patent Act transcends even the tariff issue. He declares that there are 10,000 articles being manufactured in the United States which, under the provisions of the Patent Act and owing to the non-enforcement of that act, should be made in Canada. Not only has Mr. Munnoch impressed the Sault board of trade with the cogency of his arguments, but he has carried the matter to Premier Meighen, who is said to have expressed regret that action could not have been taken by the government prior to election. The Associated Boards of Trade at their convention in Brantford in November will discuss the matter. The Sault board having just forwarded a resolution covering the question.

An American taking out a Canadian patent has two years in which to start manufacturing operations on this side of the border. If he can show a good and sufficient reason, and makes application before an expiration of the two years, he can secure a year's extension. This provision of the act is not enforced. It works out in practice, that once an American gets his patent, he continues to manufacture the article patented in his own American factory, and it is said that there are 10,000 such articles being produced, and shipped to Canada, while there are about 20,000 American patentees all told. The Canadian patent office keeps no check, once a patent is granted, as to whether its manufacture in Canada is ever attempted. It might be fair that an American patentee failing to meet the requirements of the act, and build a factory in Canada, loses his rights automatically. In actual practice, however, if some enterprising Canadian starts the manufacture of the patented article, an injunction is secured, and the way is opened up for some expensive and long drawn out litigation. In the meantime, the Canadian producer is tied up completely, pending a settlement in the courts. It is a prospect which discourages any attempt on the part of Canadian manufacturers to infringe on so-called American patents rights, even although under the terms of the very act by which these rights were granted, the patent should be null and void in Canada.

Mr. Munnoch states, to prove his case, that anywhere one goes, American articles for which patents have been secured in Canada and which are still made in the U.S. may be found. In the new Parliament buildings, Ottawa, steam traps, meters, etc., are to be found all bearing the stamp of U.S. manufacture. A modern machine shop will show lathes, drills, stamps and tools protected by Canadian patent but made in the U.S. The typewriter, the adding machine, the stamper, the check protector, are said to be in the same class.

The importance of the question is emphasized by some figures as to patents granted in Canada. In 1919, there were 9527 patents taken out, of which 6856 were American patentees, in 1918, there were 6052 issued, and 4569 American, and in 1917, there 7233 issued, with 5631 of that number of American origin. The average in any period would be found over 70 per cent., and the question arises, are the articles for which these patents are issued manufactured in Canada as stipulated by the Patent Act? The answer according to Mr. Munnoch is that manufacture in Canada is the exception, where it should be the rule.

It has been estimated that putting the number of articles at 10,000 which should under the law be in the process of production in the Dominion, employment would be provided, very largely for skilled labor, for 300,000 operatives, It is pointed out that in normal years about 90,000 Canadians go to the United States, of whom only about 8,000 are not accounted for, and that there is a large percentage of the 90,000 who would not find opportunities better in the U.S., if the Canadian Patent Act were rigidly enforced. The weak point in the Canadian Patent Act is that it gives an American patentee the opportunity of fighting in our own courts in such a way as to defy one of our own laws, by using the injunction process. Several remedies have been brought forward, the most simple of which seems to lie in the appointment of a Controller of Patent Licenses, whose duties shall be devoted to the prompt enforcement of the Canada Patent Act in respect to surrender cancellation of patents or licenses granted under the act. An amendment to distinguish assembling of parts from actual manufacture is also desirable, according to Mr. Munnoch from the viewpoint of Canadian employment.

In support of changes and the tightening up of the Candian Patent Act, it is urged that the results achieved in other countries show actual negligence in Canada. The Patent Act should be made the strong arm of industrial development, Germany having shown the world what could be done in this regard. The Patent Act of Great Britain is one of the industrial supports of the nation, while the act framed at Washington guards American rights very jealously. The question is regarded as a non-partisan one, and is being presented as such at the Associated Boards of Trade convention. It is not too much to say, however, that Premier Meighen, and others of his party, who are now emphasizing tariff are seized with its importance, and that some radical changes in the operation of the Patent Act of Canada may be looked for. When they come, opportunity will be afforded many Canadian industries to broaden out, if not, it will mean that many American concerns will have to establish branch factories in Canada, if they wish to protect the trade which they have built up on articles which they produce and for which they have received Canadian patent protection, without returning the quid pro quo, as called for under the act. This quid pro quo is virtually an agreement to start manufacture in Canada within two years after securing a patent license.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

Unfortunately, in spite of the many answers sent in, not one was correct. Question seven was the trouble. The "Good Advice" we referred to was "Don't let present-day conditions worry you; everything is fundamentally sound." Refer to Pg. 61 in the Nov. 3rd issue.

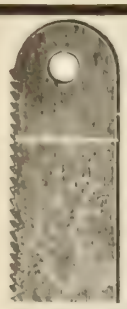
CONTEST FOR NOVEMBER 24th ISSUE
Contestants are required to write us, stating to which advertisements we refer in this number.

1—Something that is going begging.
2—A product that is self contained.
3—Something that combines two advantages.
4—How to get the advantage of 30 years' experience.
5—Something that is giving good satisfaction.
6—When to discard—even when not playing poker.
7—Something that is fully guaranteed.
8—A very essential quality—where?
9—A product said to be for every purpose.
10—Something distinctive.
11—How to get over your control problems.
12—Something that's full in spite of prohibition.

These are Correct Answers for List from November 3rd Issue

1—Pratt & Whitney Co.
2—Diamond State Fibre Co.
3—E. W. Bliss Co.
4—Franklin Die Casting Corp.
5—Dominion Rubber Systems.
6—Canadian Desmond Stephan Co.
7—E. C. Atkins Co.
8—Geometric Tool Co.
9—Oliver Machinery Co.
10—Cincinnati Electric Tool Co.
11—Wallace Barnes Co.
12—J. H. Williams Co.

Closing Date for This Contest is December 15th.



SIMONDS

Non-Breaking

Hard Edge
Hack Saw Blades



When you put a Simonds Hard Edge Blade in your Hack Saw Frame you are assured of the maximum of cutting service, because these are the blades that cut fast, do not shell teeth, and when properly used they are non-breaking.

They are scientifically heat-treated and smoothly finished.

GET SIMMONDS HACK SAW BLADES FOR BETTER WORK

SIMONDS

Canada Saw Co, Ltd.

"The Saw Makers"

Montreal, Que.

St. John, N.B. Vancouver, B.C.

FUTURE OF RAILROADING

MR. W. R. Stinemetz, manager of the heavy traction railway department, of the Westinghouse Electric Co., of East Pittsburg, Pa., presented a paper on "The Future of Railroading is Electrification" before the Railway Club in Montreal on November 8th. Mr. Stinemetz classed Electrification as, desirable, at present, but felt sure it would, in the future, become a necessary factor. The steam locomotive has been developed over a period of nearly a century and is today a highly efficient machine, but possessed of certain basic disadvantages. The tractive effort, or draw bar pull, of any locomotive is limited by the adhesive effect of the driving wheels on the rails, which factor is controlled largely by the weight of the locomotive. The power of a steam locomotive is limited by the steaming ability of its boiler. On the other hand an electric locomotive is not compelled to carry its power plant with it, but can draw upon the stationary power plant, up to one or the other, of two limiting factors, namely the amount of power that the motors of the locomotive can develop in safety without running the risk of burning out, or the total power developed by the stationary generating plant. "Electric locomotives," he said, "produce a more uniform torque on the driving axles, and also develop their maximum torque when at rest, thus enabling them to start heavy trains with ease and to make a remarkable showing on grades." Some railways in mountainous territories according to Mr. Stinemetz, have certain mountain sections over which trains can not be hauled by steam locomotives at a greater speed than five miles an hour. Now this naturally slowed up the whole trunk line, limiting its total capacity. Electric locomotives have been called upon to operate over these grade sections and have hauled these same trains at speeds from fourteen to twenty-five miles per hour. Such was the experience of the Norfolk & Western Railway. To increase the capacity of their lines they were faced with the problem of laying additional tracks, but overcame the difficulty through the use of the electric locomotive. On this line all electricity was generated by steam plants. The Norfolk & Western Railway modern mallet, compound, superheating steam locomotives, equipped with all improvements except feed water heaters, require 5.4 lbs. of coal per draw bar horse power when operating under their road conditions. With electric operation, about 3.3 lbs. of coal per drawbar horse power is required, which is a saving of 40 per cent. The additional saving in crew cost, due to the additional work the electric locomotive can perform in a given time, has been stated to be nearly 40 per cent.

Another feature of the electric locomotive is its ability to make long runs with a minimum of round house attention. The electric passenger locomotives on the electrified sections of the Chicago Milwaukee and St. Paul Railway make daily runs of 440 miles. Crews are changed once, but the locomotive continues on its way. These locomotives are taken off for shop inspection every eight or ten trips after they have made mileages from three to five thousand miles. These locomotives make between ten and eleven thousand revenue miles per month. In suburban and commuting services more intensive uses of facilities can be made. Here an electric locomotive is not always employed. Each car has its own electric motors and thus multiple unit trains are operated. These trains run into terminals, unload, load and are away again, the motorman merely walking from one end of a train to another.

Cold weather does not tend to lessen the efficiency of an electric locomotive. The necessity of firemen on locomotives is dispensed with. Where water power is available the cheaper power is an added advantage. Electrification of steam roads is almost world wide. Orders for electric locomotives are being filled in the U.S. for Europe for Sweden, France, Japan, Switzerland, Italy, Brazil and Chile. The Westinghouse Co., in Pittsburgh is now working on a $7,000,000, order for complete electrification of the 200 mile line between Valparaiso and Santiago, for the Chilean Government. Thirty-nine locomotives are ordered. Other large amounts are being spent in the various countries. Where long tunnels exist it is a positive necessity for electrification to be installed for the purposes of ventilation.

Mr. Willimas of the Engineering Department of the Chicago, Milwaukee and St. Paul outlined some of the actual experiences of his road in connection with the two electrified divisions in the mountainous sections. He showed some remarkable savings and unusual advantages derived from the use of electric locomotives.

A resident of Edmonston, N. B., discovered natural gas a few days ago. The first indication of its existance was that bubbles were noticed on the surface of the Madawaska river at a point where it passes through the heart of the city An investigation was undertaken by a Moncton engineer, Mr. Matthew Lodge who found traces of gas at many points It was decided to drive a pipe into the river bed which was done. and on lighting the gas there was a slight explosion blowing the pipe out of the workman's hands. Another pipe was driven having the end capped but the pressure of gas was so great that they again lost the pipe. A geologist was brought down from Ottawa to continue the investigation into the supply. He will report the result of observations in a few days.

The Canadian Pacific Railway, Windsor station, Montreal, has awarded a contract for a 17-storey extension to the Chateau Frontenac Hotel, to a Montreal firm.

JARVIS
Friction Tapping Device

One man worked to overcome the enormous waste from stripped threads and broken taps on light tapping

The FD Tapping Device Resulted

This latest Jarvis invention has taken the friction out of tapping and put it into the

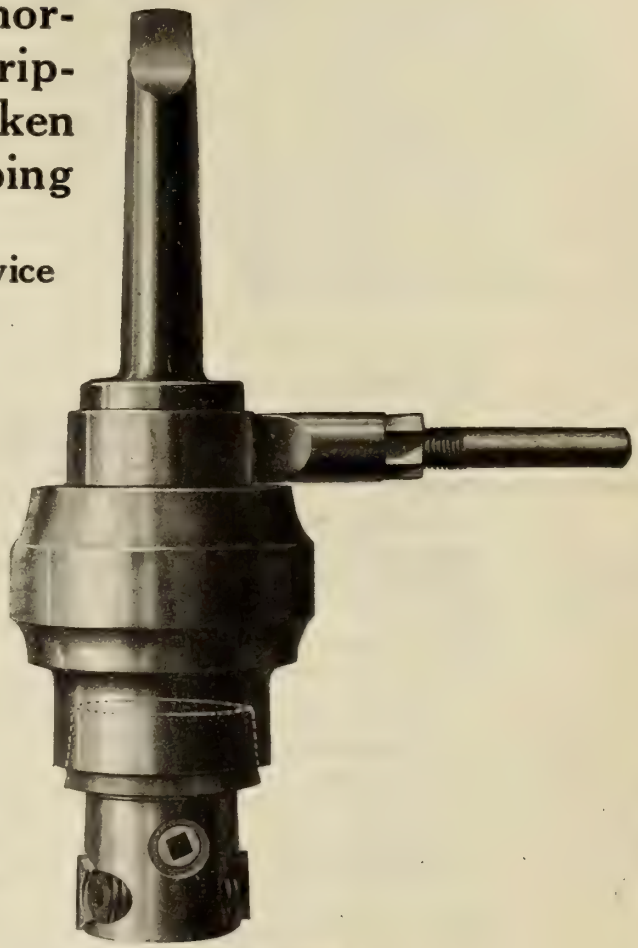
Cone Friction Drive

There it relieves all strain in driving the Tool. The pressure comes on the machine spindle that runs the Device.

Holes are tapped in the toughest metal, with broken taps reduced to the minimum, while stripped threads are entirely eliminated.

The tapping range is from 0 to 1-4 inch.

Here is a Tool that very thoroughly reduces Production Cost.



Jarvis Friction Tapping Device. Note size and location of the Cone Friction Drive.

Any Standard Jarvis Product Will Be Sent on Trial to Reliable Concerns. Jarvis High Speed Tapping Devices and Quick Change Chucks and Collets are carried solely by The Geometric Tool Company.

The Geometric Tool Company

New Haven, Conn., U. S. A.

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto; St. John, N.B.; Halifax, N.S.

Classified Opportunities

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631 · Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

PARTNER TO ORGANIZE AND MANAGE stock-selling campaign covering every considerable centre on continent; best-selling business proposition; a little cash desirable; state age, experience, references, etc. Box 797T Canadian Machinery.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

TECHNICAL COURSES

INCREASE YOUR EARNING POWER BY STUDYING mechanical drawing. Individual lessons given at reasonable cost. Only chief essentials taught. Study at home in spare moments. These lessons should appeal especially to shop men. Every student receives personal supervision. Not a correspondence course but a personally conducted help to shop men. For further particulars write Box 797, Canadian Machinery. (C 21 M.)

NOVA SCOTIANS—SPECIAL ATTENTION — The Technical College now offers new Correspondence Courses in all subjects important to men in Machine industries, such as Shop Mathematics, Mechanical Drawing, Machine Design, Blueprint Reading, Steam Engineering, and many others. Cost per course from $6.00 to $14.00. Write for full information to Technical College, Halifax, N.S. (c21m)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

HELP WANTED

WORKMAN FOR LOG BAND SAWS
Sheffield, England, steel mill wants good workman for Log Band Saws (all sizes). Must be capable of brazing, tensioning, and straightening. Give full particulars of experience in this work and where obtained. State wages expected. Box 796, Canadian Machinery. (c20m)

SITUATION WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 795 Canadian Machinery. (c23m)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W. H. Sumbling Machinery Co., Toronto. (etfm)

FOR SALE

FOR SALE—1, 5, 7½ AND 10 H.P., 550 VOLT, and 3, 8, 15 and 20 H.P., 220 Volt, 25 Cycle, Motors; good condition. Canadian Linderman Co., Limited, Woodstock, Ont. (C20M.)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning **mail.**

Canadian Machinery



Next Export Number
December 1st
Reserve Space At Once!

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
Prest-O-Lite Company, Toronto.

Accumulators, Hydraulic
Stewart & Co., Duncan, Glasgow, Scot.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

For list of Dealers see the last page of This Buyers' Directory

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers
Building Materials
Robertson Co., H. H., Cleveland.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Mchy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic

Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable

Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive

Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret

Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist

Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings

Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener.

Electrical Instruments

Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices

Banfield & Sons, Ltd. W. H., Toronto, Ont.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical

Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube

Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)

Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre

Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps

Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines

Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)

Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe

International Malleable Iron Co., Guelph Ont.

Flexible Shafts

Aikenhead Hardware Ltd., Toronto, Ont

Flux, Galvanizing

British Smelting & Refining Co., Ltd. Montreal, Que.

Fluxes, Welding

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Forging Machinery

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop

Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment

Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies

Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid

Can. Steel Foundries, Montreal, Que.

Furnaces, Electric

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas

Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.

Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing

Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric

Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording

Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard

Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread

Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed

L'Air Liquide Society, Toronto, Ont.

Gas, Compressed

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure

Taylor Instrument Co., Toronto, Ont.

Gear Blanks

Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters

Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines

Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast

Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut

Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed

Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged

Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone

Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)

Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain

Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm

Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene

L'Air Liquide Society, Toronto, Ont.

Generators, Electric

Northern Electric Co., Montreal, Que.

Goggles, Safety

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets

Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass

Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating

Canadian SKF Co., Toronto, Ont.

Grinding Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt

Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench

Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center

U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die

Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc

Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill

Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W. Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.

Burke Machine Tool Co., Conneaut, Ohio

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto ont
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Pars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass
Bilton Machine Co., Bridgeport, Conn
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Oliver Machinery Co., Grand Rapids, Mich

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

Milling Machines, Horizontal and

BUYERS' DIRECTORY

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W.H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rebuster Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland

Second-Hand Machinery
See last page of directory
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets,
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Bertrams & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Bertrams Ltd., Wallace, Hamilton,

Springs
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton,

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertrams Ltd., Edinburgh, Scotland.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.

Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Williams & Co., J. H., Brooklyn, N.Y.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres,
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal Q
Dominion Engineering Works, Limited, Montreal, Que.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co. Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont
Northern Electric Co., Montreal, Que.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

Seven pages printed here each week for your convenience

Consult this Buyers' Directory when you want the names of reliable makers of machine tools, parts, steel, in fact any equipment you may need.

Is Your Factory Protected?



Eventually you will realize that *ordinary* firedoors with wood cores "protected" by light terne DO NOT afford adequate protection.

There is *only one* FIREDOOR which can meet every test successfully—and that firedoor is the "ALMETL." It is constructed of heavily galvanized corrugated steel — laid transversely and interlined with stout asbestos roll board.

The frame of 3/16" x 2½" Bar Steel reinforced by an extra heavy binder of galvanized steel, which forms a box for the panel and prevents damage to the door by trucks, etc.

THIS is the firedoor which will give you unnumbered *years* of protection and satisfaction.



APPROVED BY THE UNDERWRITERS

Our Department "A" will mail you descriptive literature and blueprints on request.

SOLE CANADIAN MANUFACTURERS

KEEP CANADA BUSY

GEO. W. REED & CO., LIMITED, MONTREAL

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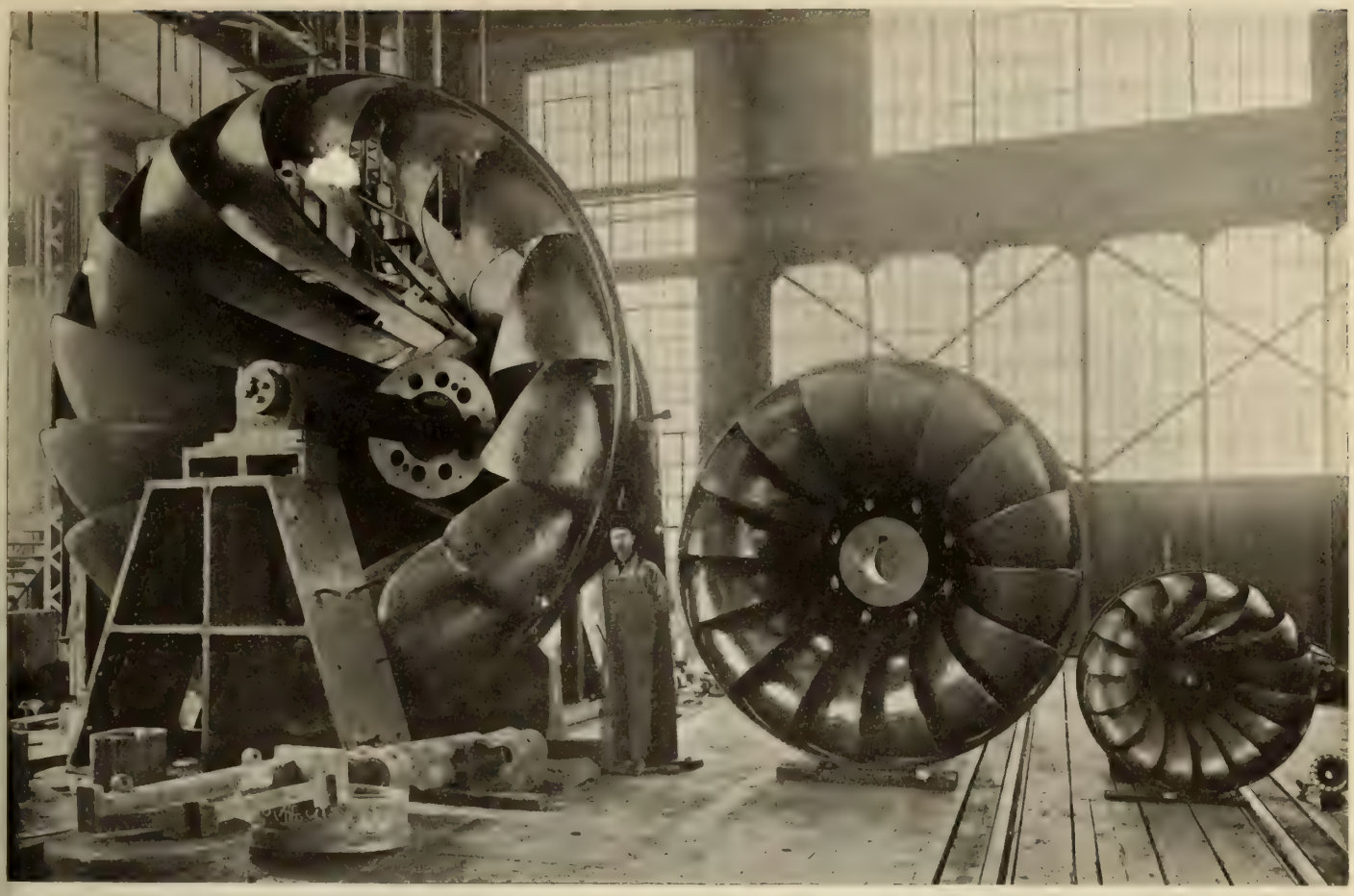
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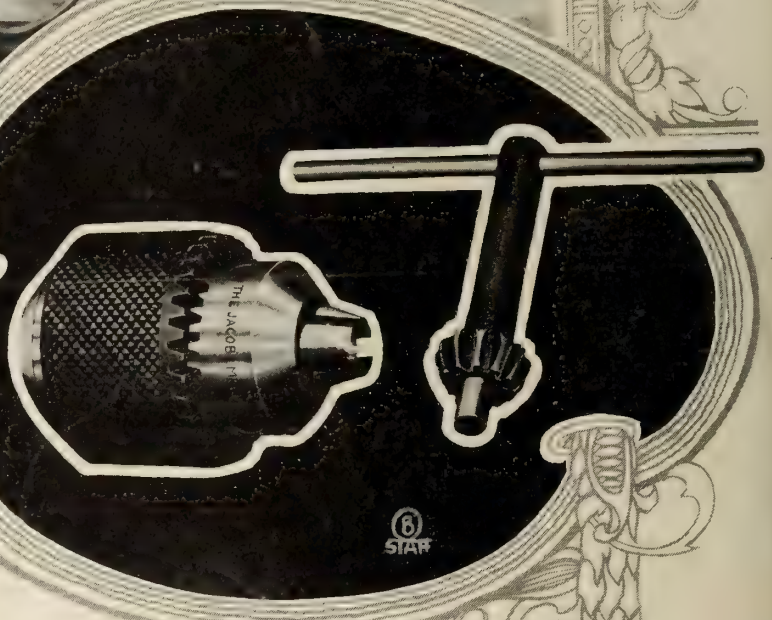
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(M-33)



Jacobs Quality Chucks



THIS cut shows the well known "Haskin's" Flexible Shaft Equipment called by its many users "The Handiest Tool in the Shop." All types of "Haskin's" portable electric drilling machinery are equipped with JACOBS Precision Chucks.

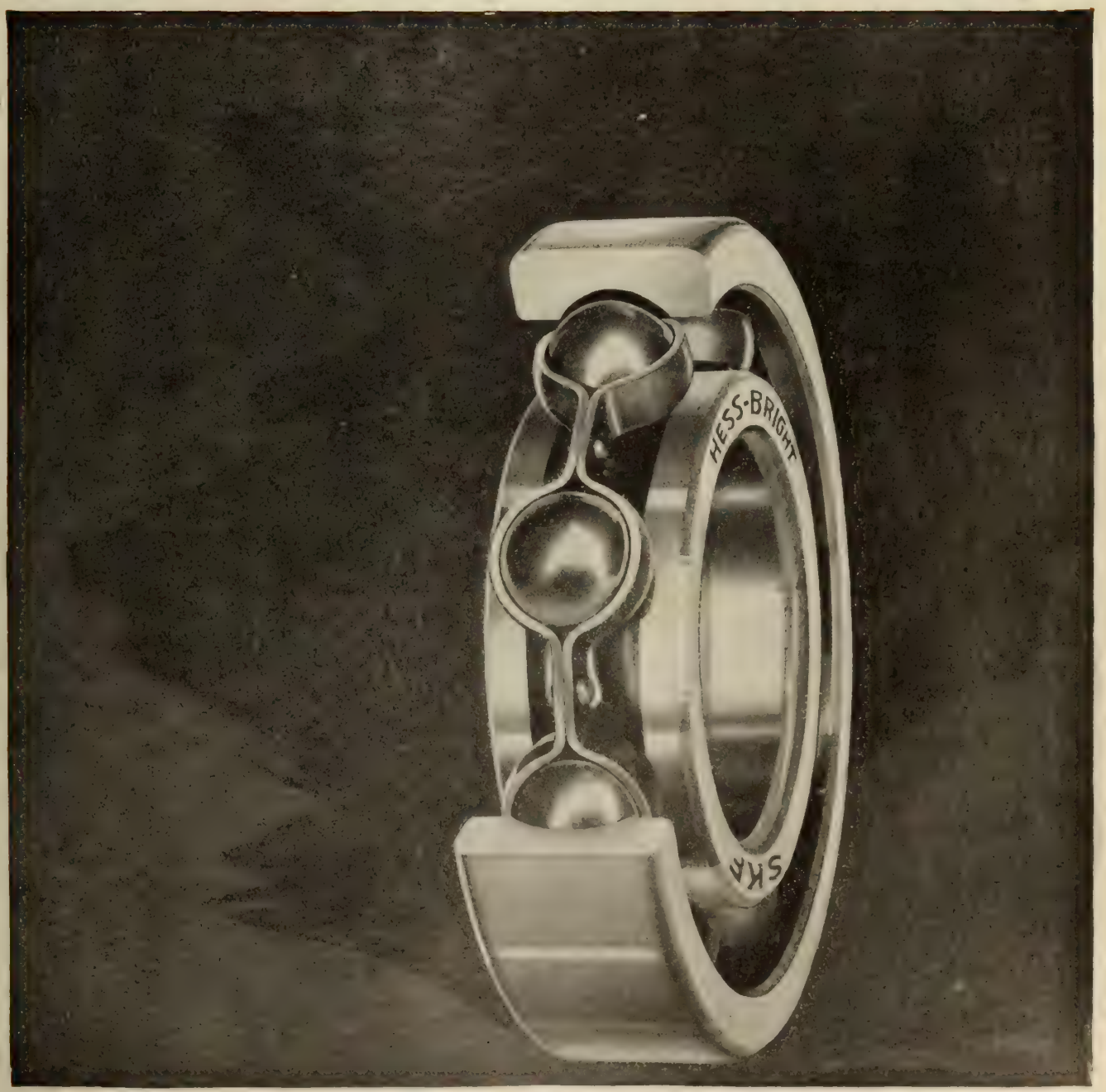
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Hartford, Conn U. S. A.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVI., No. 22 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Dec. 1, 1921 | $4.00 a Year Subscription Price

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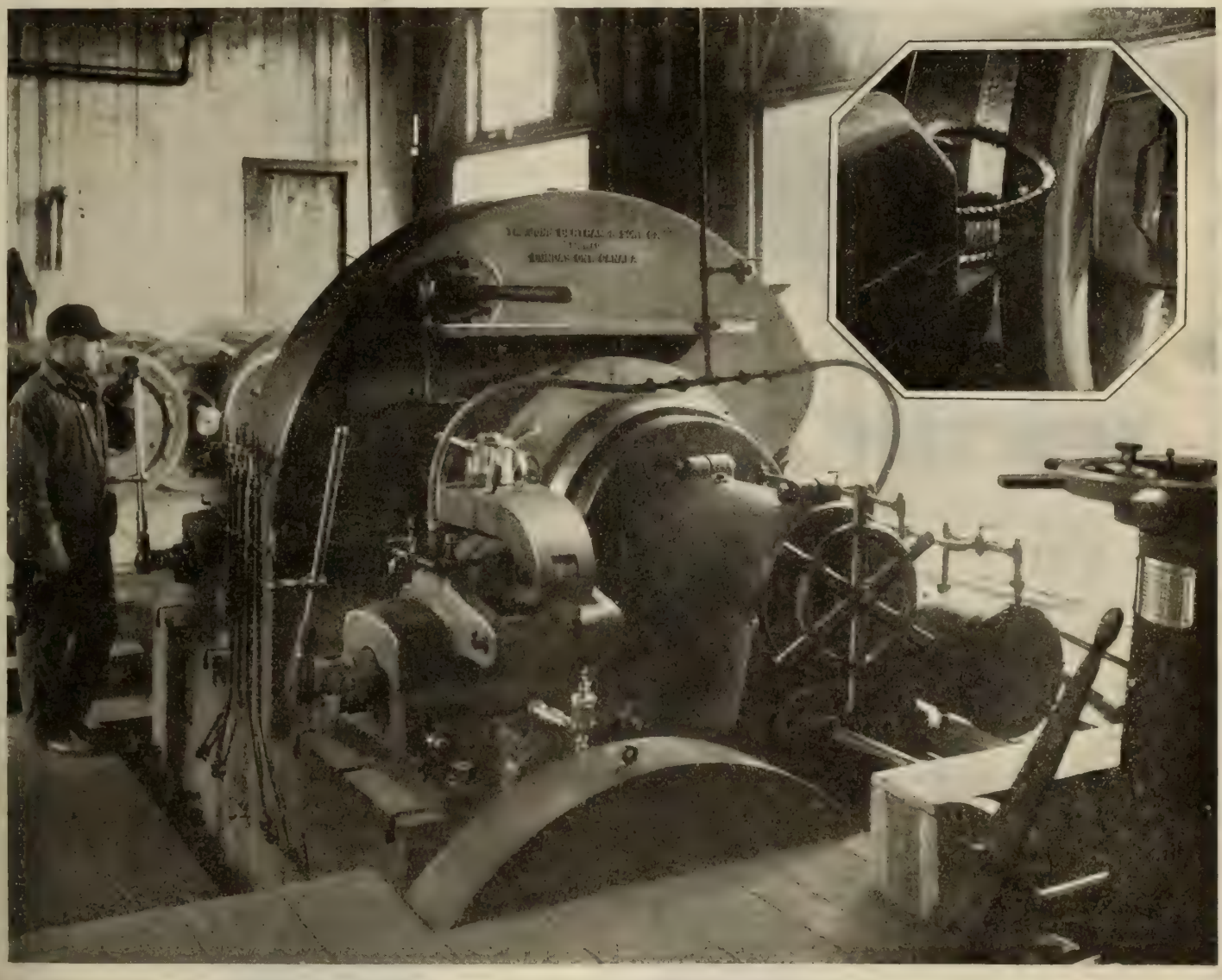
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BERTRAM
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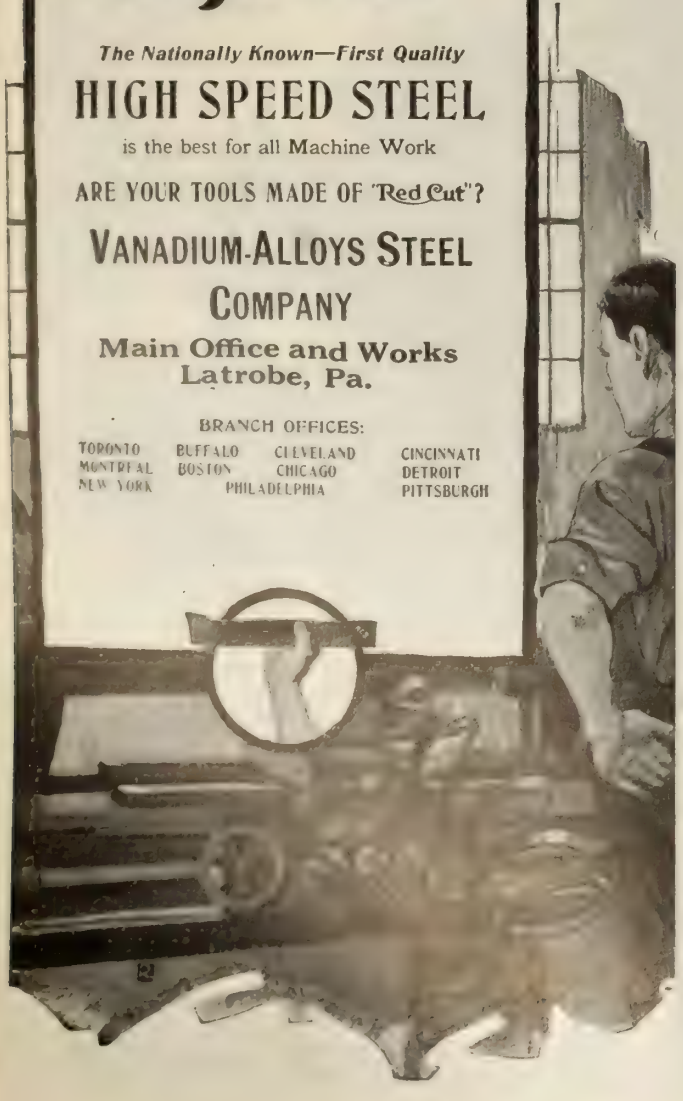
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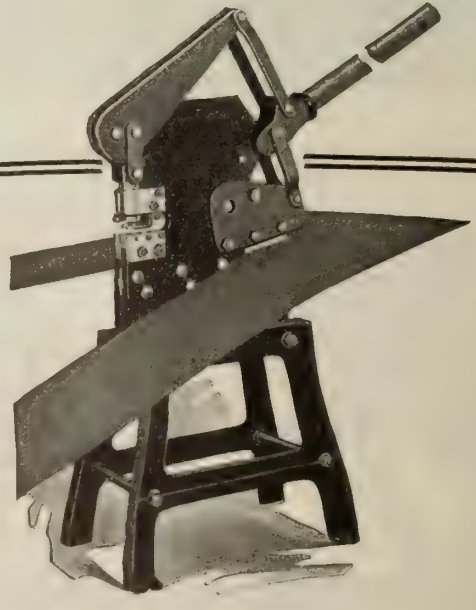
This frame construction consists of a rolled steel plate having a tensile strength 7½ times that of cast iron. This strength permits of a machine much lighter and more compact than is possible with either cast iron or cast steel.

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FRANKLIN DIE-CASTINGS



PRESSES Number 18

(Photograph by courtesy of our customer)

Blanking, cupping and stamping electric light wiring device parts in the Arrow Electric Company's plant at Hartford, Connecticut. Steel, brass, copper and pressed paper stock, 1-64 to 3-32 thick is used. The company began to install "Bliss" Presses about 10 years ago. It required a high rate of production on a variety of small parts. It now has in operation over one hundred "Bliss" Machines and is getting the production it wants.

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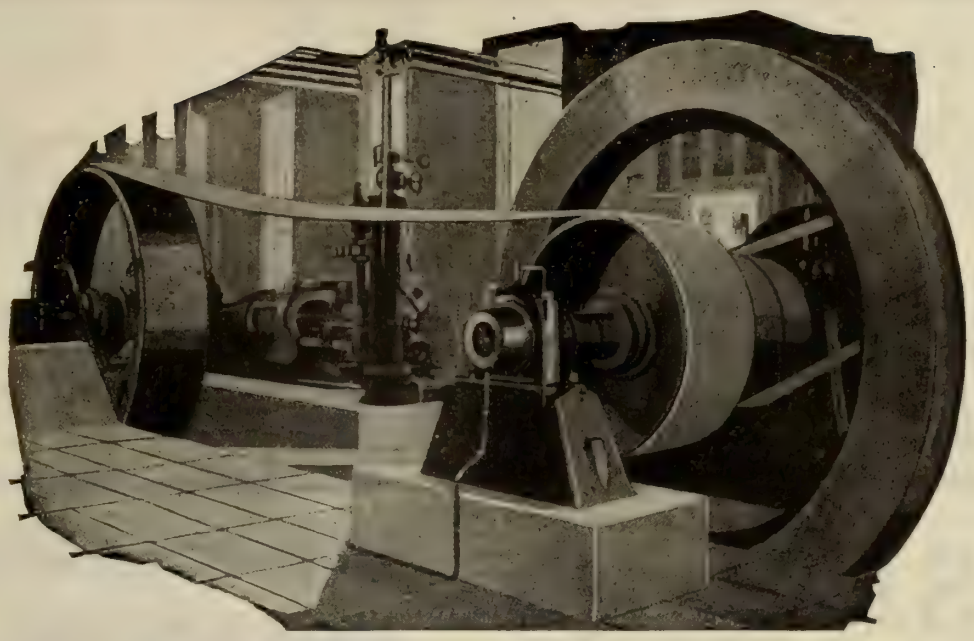
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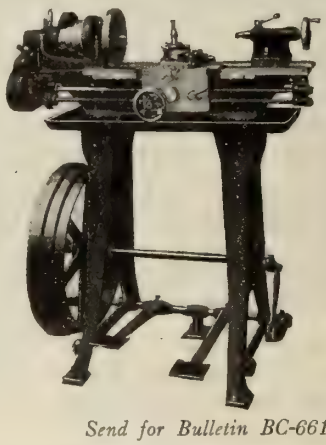
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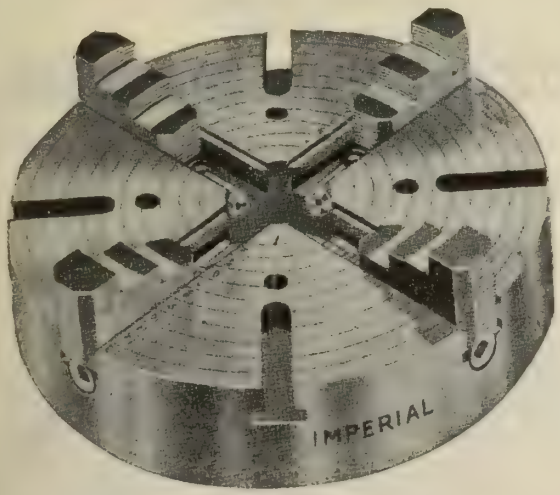
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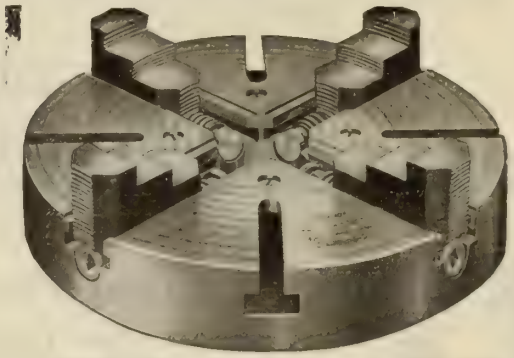


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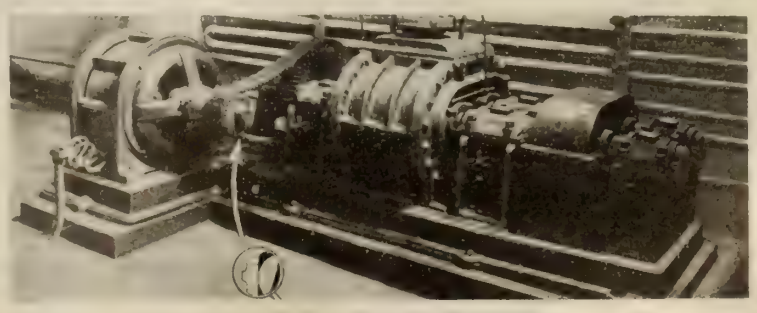
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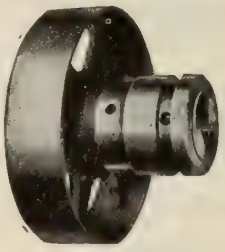
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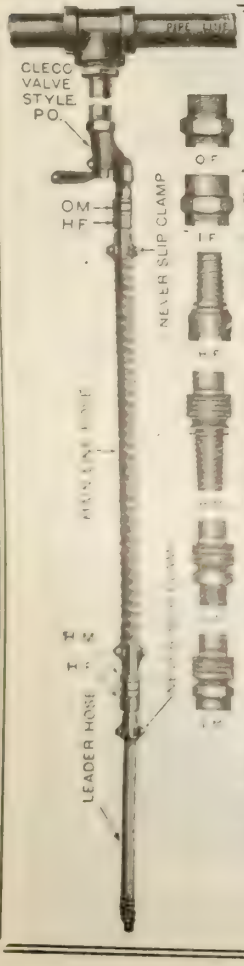
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THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

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[illegible] and will not rust.
[illegible] changes in couplings ¼-inch to [illegible]-inch.

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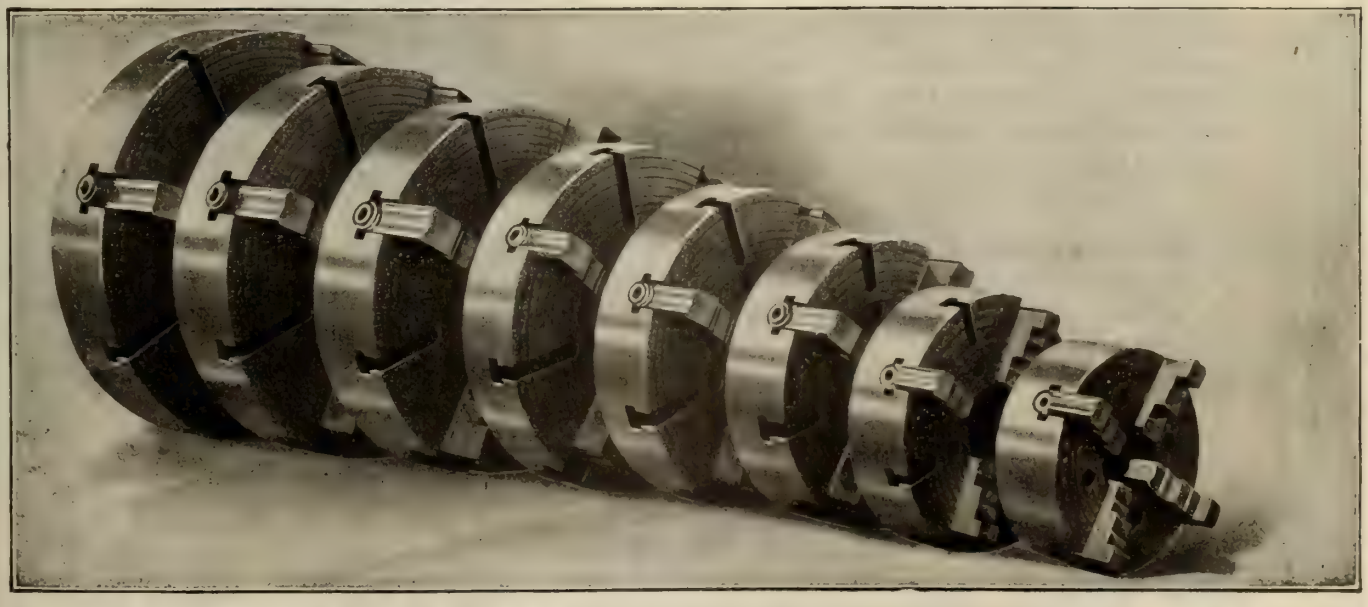
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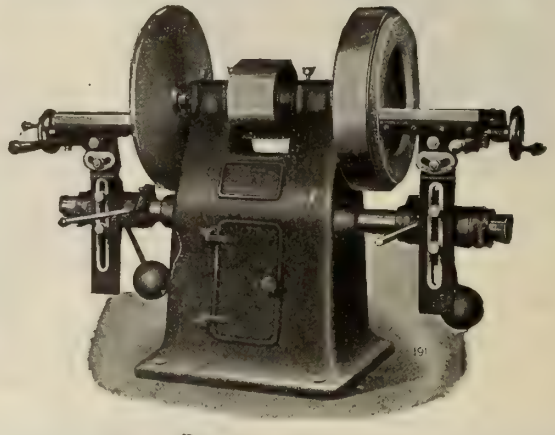
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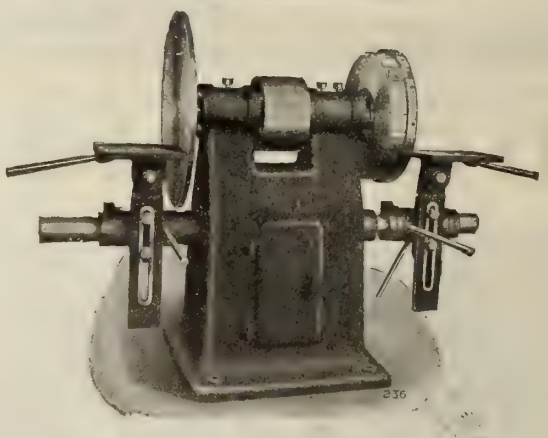
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DISC

Grinders

High-Class Made-in-Canada Machines





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Such machines are Ford-Smith Disc Grinders; every model of the Ford-Smith line—and there's a model for practically every purpose—is designed to give *quality* production as well as *quantity*.

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Send for our latest Disc Grinder Bulletin.

THE FORD-SMITH MACHINE COMPANY, LIMITED

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W. E. Storey, London, England. McLeod & Co., Calcutta, India.

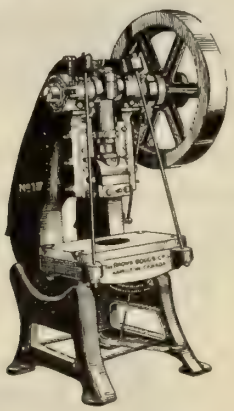
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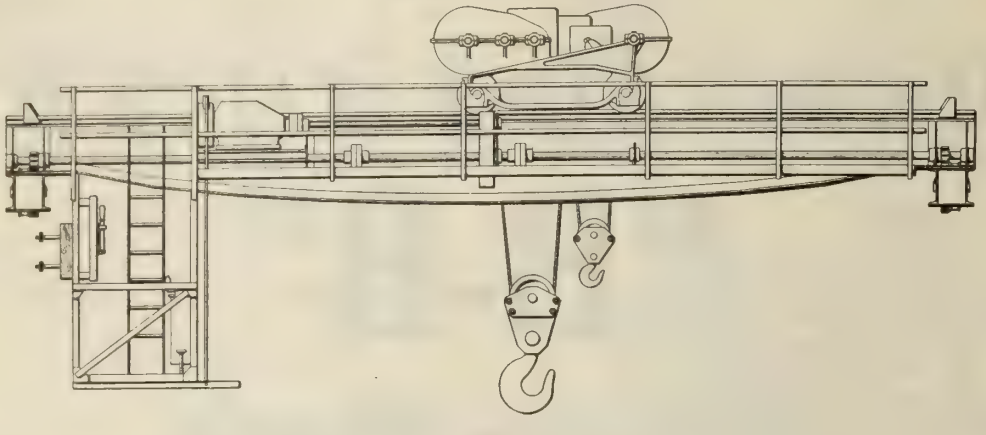
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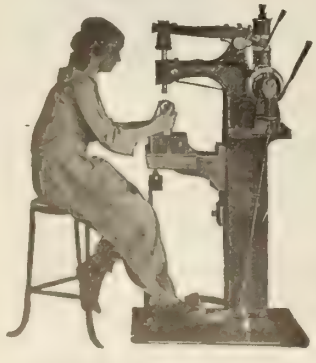
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The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads "all flush" or loose, flush, countersunk, or finishes heads any shape desired and at the rate of:

A rivet [illegible] size ½" to ¾".

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And on special order we build machines to handle rivets up to 1½" with proper speed, economy.

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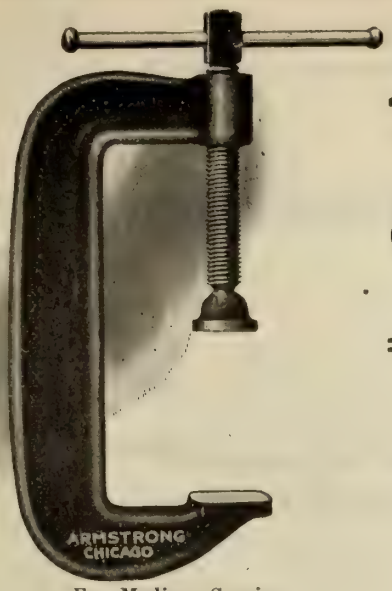
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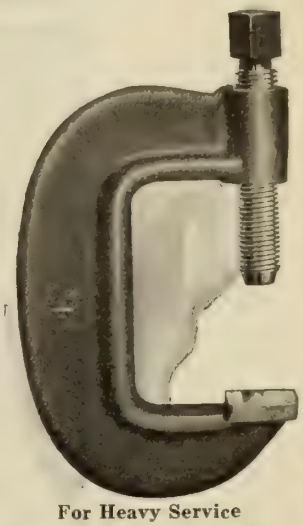
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3/8" to 18" in capacity.

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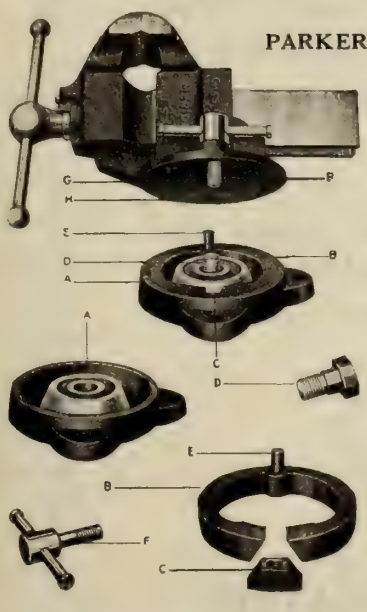


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PIONEERS 1842 LEADERS EVER SINCE



PARKER SUPERIOR SAYS—

7 Reasons Why—
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The first swivel base above the bench a patented feature, a challenge to produce its equal. Wedge "C." when drawn up, by bolt "F," expands ring "B" against wall of base "A," forming a positive grip.

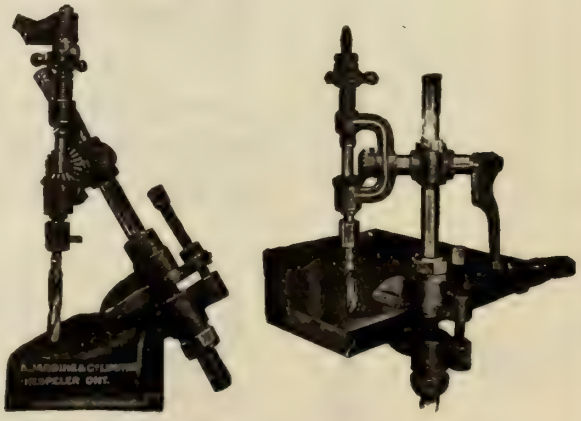
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Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



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GTD has maintained and proved by many experiences that in the work of screw-threading, GTD tools, particularly *"Gun"* Taps, *"Acorn"* Dies and GTD Gages, reduce costs and increase production.

We will gladly supply you with details regarding these GTD tools. Just clip the coupon and send it in. No obligation of course.

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There is only one standard inch. The U. S. Government sets that standard — GTD gages accurately reproduce it. A certificate of the Bureau of Standards will be furnished with any of our gages, when requested. GTD manufactures both thread and cylindrical gages and designs complete gaging equipment for any product. GTD gages increase production and lower costs. Our gage experts are always at your service.



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Successors to Wells Bros. Co. of Canada, Ltd., Galt, Ontario.

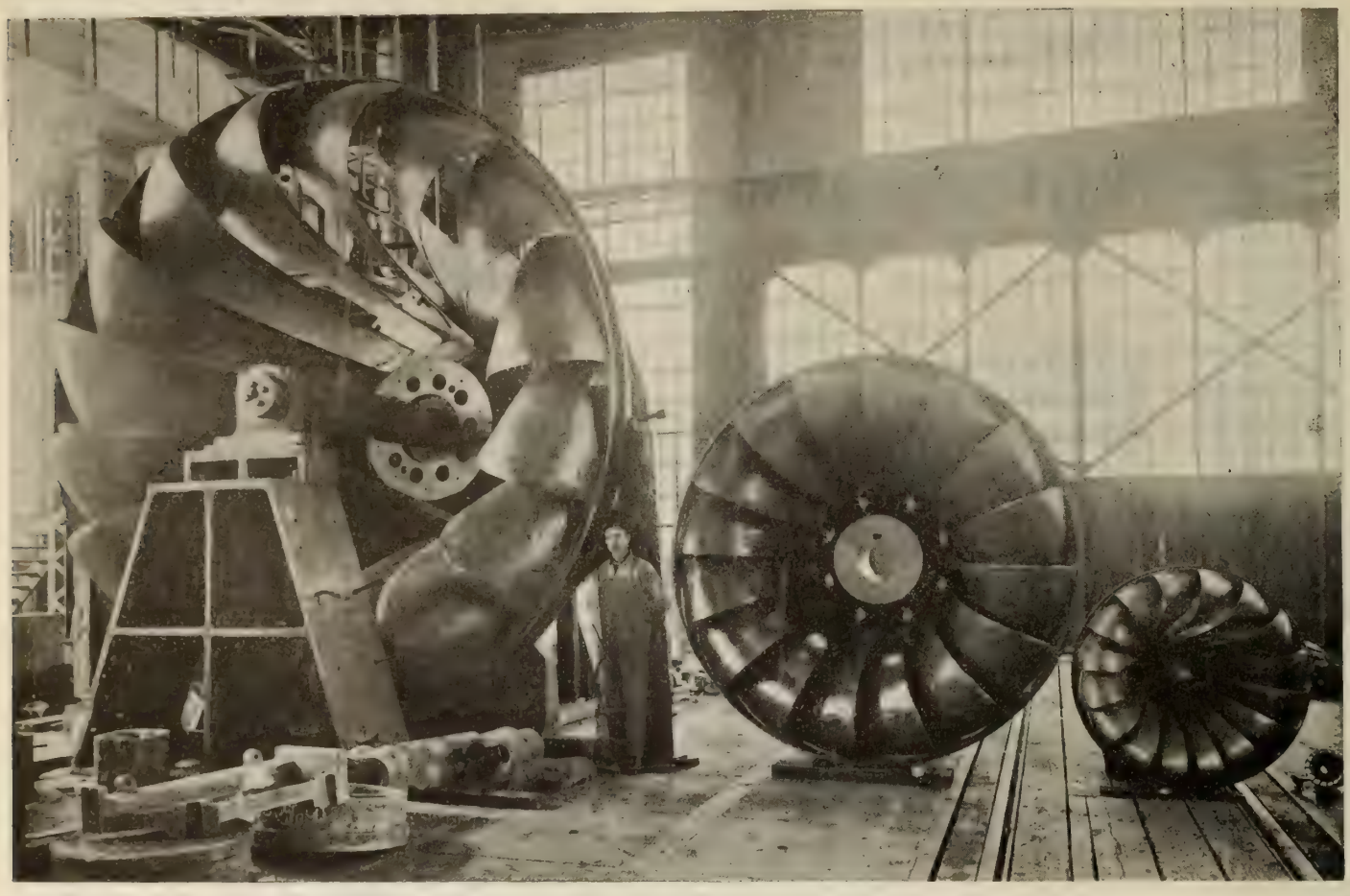
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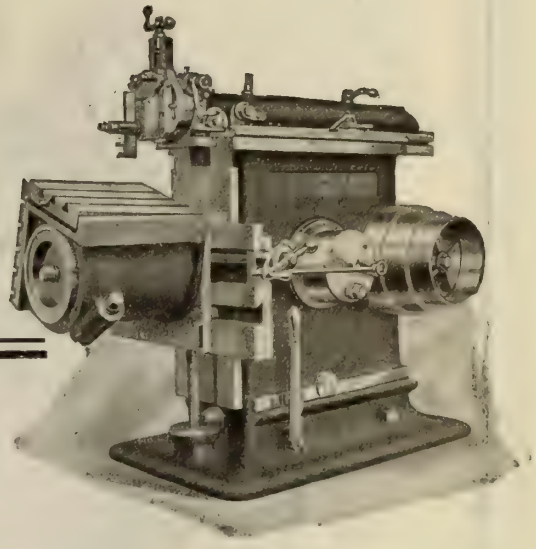
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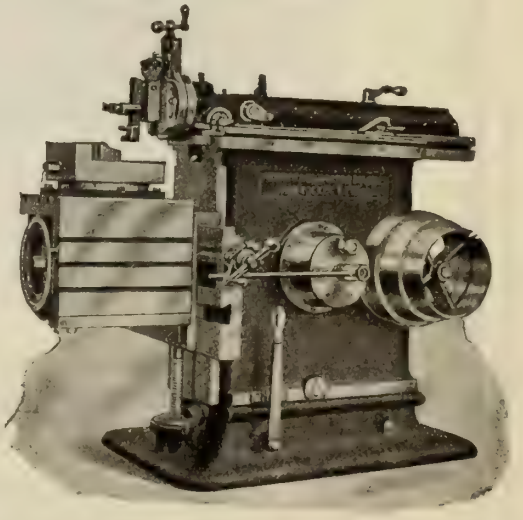
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Machines regularly furnished with—

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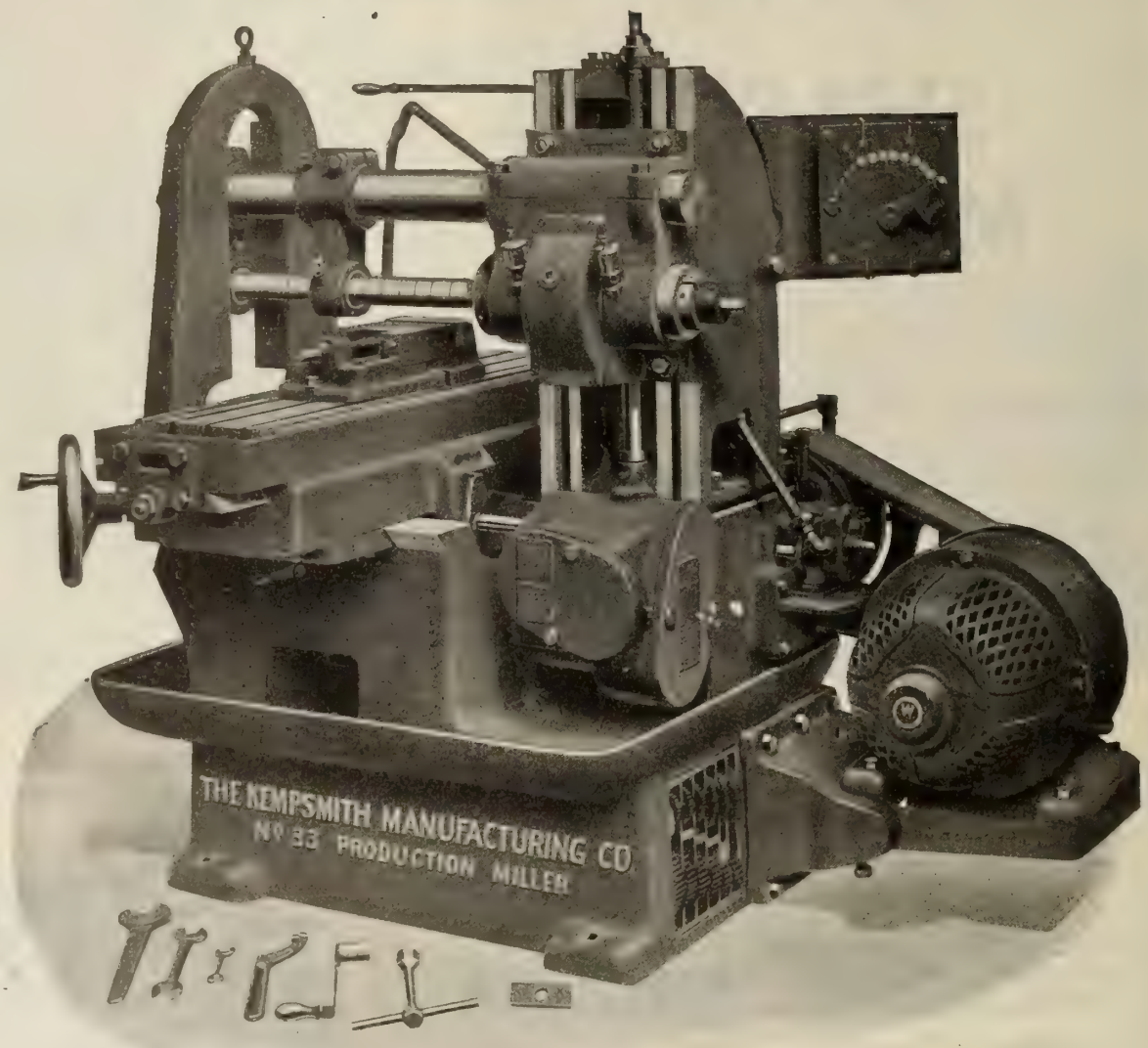
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A machine designed for the rapid production of duplicate parts.
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These wheels are the most generally used and give the greatest satisfaction for the majority of grinding jobs, since the bond is less affected by heat and may be used wet or dry. The Vitrified process affords a wider range of grades, the wheel is more open in texture and more free-cutting. It takes from 20 to 30 days to carefully manufacture a wheel by this process.



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Once you find the correct grade and grain, you want to feel **sure** that **every** future wheel you order will give the same satisfactory service as the first.

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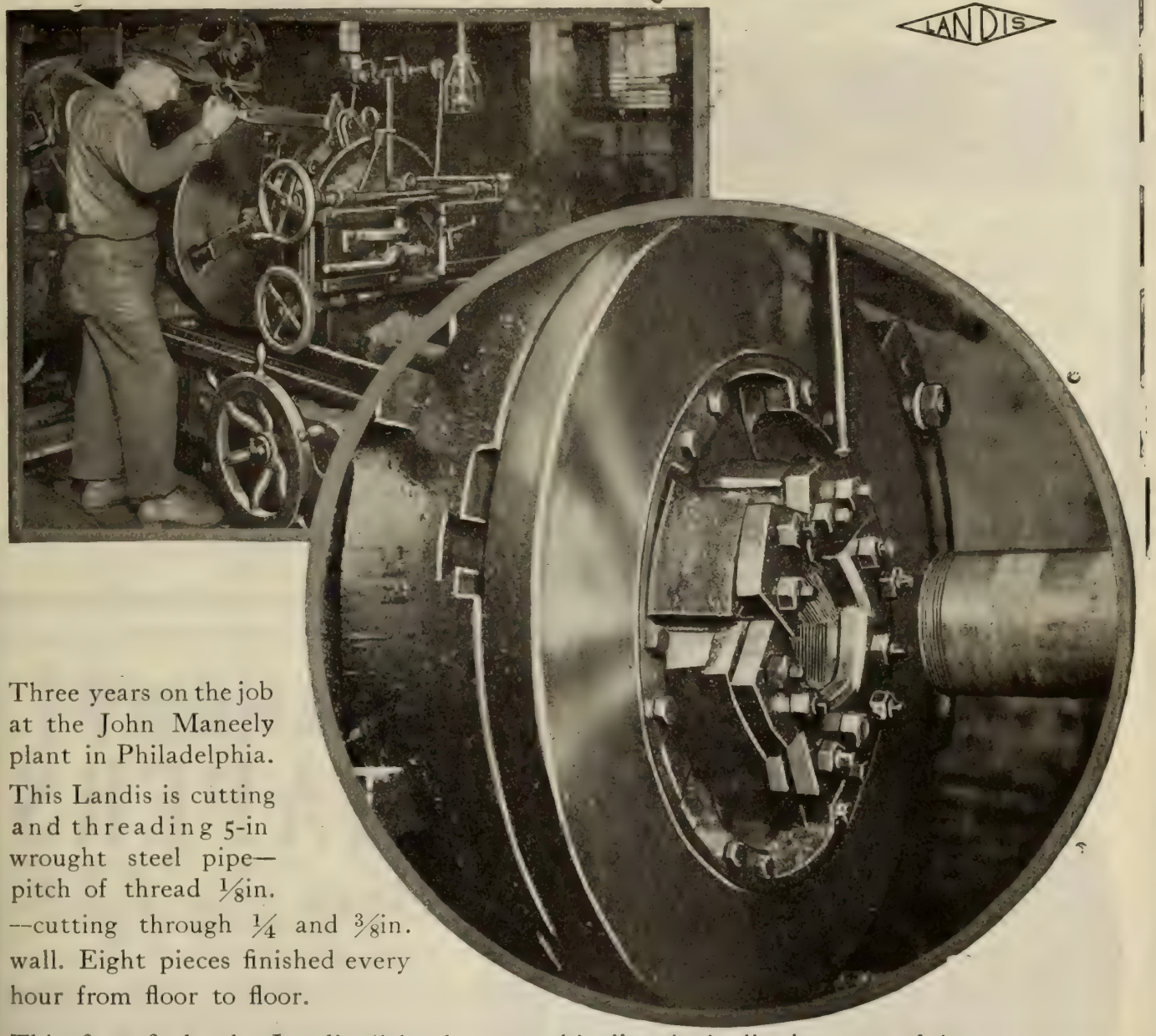
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Three years on the job at the John Maneely plant in Philadelphia.

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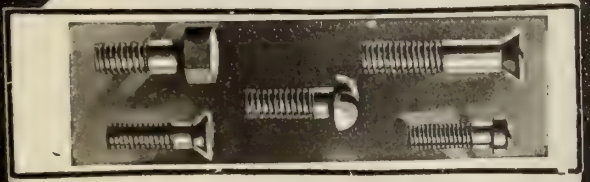
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For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

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It's a quiet, cool, smooth-running commutator where

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Let's Co-operate

There's one best type of Columbia Pyramid Brush for your generator or motor, whatever its make—tell us about your machine, and we'll put on exactly the brush it needs.

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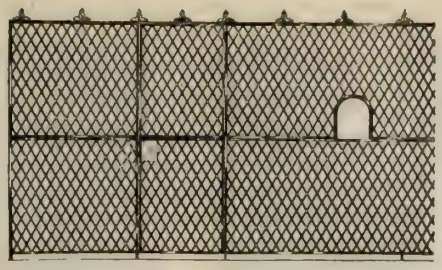
A machine which is not the easy boss of every job which it is required to handle, is not worth the floor space it occupies. Far better sell it and invest the money in a really efficient machine.

Hendey Shapers are proving daily to shops throughout the entire continent that a good versatile shaper can be successfully adapted to a large variety of work—and prove itself the "boss of them all."

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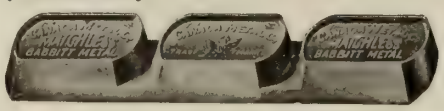


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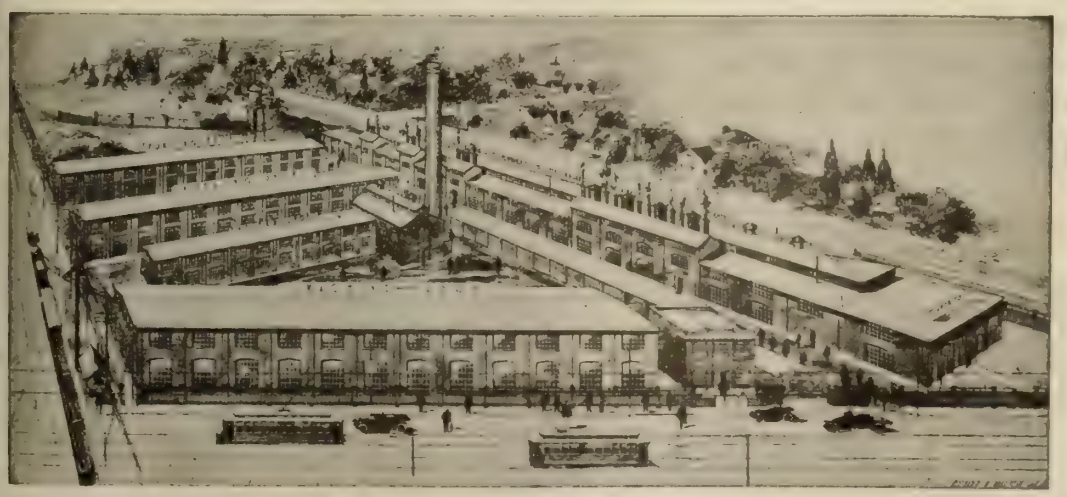
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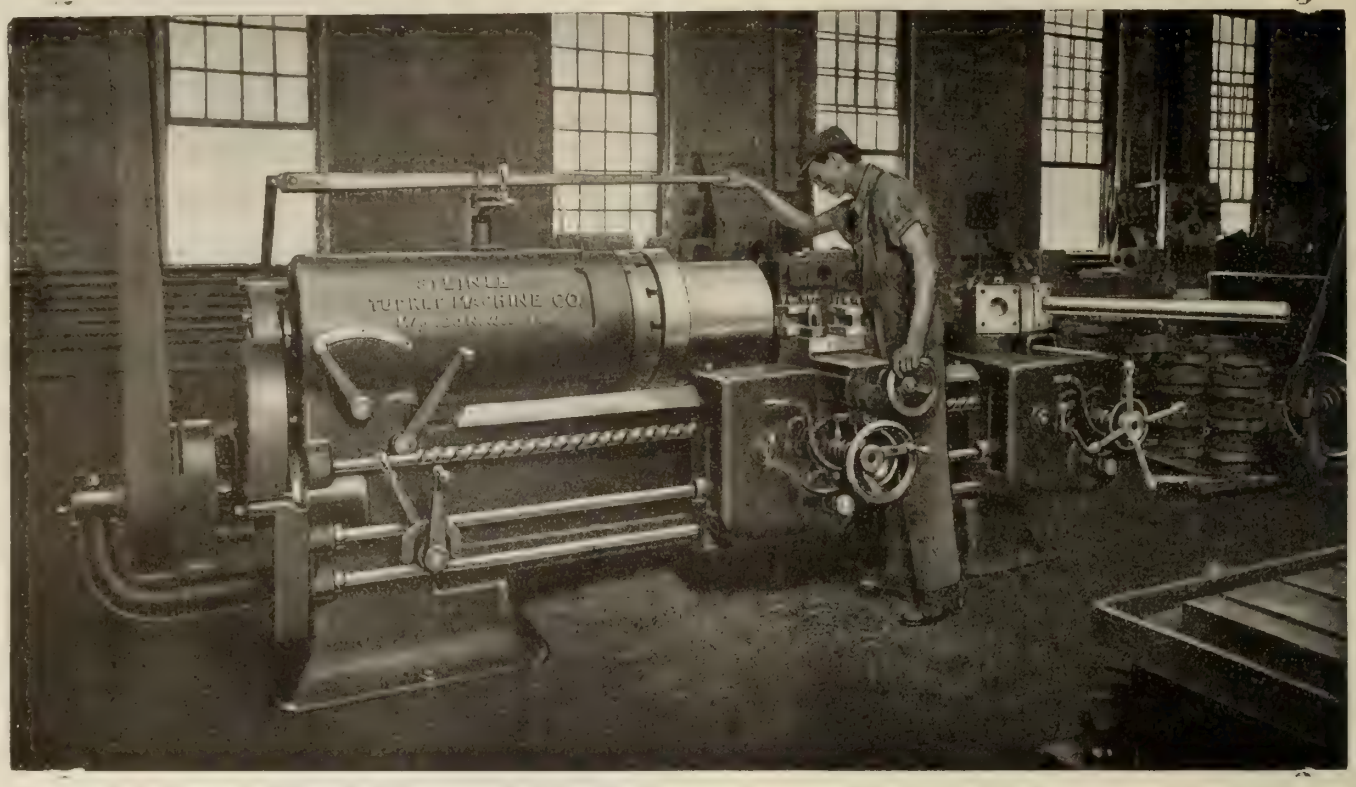
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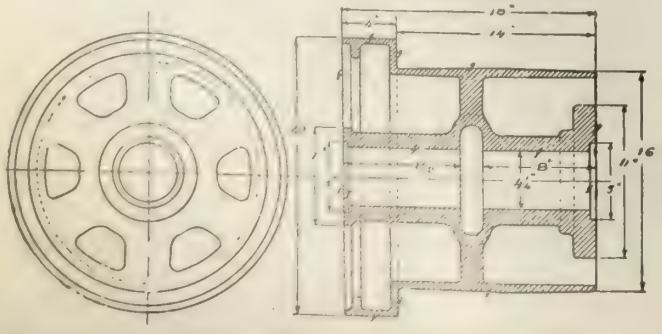
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It is a demonstration of the ability of the Steinle Heavy Duty High Power Turret Lathe to pull maximum cuts at as high cutting speeds as the best tool steel will stand.

Especially is this made apparent when it is realized that the surface machined on each pulley is 1,446 square inches, the surfaces machined including turning the 16-in diameter, turning and facing the 20-in. diameter flange, boring the hub, and counterboring and facing one end of hub. All surfaces received a roughing and finishing cut.

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Why not send us your blueprints so that we may show what "Steinle Saving" means as applied to your work?



STEINLE TURRET MACHINE COMPANY

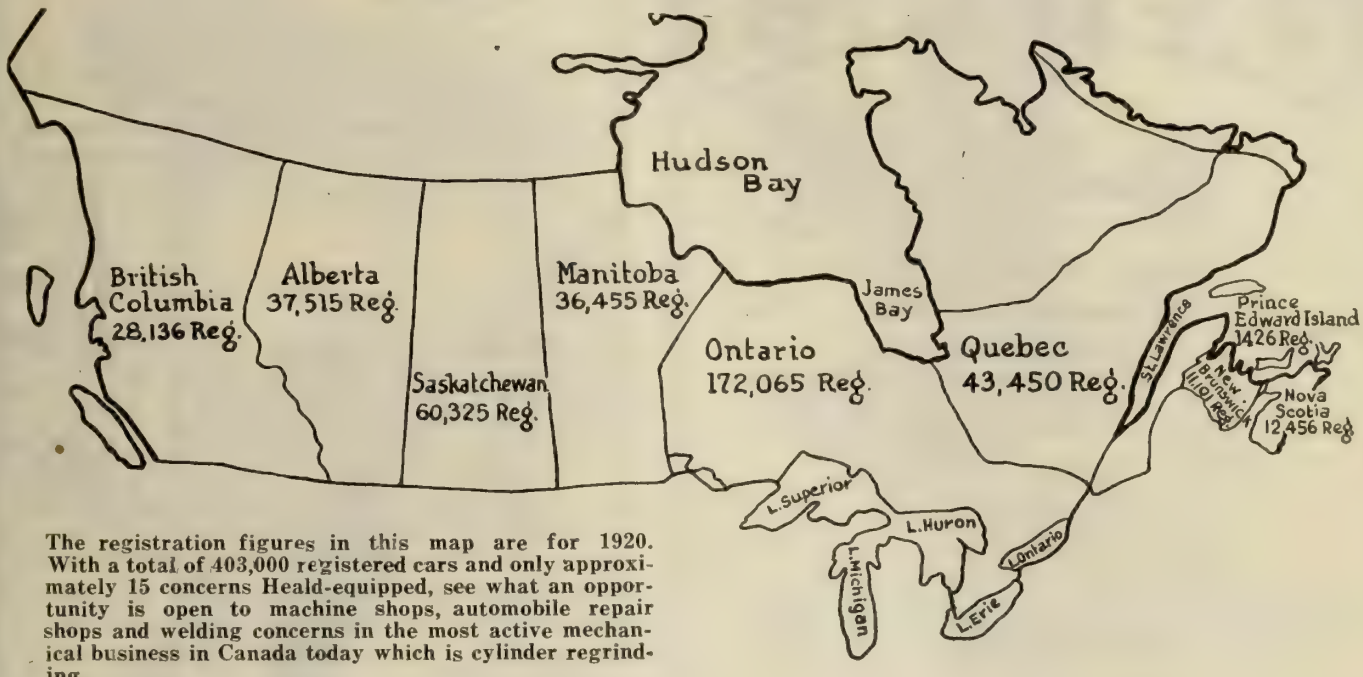
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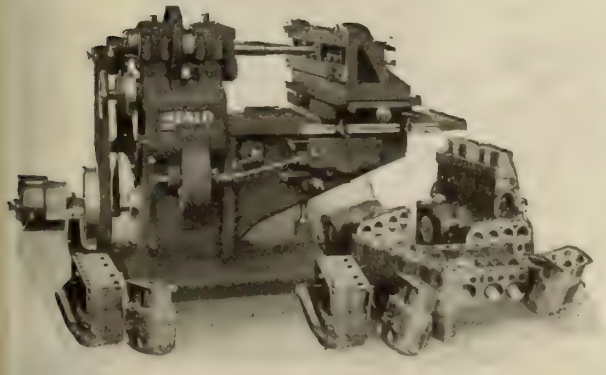
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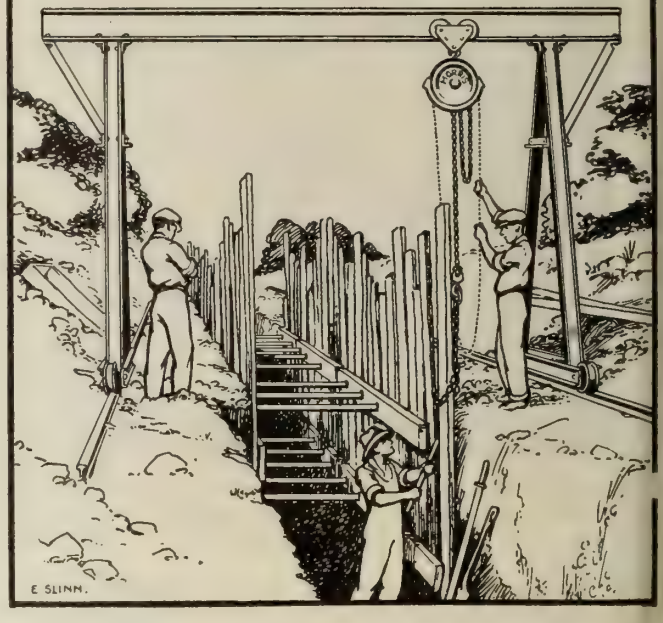
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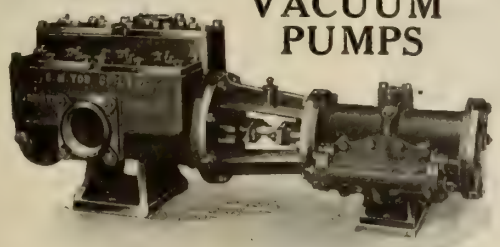
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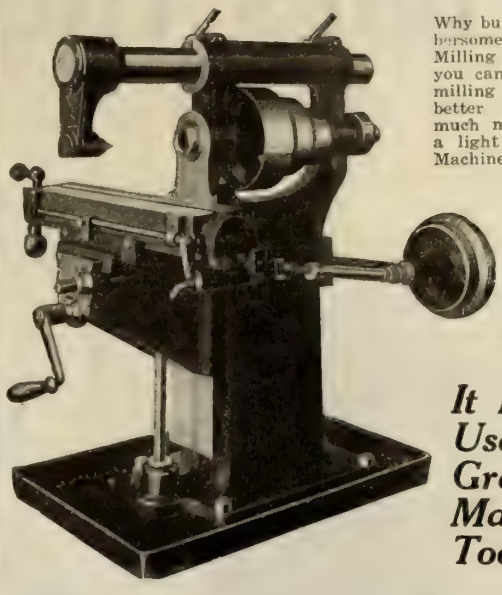
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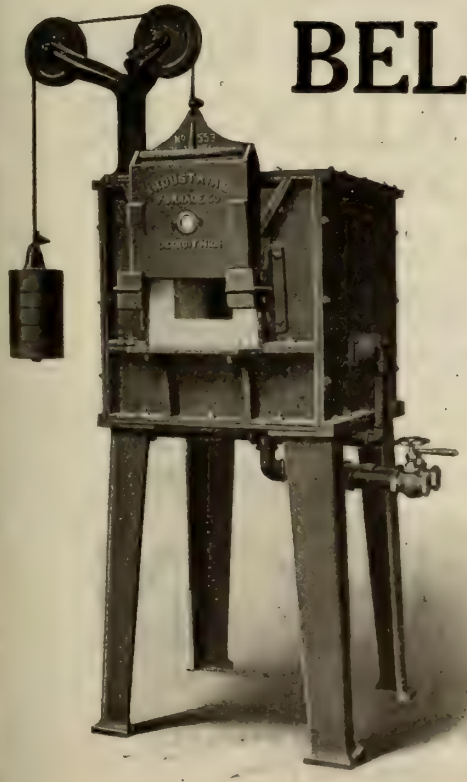
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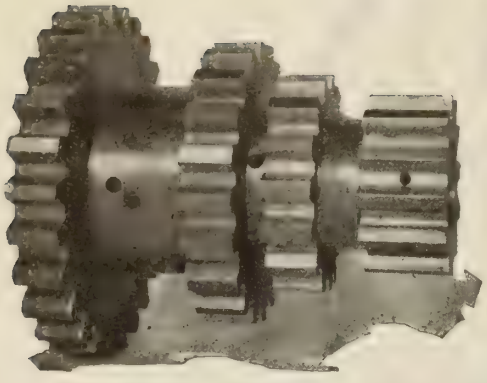
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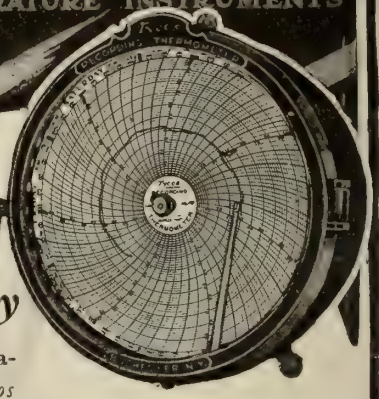
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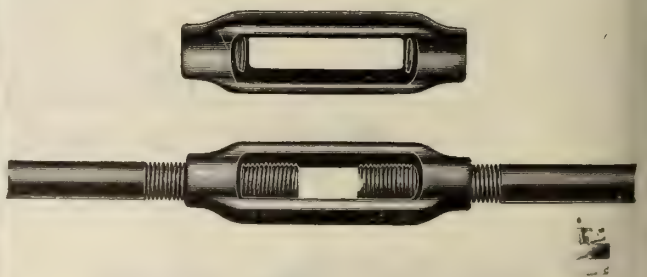
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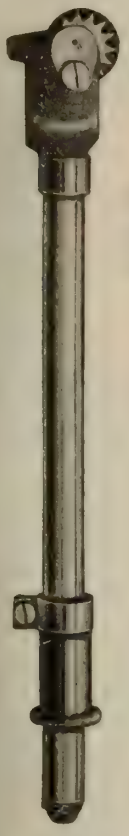
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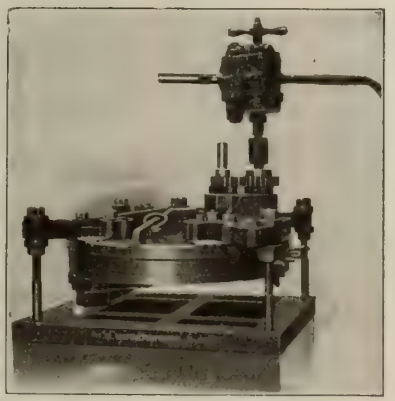
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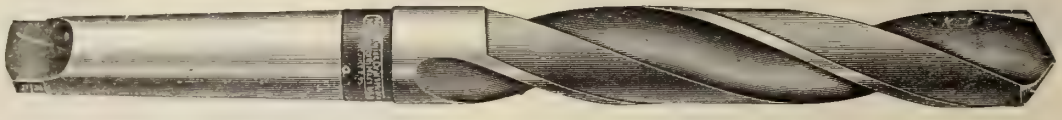
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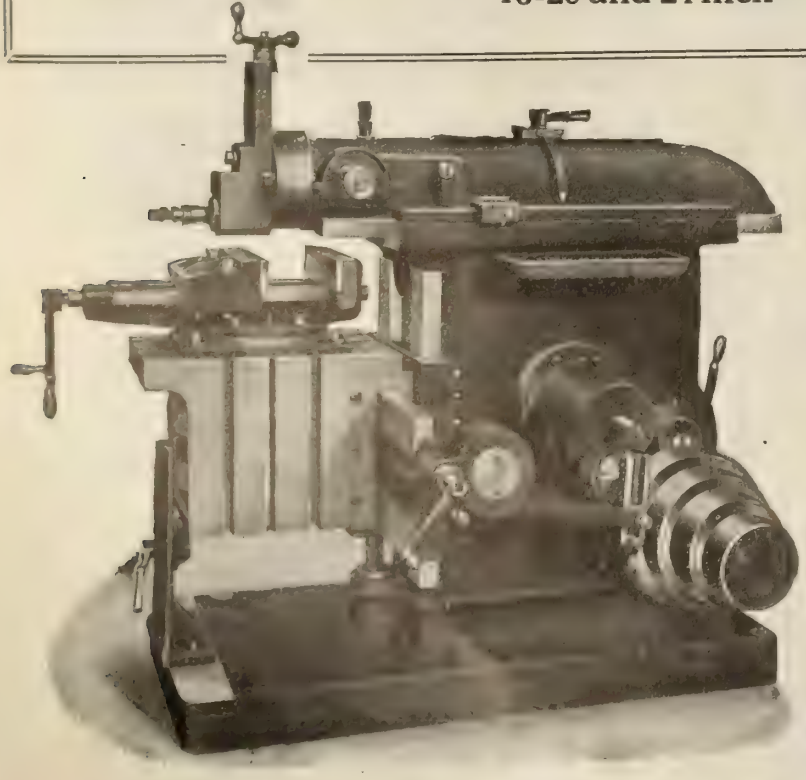
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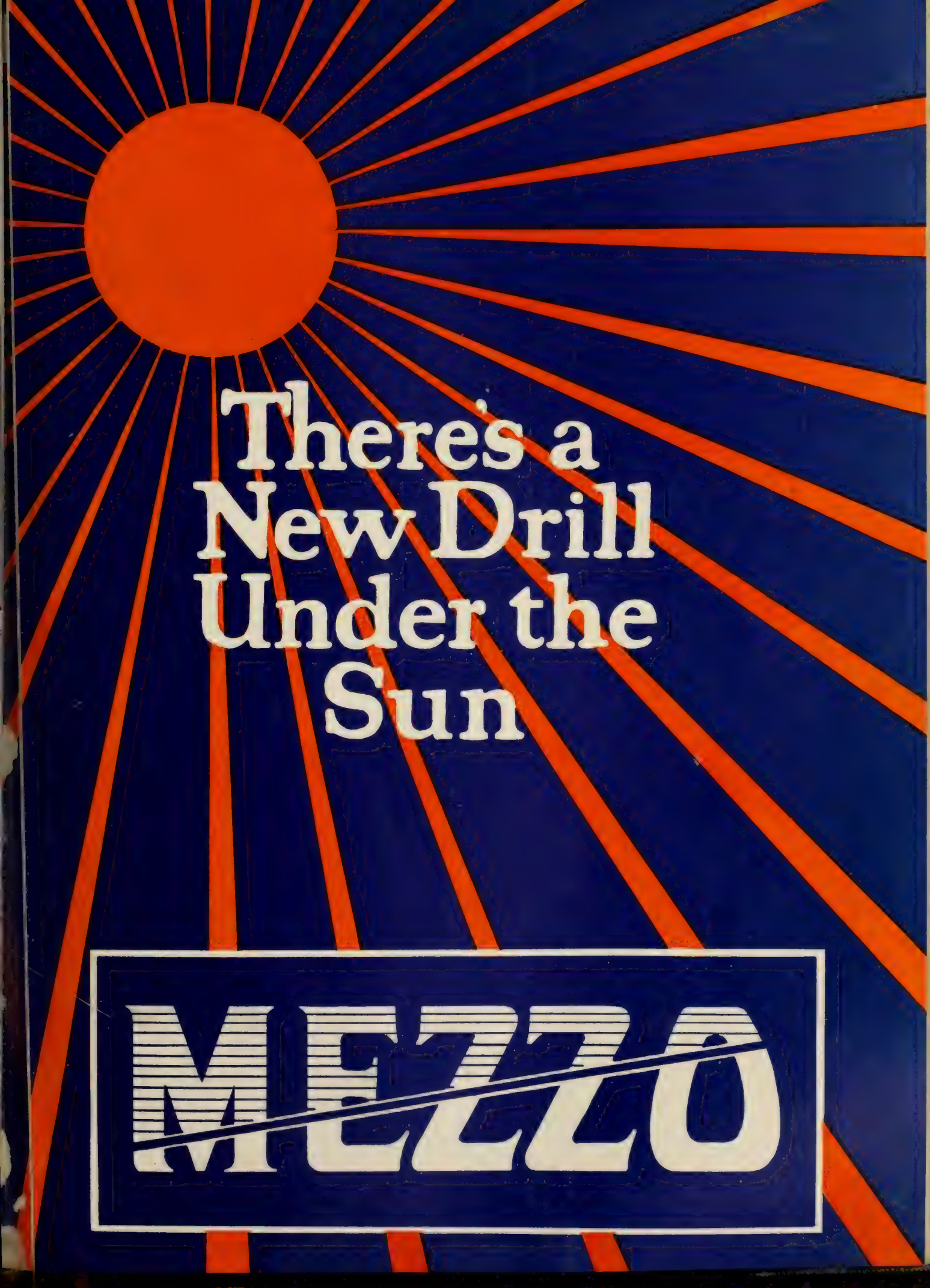
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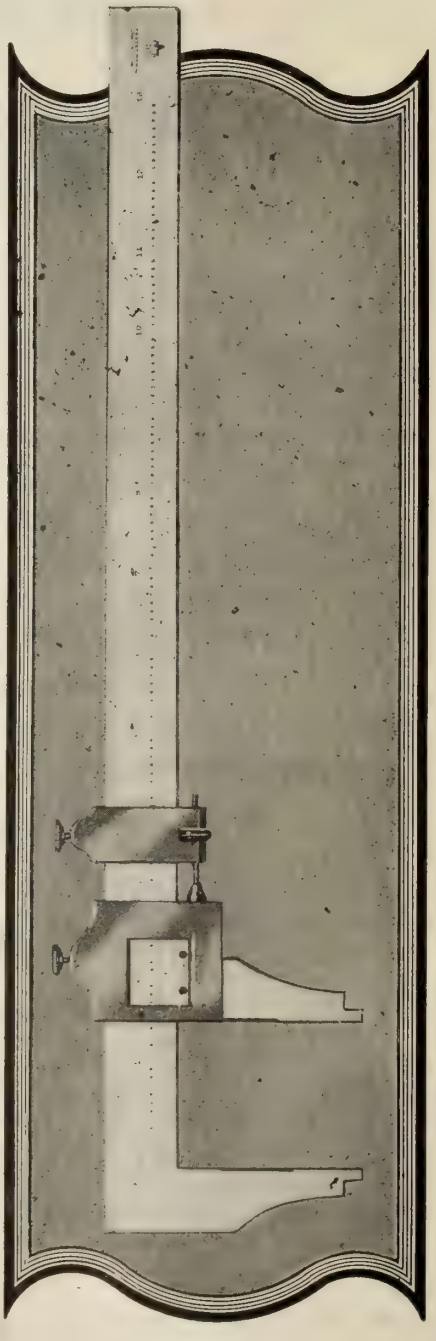
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CANADIAN MACHINERY
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VOL. XXVI No. 22 DECEMBER 1. 1921

Various Examples Of Cylindrical Grinding

Tolerance on Ground Work Can Be Very Close—Miscellaneous Parts Which Have Been Ground Successfully—Roll Grinding Machinery—Special Machine for Grinding of Paper Dryers

By H. A. WILSON.

FROM time to time we have published articles of a varied nature in connection with grinding problems in the machine shop, and, perhaps, some of the observations in this matter will touch on subjects that have been referred to before. To go back to the early conception of grinding, it will be realized that grinding was only used to remove stock from hardened pieces of steel, such as sharpening small tools, smoothing up surfaces of chilled cast iron, etc. In these early days natural abrasives only were used and they were of uncertain hardness and of miscellaneous "grits."

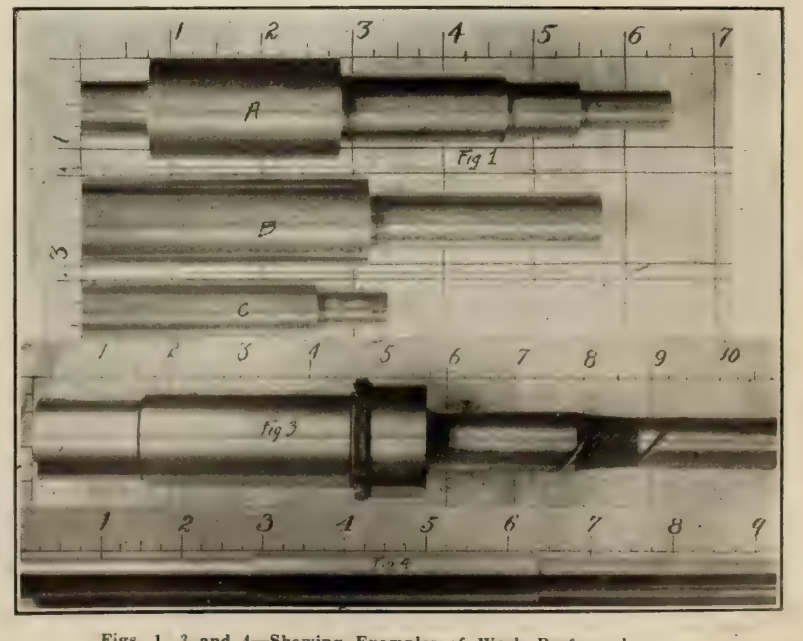
Since those days we have learned to manufacture the artificial abrasives whose grits and grades are fully controlled and understood. Grinding machines have also developed, and the field of grinding operations has increased by leaps and bounds, until today it has become a very exacting science which is employed in a multitude of production operations dealing with various kinds of metals. In attempting to take up instances of cylindrical grinding we have a very broad field and will confine ourselves largely to instances of production work of an interchangeable nature. Thus we will pass by the many interesting jobs done in the tool room on the tool and cutter grinders.

In production work we have various classes of metals to deal with such as cast iron, chilled iron, machinery steel, high carbon steel, and high speed steel. These latter two metals are often ground both before and after hardening. Each and every job requires careful calculation in the way of designing jigs and fixtures, also the grains and grades of stones used must be intelligently selected. In many cases a product specified as being "hardened and ground." The general procedure is to rough machine such articles as generator shafts for automotive generators, pins, plugs, arbors, etc., on an automatic lathe. The latter lathe produces these pieces only a few thousandths larger than finished dimensions. They are hardened by the process best suited to the metal being dealt with, then the parts are finished on the grinder. Sometimes bar stock of machinery steel, drill rod, and various other metals are used with little or no preliminary machining. As readers are familiar with the appearance of a Pratt & Whitney cylindrical grinder, we need not illustrate the machine itself, but will proceed to show some work completed on such grinders.

Fig. 1 shows three examples of work done. The limit of tolerance is plus or minus .00025 inches. Piece A is not ground on the two small diameters shown to the right. This work can thus be set up and held in a chuck, with or without a tail centre to steady it, or it can be supported between two centres and driven by means of a dog. Twenty pieces per hour are produced. The scale shows the dimensions of the piece very closely. Piece B was ground all over but has to be changed end for end to allow for that part under the driving dog to be finished. The piece is supported between centres. The production is 40 pieces per hour. Piece C is the smallest of the three and is handled similarly to piece B. Owing to the smaller diameter less metal is removed per cut and the production is 30 pieces per hour.

Fig. 3 shows a shaft with five shoulders. The limit is plus or minus .00025 inches. A production of fifteen shafts per hour is maintained.

Fig. 4 shows a shaft 9 1-8 inches long. The limits are plus or minus .0003 inches. A production of twenty-five to thirty shafts per hour is maintained. The stock removed is .008 to .01 inches.



Figs. 1, 3 and 4—Shewing Examples of Work Performed.

*We are indebted to the Pratt & Whitney Co., Hartford, Con., for data and illustrations covering Figs. 1, 2, 3, 4, and 5, also the top sketch in group Fig. 6.

The data on work shown at Fig. 6 were furnished by the Brown & Sharpe Co., Providence, R.I., while the remainder of the illustrations were supplied by the Dominion Engineering Works, Lachine, P.Q.

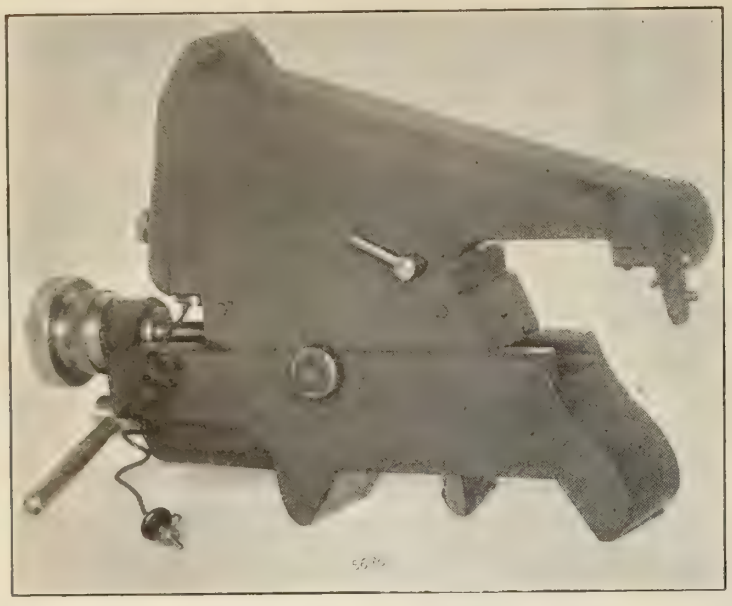


Fig. 5.—Automatic Sizing Device Electrically Controlled.

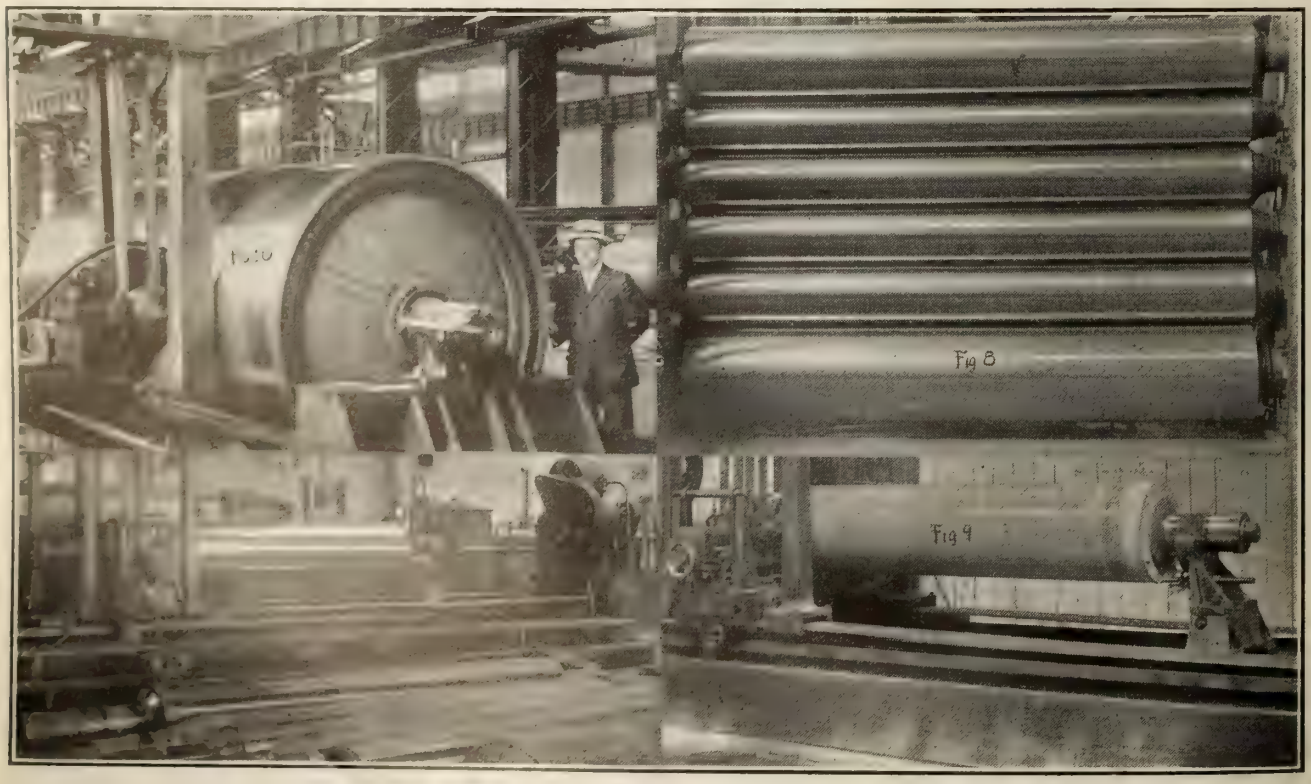
Fig. 5 depicts an automatic sizing device which is electrically controlled. This apparatus can be arranged to knock off the feed when the proper size is reached. There is a micrometer adjustment on the device and it is an extremely efficient apparatus. In addition to the accuracy obtained by its use, it enables one operator to take care of several machines without any possibility of spoiling work.

Fig. 6 shows several examples of work done on standard grinders. Example A is ground with an Alundum wheel 12 in. diam. x 1 in. hole x 5 in. face. The wheel is 38-80 grain, grade L. The wheel speed is 6,500 ft. per minute and the speed of the work is 30 ft. per minute, with a table travel of 40 in. per minute. Because of the threaded stud this piece can be gripped by a dog in such a way that the wheel can pass over the entire surface to be ground from end to end. The production on this piece is 35 per hour. The material is machinery steel and the low and high limits in diam. are .3745 in. and .375 inches respectively, as shown in the cut.

Example B is another machinery steel piece. A wheel of similar dimensions and similar grain to that used on example A is employed but the grade of the wheel is K. Similar wheel speed, speed of work and table speed are also used. This piece is ground to a point beyond the half-way mark; is then taken out, another piece inserted, then the driving dog is placed on the ground end of the first piece, afterward the piece is replaced in the machine and the balance of the surface ground. The sequence of operations is then repeated throughout the entire lot. The production is sixteen pieces per hour.

Example C is a similar piece to example B, but is shown in order to draw attention to an interesting point. The Alundum wheel is 12 in. x 1 in. x 5 in., same size as used on previous examples A and B. The wheel is 38-80 grain and grade K. The wheel speed is 6000 ft. per minute and the speed of work is 35 ft. per minute. Table travel is 40″ per minute. Now we wish to draw attention to the production of eighteen pieces per hour. This is a larger piece than example B and yet the production is greater. The explanation is that long pieces of small diameter must be ground more slowly and carefully, than pieces of the same length but larger diameter, in order to prevent springing and therefore an inaccurate job.

Example D is only ground on the smaller diameter at one end. A carborundum wheel 12 in. x 1 in. x 5 in.—401—N at 6,000 ft. per minute was used. The average production is one hundred and twenty per hour. The use of the independent automatic cross feed by which the wheel can be fed to bring the piece to any predetermined size, is the reason for the high rate of production on this work. The feed is automatically thrown out when the piece is



Figs. 7, 8, 9, and 10.—Text Matter Explains Each View.

the proper size. As before stated, the table is stationary and a wheel broader than the length of the surface to be ground, is used. A girl operator ground four hundred and eighty of these pieces in three hours which is a record production. This means 2 2-3 pieces per minute or one piece every 22.5 seconds.

Example E is one of internal cylindrical grinding. The piece has four gears cut on it and all four had to run true with the centre. A variation either way of only .00025 inches in the diameter of the whole was permitted. The material was special steel, hardened. The Alundum wheel used was grain 38-80, grade J and was 1 1-2 in. diameter x 3-8 in. bore x 5-8 in. face. The wheel speed was 4000 ft. per minute, (approximately 10,200 r.p.m.), the work speed was 120 ft. per minute, and the table travel 30 inches per minute. The production was one piece every twenty-five minutes, trued on the pitch line.

Example F is an excellent illustration of small size work ground to close limits. The rate of one hundred and fifty pieces ground in 10 hours with .012 inches of stock to remove and a final finish size of .250 inches with a plus and minus limit of one ten thousandth are rather unusual. The work was done on a No. 10 plain grinder. The wheel used was an Alundum wheel 12 in. x 1 1-2 in. x 5 in.—grain 38—36 grade C. The wheel speed was 5500 ft. per minute. The work is driven by a driver, through keyway on the end of the piece which allows wheel to pass completely across the work.

Example G was ground without any stopping of any part of the machine. At the end of the second pass of the wheel, the centre was pulled back, the piece was taken out while still revolving and a blank inserted. The piece was driven by the squared end and the wheel passed over the work from end to end. The wheel used was an Aloxite 401 GRN, 12 in. x 1 in. x 5 in. at a speed of 6000 ft. per minute. The work revolved at 400 r.p.m. The table travel was 39 inches per minute. The average rate of production is 1000 pieces in 3 hours and 43 minutes, which otherwise expressed is 4.48 pieces per minute or one piece every 14.28 seconds.

Example H was ground by the use of the independent automatic cross feed, mentioned in connection with example D, and with the table stationary. The wheel used was an Aloxite 40 in. at a speed of 6,000 ft. per minute. The speed of the work was 15 ft. per minute. In this case also, a girl operator made the record production of 500 pieces in 3 hours and 40 minutes which is at the rate of 2.27—plus, pieces per minute or one piece every 26.3 seconds.

Example I is a similar piece of work to Example H. The wheel used was an alundum 38—46, K—14 in. X 3 in.X 5in. at a speed of 6,000 ft. per minute. The speed of the work was 45 ft. per minute, and the table was stationary. The production is 88 pieces per hour, one piece every 1.4 minutes.

The previous examples of work have been of the small piece type, and we will pass on to larger work, which is being done in Canada to a great extent, namely the grinding of rolls for paper mill work.

Fig. 7. represents a Farrel Roll Grinding Machine in the plant of the Dominion Engineering Works, Lachine, P.Q. This machine is used to finish grind the calender, granite, and other rolls in use on paper machines. The machine is provided with two grinding spindles. One of the unique features is that the ways on the bed of the machine, along which the wheel carriage slides, are inverted and of the removable type, thus they shed instead of retain the grit and impurities that cause wear. In addition the ways are provided with guards, as also is the feed screw, to better protect them from grit and water. The feed screw is equipped with thrust ball bearings at both ends. A circulating pump for lubricating oil forms part of the regular equipment of the machine.

This pump automatically lubricates, and cleanses, by a constant flow of oil, the ways and feed screw of the machine. The wheel carriage is equipped with an automatic reverse, thus travelling backwards and forwards over the roll surface automatically. The wheels are mounted on the swing-rest principle

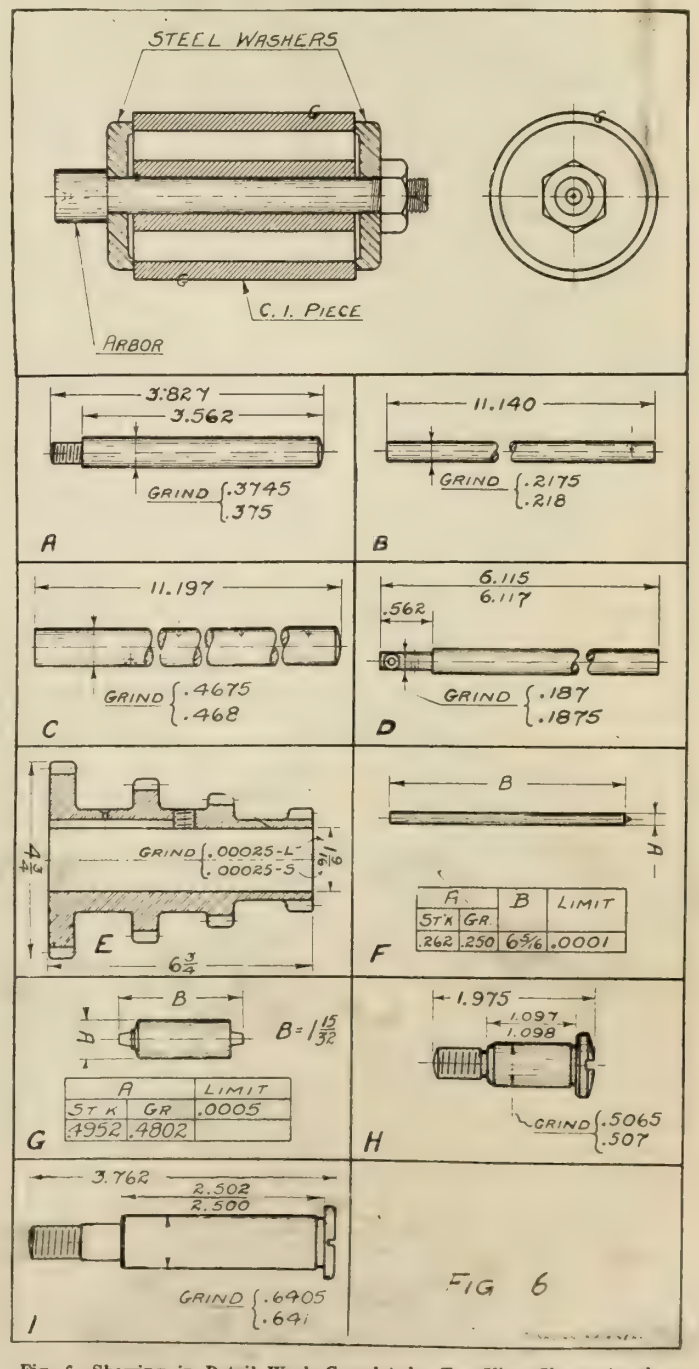


Fig. 6—Showing in Detail Work Completed. Top View Shows Another Piece Ground Successfully.

which insures extremely accurate work. Two electric motors drive the two grinding wheels. A third motor is mounted on the machine and is connected to the driving spindle. Thus the machine is entirely electric driven and self-contained.

The grinder is equipped with a patented Vine roll crowning device consisting of a guide, or former, secured to the side of the bed. This former is seen in the photograph. The top of this guide is finished in the arc of a circle upon which rides a shoe controlling the lifting rods which are compounded and connected to the grinding wheel housing on either side. This system of connecting by adjustable levers, or rods, enables any desired crown to be obtained, the crown being determined by the lift thus conveyed to the wheel housings.

The calender rolls ground on this machine, are of chilled cast iron. The rolls have to be finished with the utmost care, as when assembled in a paper machine it is these rolls that impart a smooth, uniform surface to all paper produced. Every calender roll must be ground absolutely parallel, except the bottom roll of a stack, which has to be crowned. The necessary crown varies in different stacks of rolls, all the way from half a thousandth to thirty thousandths. The crown is required to correct deflection of the bottom roll, as this roll carries the weight of the stock During the grinding process rolls are always rotated on their own journals and never on centres or at other points than journals. These rolls are from 12 inches to 26 inches in diameter. In Fig. 8 is shown a set of calender rolls stacked in the shop, in position exactly as they would be when assembled in the paper machine. These rolls are 166 inches face length. They are stacked in this way in the shop in order that the "light" test may be applied. When so stacked an electric light is passed back of each joint. If no light can be detected the rolls are parallel. If there is an opening of only a few ten thousandths it is greatly magnified by the light on the shiny surfaces and the error appears to be much greater. This is one of the most sensitive tests that can be applied. The crown in the bottom roll is calculated previous to grinding, and after the weight of the other rolls has been ascertained. This company has demonstrated its ability to calculate the amount of crown, place that crown on the roll and then have the rolls pass the "light" test, time and time again.

The wheels used on chilled calender rolls for roughing are of the carbo-vitrified type, grain 36 or 40, grade P-4" diameter x 1" hole x 5½" face. Carbo-shellac type of wheels are also used. For finish grinding and general grinding work, grain 70, grade P, wheels 3" x1"x5" are used. The grinding wheel speed is 1,500 r.p.m., the roll speed is 100 r.p.m. and table traverses five feet per minute.

Fig. 9 shows a granite roll being ground on the same machine. These granite rolls are used as press rolls in many types of paper machines. The grinding operations are for the most part similar to those on calender rolls. However, granite is very brittle and will crack if heated unevenly. How sensitive it is will be appreciated when recently a small brass ring which was rather hot, (not red hot,) was laid upon a granite roll and a piece flew out from the face of the roll. The granite rolls have solid steel shafts inserted in them, and on these shafts are mounted semi-steel or steel journals, all being held together by nuts on each end of the shafts. The shaft is heated moderately hot, put in place, then the nuts tightened lightly and the shaft allowed to cool. The journals are ground true and then the granite rolls are revovled on these journals when being ground. The wheels for roughing granite rolls are 20M-G3 carbo-vitrified. The finishing wheels are 40M-G3 carbo-vitrified. Speed of wheel, and speed of work, also travel of table, are similar to that in the case of the chilled calender rolls.

Fig. 10 shows a grinding machine designed and built in the shop of the Dominion Engineering Works, for the grinding papers dryers. As will be seen the machine has only one grinding wheel arbor. This is because of the comparatively large diameter of the dryer shells. The trend of modern designing has called for dryers from four to six feet in diameter, and 14 feet and over in length. For example the paper machines built in this shop for the Laurentide Co., called for dryers six feet in diameter, 166 inches face length. To take care of such extremely large diameters and lengths, this machine was designed. The modern paper machine of any size calls for from 30 to 40 dryers and thus the grinding of these dryer cylinders really becomes a manufacturing proposition. Fig. 19 shows a collection of dryers for one machine. These dryer cylinders are of grey cast iron on the face, and when being ground are as in the case of press calender rolls, revolved on their own journals. The wheels used are Carborundum grain 20, grade S, 36" dia. x 3" thick.

Other types of grinding done on the Farrel grinder somewhat out of the ordinary are also interesting. When brass rolls are ground, wheels with grain 60, 4" x 1" x 1½" are used. These wheels are of the carbo-shellac type. In grinding steel rolls, Aloxite wheels are used 36-3-K83 for roughing and 70-3-K83 for finishnig. When Rubber rolls are ground in general work a Carbo-shellac grain 40, wheel is used 4" x 1" x 5½". But in hard rubber rolls requiring a fine finish a carbo-shellac grain 70, 3in. x 1" x 5" is used. The handling of such large rolls to and from the machines is interesting. A railway siding runs directly into the shop and in front of the grinding machines. Rope slings are used on the finished work which is all handled by a system of electric cranes. Another interesting feature is that extremely accurate micrometer measuring devices are used to measure and gauge rolls.

Thus it is shown that cylindrical grinding is applied to all classes of work from the smallest to the largest, and to various kinds of material. The art of grinding is keeping pace with modern progress, and forms one of the most varied and interesting lines of machine shop practice of the present day.

WELDING BY CLOCKWORK

In shipbuilding and in many engineering operations, it is necessary to fix brass studs and other small parts to iron plates. This operation is usually performed by drilling holes in the plate, each hole being drilled separately. By means of an ingenious invention recently perfected by a British firm, the process is carried out in a few seconds by electric welding. The working of the machine is almost entirely automatic from the moment the stud is placed in position. Each size of stud requires a different time for welding it to the plate, and the machine can be set to give exactly the period required to make a perfect weld. The tests which have been made proved that the machine is able to weld 120 brass studs within an hour. It might be thought that welding does not give such a firm arrangement as screwing the stud into a hole in the plate, but when the welded stud is hammered the brass will break before the weld yields. Another advantage of the machine is that work can be satisfactorily carried out by semi-skilled labor.

NEW DEVICE FOR CRANE OPERATION

In the operation of large cranes used in building construction or for dock work it is generally necessary to have two men engaged, one working the controllers, and the other stationed at some convenient point to signal to the first. With the aid of a device invented in Great Britain it is possible to dispense with one of these men. The device consists of a portable electric controller which can be slung over a man's shoulder and can be supported by means of a long pointed leg. This controller is connected by means of a strong flexible cable with special controlled gear operating the crane motors. The user has merely to press certain buttons on the controller to make the crane go through all its usual evolutions. Thus the operator can stand at any point convenient for observation or he can walk about from one point to another so as to secure a complete supervision of the working of the crane. This invention should be of the greatest assistance in saving labor in docks and on construction work generally.

Elements Of Machine Design-Lesson No 3.

Continuation of Lesson From November 17th Issue—We Now Go Into Actual Problems, Showing How They Are Solved—Formulae of Importance and Charts

*By L. T. RUTLEDGE.

CONTINUING the lesson on the column from the November 17th issue, we will next take up the procedure in design. When Rankine's formulae in the form given in the previous lesson is used to determine the proper section of column to support a load "P," it must be understood that the quantity "S" is the total unit stress resulting from the combination of direct compression and the bending stress. For a given factor of safety a maximum permissible working value of "S" will be laid down in the specifications furnished. In any problem the unsupported length will be given in inches and when the material in the column is known along with the condition of the ends, then the value for the constant "k" will be selected. But even with all this information supplied, we still have the unfortunate condition, namely that there are still two unknown which are the quantities "A" and "r." We have just one equation and the usual thing is that one equation solves for one unknown. The value for the "r" will always depend on the dimensions that determine the value of "A." This condition has always seemed to introduce difficulty for the student or designer. It has been the writer's experience to observe that the theory and method of solution for columns are forgotten much more quickly than for any other type of problem.

The easiest way out of the difficulty is to adopt the method of solution known as the method of trial and error. Assume a section whose area and radius of gyration are known or can readily be found by the regular methods. Then introduce these values along with the other known values into the right hand side of Rankine's equation which will then give a value for "S" which is the resulting unit stress. If this value is close to but not greater than the maximum value allowed in the specifications then the first choice of section will satisfy the requirements of the problem and the problem may be considered as solved. But if the value for "S" is greater than the permissible value, then a second trial will have to be made. The good designer seldom has to make more than two trials. The result obtained in his first trial guides him in the choice of section for the second trial.

Example 1.—A machine weighing 8 tons is temporarily placed on a machine shop floor that is already carrying all the load the city building by-laws will allow. As an emergency measure the floor is to be shored up by a Douglas Fir stick of timber which is really a short column. The ends are square and flat and a perfect bearing is provided. The column is 15 feet long between the two bearings and it is unsupported for the entire length. What section of column is necessary to keep the maximum stress in it below but close to 800 pounds per square inch?

Solution — Given P=8 tons=16,000 lbs.; l=15 ft.=180 ins.

The material is wood and the ends are square and flat, then $k = \frac{1}{3000}$

As a first trial assume a section 6 in. x 6 in., whose area is 36 sq. ins.

$$r = \sqrt{\frac{I}{A}} \quad \text{and} \quad I = \frac{1}{12} bh^3$$

$$\text{then} \quad r = \sqrt{\frac{1}{12} \times \frac{6 \times 6^3}{36}} = 1.732$$

$$\text{and} \quad \frac{l}{r} = \frac{180}{1.732} = 104$$

Substituting the values in Rankine's equation we have

$$S = \frac{16000}{36}\left\{1 + \frac{1}{3000} \times (104)^2\right\}$$

$$= \frac{16000}{36}\left\{1 + \frac{10816}{3000}\right\}$$

$$= 2047$$

This gives the resulting stress to be 2047 lbs. per sq. in., which is much greater than the maximum of 800 allowed.

As a second trial, assume a 8″ x 8″ section. Its "A" = 64 sq. ins.

$$I = \frac{1}{12} \times 8 \times 8^3, \quad r = \sqrt{\frac{I}{A}} = \sqrt{\frac{1}{12} \times \frac{8 \times 8 \times 8 \times 8}{64}}$$

$$= 2.3$$

Then $\frac{l}{r} = \frac{180}{2.3} = 78$ and

$$\left(\frac{l}{r}\right)^2 = 78^2$$

Now on substituting in Rankine's formula, we have

$$S = \frac{16000}{64}\left\{1 + \frac{1}{3000} \times 78^2\right\}$$

$$= 755 \text{ lbs. per sq. in.}$$

This value is so close to the permissible working stress that we may consider the section 8 in. x 8 in. as satisfactory. Therefore a 8 in. x 8 in. x 15 ft. 0 in. Douglas Fir timber dressed four sides is the required column to support the floor at the place where the dead load of 8 tons can be considered as concentrated.

The student should observe from the arithmetical results obtained how rapidly the stress diminishes when the area of the section is increased. Here we did not double the sectional area yet the stress was decreased almost to one-third. This extra amount is due to the reduction in the value of $\frac{1}{r}$ which is in turn due to the increase in the value of the radius of gyration. Had we selected a section 6 in. x 8 in. the area would have been increased from 36 to 48 but the $\frac{1}{r}$ would have remained the same since "r" would be unchanged. This is

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only to pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

an important consideration and it may be beneficial to show this in detail.

"r" is the least radius of gyration and is obtained from the least moment of inertia about an axis through the centre of gravity of the section.

$$\text{The least } I = \frac{1}{12} bh^3$$
$$= \frac{1}{12} \times 8 \times 6^3$$
$$\text{and } r = \sqrt{\frac{I}{A}} = \sqrt{\frac{\frac{1}{12} \times 8 \times 6 \times 6 \times 6}{8 \times 6}}$$
$$= 1.732$$

which is identical with the value used in the first trial.

Application of Theory to Steel Columns

Rankine's formula, as we have it, is expressed thus:

$$S = \frac{P}{A}\left(1 + K\frac{l^2}{r^2}\right)$$

or it may be written—

$$\frac{P}{A} = \frac{S}{1 + K\frac{l^2}{r^2}}$$

Where $\frac{P}{A}$ is the average allowable stress per sq. in. suiting the conditions of the design and which we may denote by "p" so that the formula may be written

$$p = \frac{S}{1 + K\frac{l^2}{r^2}}$$

For a factor of safety of 4, the permissible unit stress is usually taken as 16,000 lbs. per sq. in. but in the case of mild steel columns where secondary stresses are introduced due to various causes, extra provision has to be made. The causes of the secondary stresses are as follows: (a) stresses due to eccentricity of end connections; (b) stresses due to flexure of the unsupported parts between lattice bar connections; (c) stresses due to eccentricity of lattice bar connections; (d) stresses due to poor workmanship.

These secondary stresses are independent of the value of $\frac{l}{r}$ and the only way they can be provided for is by making an allowance in the value of "s" in the formula. Instead of assuming the value of 16,000, the more usual and better practice is to take three-quarters of it as the value, that is, assume 12,000 as the value to be introduced into the formula for "s." Also, experiments performed during the last few years by large steel companies would indicate that $\frac{1}{18000}$ is a safer value to use for "k" than the $\frac{1}{25000}$ suggested by Merriman.

Thus a very excellent formula for the determination of the safe working stress to be used in the design of mild steel columns is

$$p = \frac{12000}{1 + \frac{1}{18000} \cdot \frac{l^2}{r^2}}$$

Where p=the safe working stress depending on the value of $\frac{l}{r}$.

l=greatest unsupported length in inches.

r=least radius of gyration.

It should be clearly understood that in all probability each new design or problem requires a different permissible working stress. Only when $\frac{l}{r}$ remains constant does the stress remain constant.

The ordinary method of procedure for design of steel columns is as follows: Being given the value of "l" in inches and the load "p" choose, as a first trial, a section that you think will be suitable. Determine the value of its "a" and its least "r." Introduce into the above equation (23) the values for "l" and "r" and solve for "p." Multiply the value of the unit stress "p" by the area of the chosen section to ascertain the capacity of the section at the allowable unit stress. If the capacity of the section is approximately equal to the load but not less in any case, then the section chosen will satisfy the conditions. Should it be noted that the capacity is less than the load, then a new section will have to be chosen, as a second trial. The calculations will have to be repeated. The radius of gyration will in all probability be different so that a new permissible stress will govern in this second trial. The calculations may have to be repeated again, if necessary, until a suitable and economical section is found.

Example 2.—A steel I-beam with properly designed and rigid end connections is used as a short column to support a load of 25 tons. The total length of the column is 9 feet and it is unsupported in any way over its entire length. Determine the proper section of column for this case.

l=9 ft.=108 ins.

Choose a 10 in. I at 25 lbs. as a first trial.

From the handbook we find its area to be 7.37 sq. ins., its least "r" to be .97.

$$p = \frac{12000}{1 + \frac{1}{18000} \times \left(\frac{108}{.97}\right)^2}$$
$$= 7120$$

The permissible safe working stress under the given conditions is 7120 lbs. per sq. in. Then the column is capable of withstanding safely a total stress of 7120 x 7.37 or 52,474 lbs., which is a trifle greater than the load of 50,000 lbs. In this case, our first choice provides a column that is strong enough and without much excess of strength so as to be economical.

This point should be noted, in this connection, that an I-beam is not the best design for a column. An ideal column has equal radii of gyration, that is, its radius of gyration about an axis through its centre of gravity parallel to one side is equal to its radius of gyration through the same point parallel to the other side. The I-beam selected to satisfy the conditions of the problem just solved has a radius of gyration about an axis through the centre of gravity parallel to the flange of 4.07 ins. Whereas the radius of gyration about an axis through the same point but parallel to the web is .97, being less than one-quarter of the former value. For the above problem $\frac{l}{r}$ in the first case is 26 and for the second 111. The permissible stress in the first case is 11,570 and in the second 7120 as seen above.

The designer of built-up columns always tries to have the radius of gyration the same in either direction so that the column may have the same strength in both directions.

A designer who has occasion to work out numerous column designs usually provides himself with a table showing values of "p" for various values of $\frac{l}{r}$. For illustrative purposes, an abbreviation of such a table is given on page 44. See table three for these values.

The results tabulated in table 13 are given in the form of a graph or diagram in Fig. 15. In the diagram permissible unit stresses are plotted against horizontal values of the slenderness ratio. This diagram gives the information at a glance and shows very clearly the variation in stress for a variation in $\frac{l}{r}$.

After Rankine's equation has been plotted as shown, it is possible to approximate the curve by a straight line which may coincide fairly closely with the curve. The straight line diagram given in Fig. 15 does not coincide as

closely as some others that might have been chosen. The one given, whose equation is $p=16000=70\ \frac{l}{r}$ is the column formula adopted by the American Railway Engineering and Maintenance of Way Association.

There are many other column formulae, whose equations are given in the handbooks. Some of these are Euler's, Gordon's, Ritter's, Johnston's parabola formula and Johnston's straight line formula.

The only practical way to study these formulae and see their individual merits is to plot them for a wide range of slenderness ratios and all on one sheet of cross-sectional paper. Do this for each kind of end restraint. A sample of this is given in Fig. 16. In this figure it is apparent that there is not much difference between any two formulae. The writer believes that Rankine's is about the best one and is really the one that was used by every inventor of a new formula in checking up his new one.

In another lesson the writer will work out problems on design involving the use of the beam and the column theories. Additional interest will be added insofar as it will be first necessary to decide in each case which theory applies.

IMPORTANT NOTE

In Mr. Rutledge's article of November 17th some typographical errors occurred. On page 38, in the second column, and 7 lines from the bottom, the expression should read z^2's (or better) the quantities z^2.

In the third column 14 lines from the top the arithmetical calculation should read $r = \sqrt{12} = 3.46$ ins.

On page 39, second column and the second line, the algebraic expression should read $Sc = P \div A$, and at the 10th line of the same column it should read $S \div c = M \div I$.

On page 44, the 4th line should read $\frac{S}{c} = \frac{M}{I} = \frac{E}{R}$

In the last column, 6 lines from the bottom, after $K\ \frac{l^2}{c}$ the words "after substitution in the above formula" should be inserted.

NEW USE FOR COMPRESSED AIR

A concern manufacturing ball bearings gives in a shop window in London an interesting demonstration of the elimination of friction. Compressed Air Magazine, which tells the story, says that an ordinary electric fan is placed in close proximity to two four-bladed fans staggered one behind the other. On the spindle of the latter a little pulley is fixed, from which a belt is taken to a large pulley wheel on an overhead shaft, about three inches diameter, running entirely in ball bearings with several other large pulleys, and from two of these a belt is connected with more machinery on the ground driving a bevel gear, this in turn driving a circular group of large ball bearings. The working of all this series is done entirely by the pressure of air. The electric fan produces a current of air which impinges on the blades of the second fan and keeps the whole train in motion at a good speed. The belts used to drive this combination are made of ordinary cotton tape and thin string.

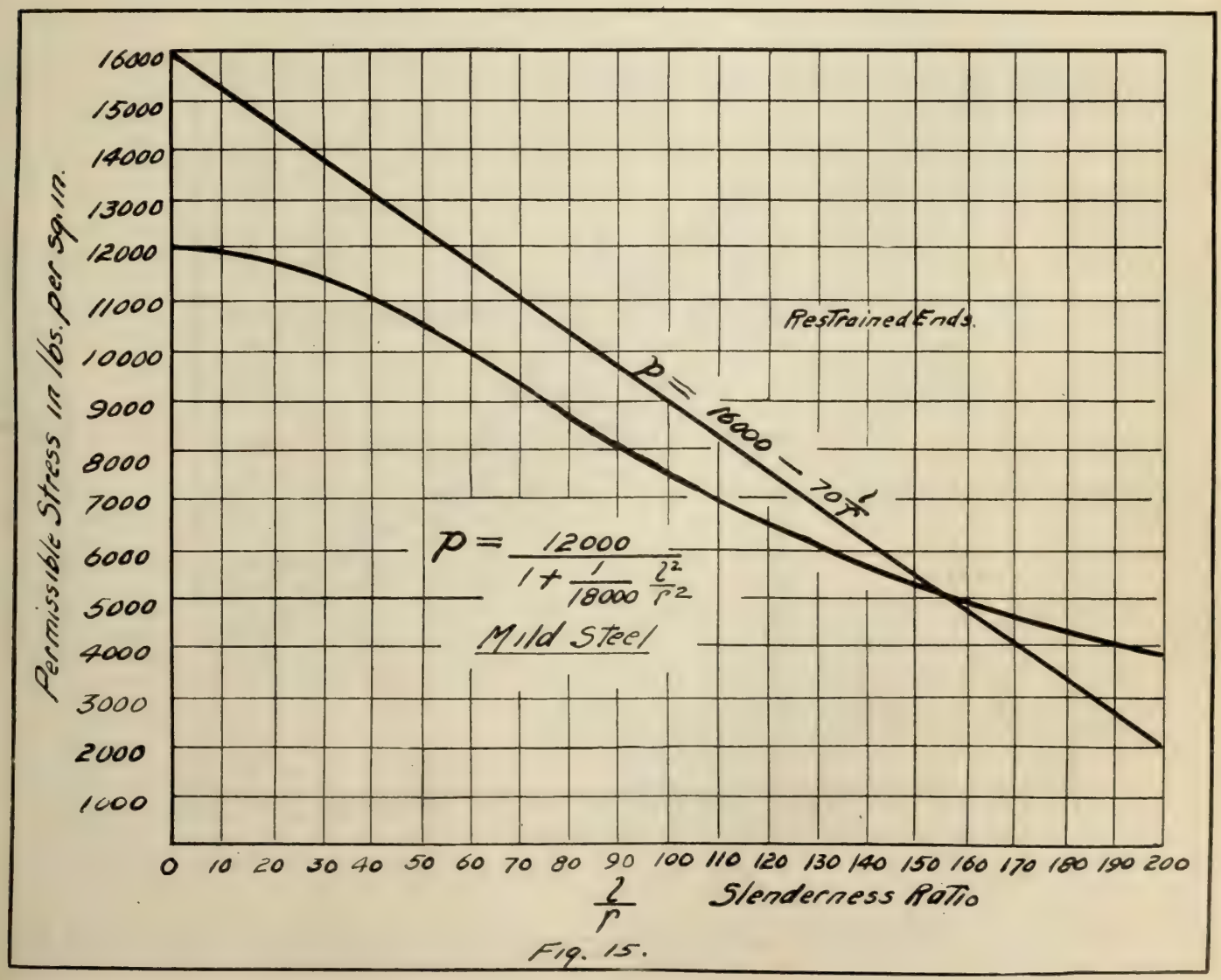


Fig. 15.

$\frac{l}{r}$	p	$\frac{l}{r}$	p
10	11930	90	8280
15	11850	95	7990
20	11740	100	7710
25	11600	105	7440
30	11430	110	7180
35	11240	115	6920
40	11020	120	6670
45	10780	125	6420
50	10530	130	6190
55	10270	135	5960
60	10000	140	5740
65	9720	145	5530
70	9430	150	5330
75	9140	155	5140
80	8850	160	4950
85	8560	165	4770

Table 13 — Showing values of "p". See formula in opposite column.

A Study in Concrete

NEW YORK can rightfully claim to have the tallest concrete building in the world. The structure stands on a site approximately 75 feet square and is eighteen stories high. From the basement to the top of the roof the building measures 223 feet high. Work was begun in October, 1920, and finished early in 1921. To guard against freezing, the concrete was delivered into the molds steaming hot, and the molds were kept sufficiently warm by means of special heaters. As one floor was molded every week, care had to be taken to avoid excessive strains in the green concrete, and five successively completed floors were kept shored during the greater part of the time. The exterior surfaces of the building consist of white Portland cement and colored aggregates, including quartz, felspar and green stone chips, the lowest stories being finished by bush hammering and the sixteen upper stories by the aid of an electrically driven carborundum grinding machine. The general effect of the surface treatment is said to be excellent.

Table 13 — Permissible Unit Stresses for Mild Steel Columns in accordance with formula

$$p = \frac{12000}{1 + \frac{1}{18000}\left(\frac{l}{r}\right)^2}$$

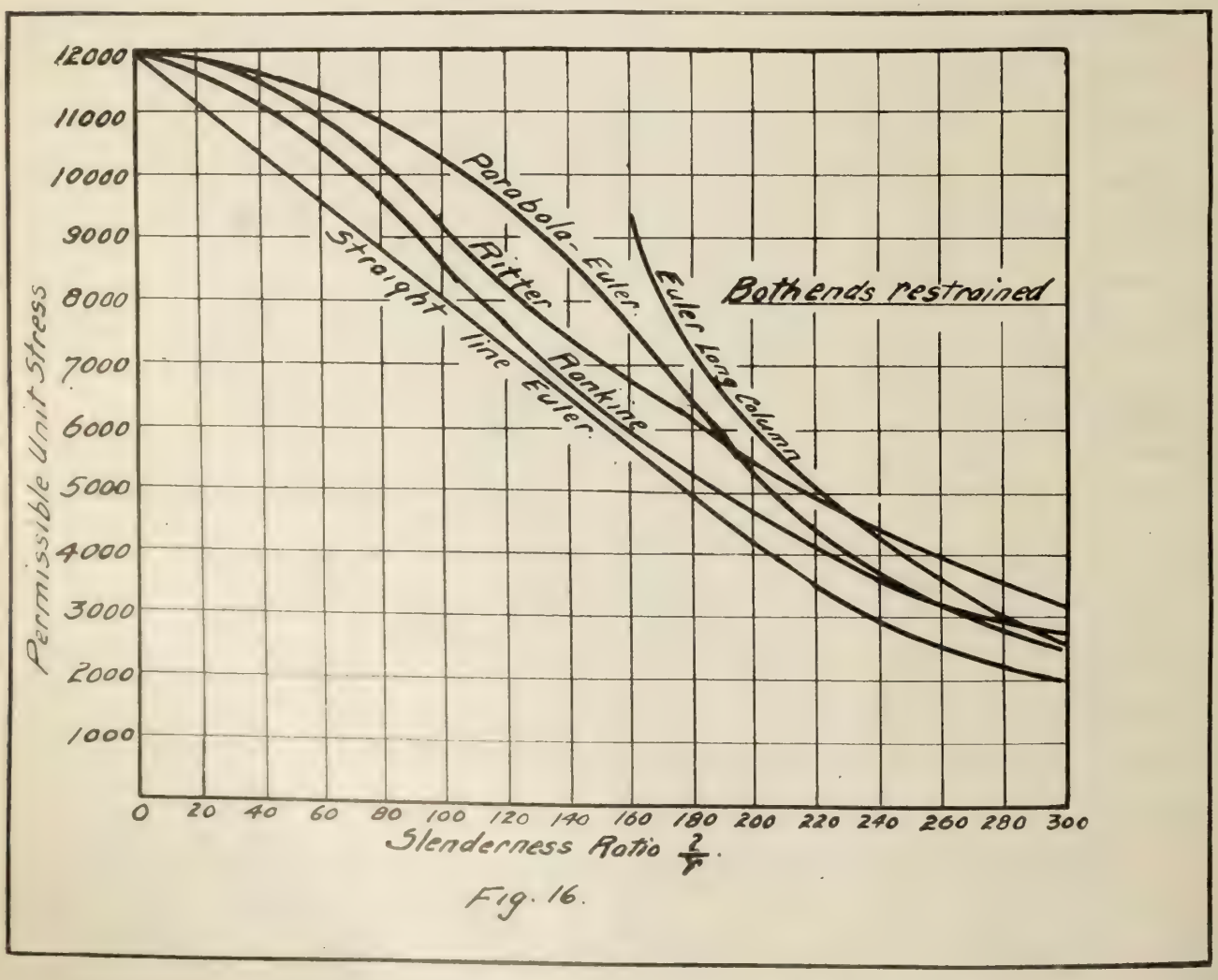


Fig. 16.



WELDING AND CUTTING



Learning To Weld—Some Points For Beginners

Treatment Must Be Varied, Depending Upon Material, if Best Results Are to Be Obtained—Tool Steel Welding—Steel Melting Range Table—Critical Temperature of Iron and Steel, Etc.

IN THE previous matter discussed, the principles of welding practice have been taken up which apply in general to all metal welding but inasmuch as the characteristics of cast iron, wrought iron, steel, aluminum, brass, copper, monel and other commercial metals and alloys differ widely it is necessary to vary the treatment and methods to secure the best results.

Common sheet and structural steels made by the Bessemer and open-hearth processes are readily welded with the oxy-acetylene torch. The carbon content is generally low, ranging from 0.10 or less to 0.25 per cent. (from about one part to two-and-one-half parts in a thousand). These grades of steel 1-8 inch or thinner may be welded without preparation or the use of welding rods. The joint will be somewhat thinner than the adjacent metal, however, and if the same thickness is required a 1-16 inch welding wire should be used to fill the joint. Steel much thicker than 1-8 inch may be beveled or chamfered to form a vee of about 90 degrees in the joint. Welding rod must be used with all prepared joints to fill the groove.

A principle to be observed in all welding applies to steel when using welding rod, which is, never add welding rod until the edges of the metal to be welded are fused, and a puddle of molten metal lies in the vee. Another principle to be observed in all welding is never to direct the flame upon the welding rod to melt it. The flame should be directed against the joint to form a puddle of molten metal and the welding rod should be melted by the heat of the puddle and the radiation from the flame. If the welding rod is held directly beneath the torch flame two evils may result, the first being oxidization of the welding metal and the second adhesion. The weld metal will be plastered onto the comparatively cold metal beneath which, not having been properly fused, will not cohere. By always forming a puddle in the joint vee and adding to it from the welding rod, using the heat of the puddle to melt the rod, the welder is reasonably sure of securing penetration and cohesion.

When welding thin gauge steel without beveling, the weld should be started at the right and proceed toward the left (for right-hand operators). The flame envelope preheats the metal in front of the weld, and there is less danger of overheating the thin metal than if welding proceeded from left to right. Moreover, greater speed will result.

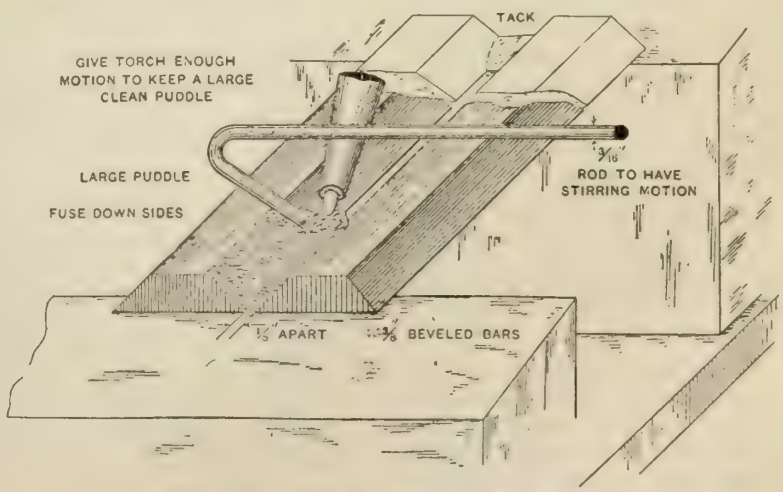
When welding prepared joints in metal 1-4 inch or more in thickness the welder should start at the left and proceed to the right. The reason for the difference in the direction of welding is that more heat is absorbed by radiation to the cold metal adjacent the weld and it is necessary to apply the flame in the way that will concentrate the white bulb or cone most effectively. When welding a prepared joint from left to right the torch head is held at a slight angle in the direction of the joint, and this naturally throws the flame squarely against the declivity of the material filling the joint.

In no case should the flame be held in one spot until a foam is produced as this is an indication that the steel is being oxidized or burned. Foaming is evidence of improper torch manipulation or that too large a tip is being used for the thickness of the metal.

The welding rod held in the left hand is applied by dipping the end in the puddle. It is general practice to bend the rods to a right angle five or six inches from the end as it is then more convenient for the operator to hold the rod than if left straight. Bending the rod is done quickly by simply playing the torch glame on the rod for a moment and then jamming the end against anything solid to bend it around.

The use of flux on low carbon steel is not necessary. The oxides melt at temperatures close to those required to melt steel, and float on top of the molten metal where they usually give little or no trouble in the joint provided a proper fusing temperature is constantly maintained in the zone of welding.

When welding thin metal strips it is necessary to provide for expansion and contraction stresses in order to avoid



Welding Beveled Joint using Bent Welding Rod.

*From a book entitled Welding and Cutting, published by the Davis-Bournonville Co., Jersey City, N.J.

distortion. The heat tends to throw the edges apart and out of parallel in the opposite way. Unless provision is made to counteract this action the welder will have trouble on long seams as the contraction of the cooling weld will cause the edges in advance of the weld to overlap and make it impossible to proceed. The rule is to set the edges out of parallel about 1-4 to 1-2 inch to the foot. When welding long seams in tanks it is customary to use a separating piece, usually a wedge, or steel piece, shaped like the letter H. The dimensions of the separator depend upon the size and thickness welded. The piece should be set between the edges, and kept in advance of the weld from six inches to a foot or more.

When welding a crack in the middle of a heavy steel plate prepare for welding by chamfering the metal at an angle of 45 degrees to within 1-8 inch of the bottom. Pre-heat the plate beyond the crack at each end until it expands sufficiently to open the crack, an amount that will depend somewhat on the thickness of the plate, usually about 1-32 inch. Then proceed to make the weld and having made it, cover the plate with asbestos sheet and let cool down uniformly.

If the attempt were made to weld a crack in the middle of the plate without preheating, the edges of the plate would buckle under the welding torch or the crack would be extended beyond its original limits. Even if buckling or expansion stresses were not so severe as to interfere with welding the weld would be under severe tensile stress when finished and likely to break in service.

The welder should learn to judge the quality of steel presented to him for welding and be governed accordingly in the selection of welding rod. As previously stated, the common steels of commerce contain low percentages of carbon and are easily welded. But machine steel and some steel castings may contain in excess of 0.25 carbon in which case there may be trouble in welding when using the grade of welding rod recommended for low carbon steel. A test of steel that can be readily made in the machine shop is to apply a piece to the emery wheel and note the sparks. Low grade steels throw comparatively few sparks when ground but the high carbon content steels spark excessively, the sparks exploding in mid-air with characteristic formation which once seen will not be forgotten. High carbon steels up to say 0.50 per cent. carbon including steel castings, steel rails and other track metal may be welded successfully with nickel welding rods.

Tool Steel Welding

Tool steel welding may be accomplished with nickel steel or vanadium steel welding rods but in general the welding of tool steel is not recommended for tool purposes unless it be simply to attach a tool steel bit to a low carbon steel shank or holder. A welded joint in tool steel is generally worthless for cutting purposes as the nature of the weld is necessarily quite different from the tool steel. In other words, it will not harden well and hold a cutting edge satisfactorily.

Alloy steels such as are used in the construction of motor cars, motor trucks and other high-grade machinery may be successfully welded with vanadium steel rods; unless the joint is subsequently heat-treated such work should be avoided, however. No welder who knows his business would weld a motor car axle and put it into service without appropriate heat treatment. While he might be able to make a perfect weld the job no doubt would fail in service because the metal in the weld and that adjacent no longer have the high physical properties which enable the axle as a whole to long withstand the shocks of road service. A welded motor car part is allowable only when it has gone through heat treatment which restores the part to the physical condition of the new part when leaving the factory.

Steel Melting Range Table

The Bureau of Standards, Washington, D. C., has made melting point determinations upon commercial low and high carbon steels with the following results. The melting range of the steels with the high carbon content is not well defined and the results given are accurate within 10 degrees C, or 18 degrees F. for the upper and lower limits.

Melting Points of Steel Oxides

The melting points of the oxides of these steels should be practically the same as the melting point of the oxide formed from pure iron. The composition of iron oxide varies from mixtures rich in FeO and poor in Fe_2O_3 to those rich in Fe_2O_3 and poor in FeO. The oxide produced by heating a steel bar in air is composed largely in Fe_3O_4. The melting point of this oxide is about 2800 degrees F.

Black Oxide	FeO	1419C.	2586F.
Red Oxide	Fe_2O_3	1548C.	2818F.
Black Oxide	Fe_3O_4	1538C.	2800F.

Critical Temperature of Iron and Steel

Mild steel used for boiler plates is seriously injured if worked at a so-called black heat which roughly has a temperature range of 650 to 800 degrees F. This range of temperature is known as the critical range, and steel should not be bent, rolled, punched or worked in any manner while within these temperature limits. The metal must either be cooled to a lower temperature or raised to a higher temperature if damage would be avoided. The critical range of pure iron is higher, ranging from about 1475 to 1830 F. Inasmuch as welded joints are composed of nearly pure iron the welder should avoid bending or otherwise working an oxy-acetylene welded joint at a temperature above cherry red and below a lemon in the heat color scale. If a mild steel plate with welded joint must be worked hot it should be heated to a medium cherry or full cherry red or to a much higher temperature like yellow. On account of the difficulty of judging temperatures from colors and the unevenness of heat distribution in a plate it is generally better to work welded mild steel cold if the conditions and means available will permit.

Welding Shafts

A broken shaft is prepared for welding by beveling the ends, chisel fashion, to an included angle of about 90 degrees, leaving the ends blunt in order that the parts may be accurately lined up. They should be held in veeblocks and adjusted for height and lateral position as closely as possible.

When starting to weld, the broken ends are fused together, breaking down the beveled parts above to fill in. When

Continued on page 66

MELTING RANGE TABLE

Carbon	Sulphur and Phosphorous Each	Manganese	Melting Range Deg. C	Melting Range Deg. F.
0.05	0.04	0.30-0.60	1465-1520	2669-2768
0.10	0.04	0.30-0.60	1430-1515	2606-2769
0.15	0.04	0.30-0.60	1405-1510	2561-2750
0.20	0.04	0.50-0.80	1380-1500	2516-2732
0.25	0.04	0.50-0.80	1360-1495	2480-2723
0.30	0.04	0.50-0.80	1345-1490	2453-2714
0.35	0.04	0.50-0.80	1330-1480	2426-2696
0.40	0.04	0.50-0.80	1315-1475	2399-2687
0.45	0.04	0.50-0.80	1300-1470	1372-2678
0.50	0.04	0.50-0.80	1285-1460	2345-2660
0.55	0.04	0.50-0.80	1275-1455	2327-2651
0.60	0.04	0.25-0.50	1265-1450	2309-2642
0.65	0.04	0.25-0.50	1255-1445	2291-2633
0.70	0.04	0.25-0.50	1245-1435	2273-2615
0.75	0.04	0.25-0.50	1235-1430	2255-2606
0.80	0.04	0.25-0.50	1225-1425	2237-2597
0.85	0.04	0.25-0.50	1215-1420	2219-2588
0.90	0.04	0.25-0.50	1210-1410	2210-2570
0.95	0.04	0.25-0.50	1200-1405	2192-2561

How to Make Use of Logarithms

The First of a Series of Articles Showing How to Learn the Use of This Method of Shortening Long Calculations. It Will be Continued in Consecutive Issues.

By T H. Fenner

NOW that the Ontario Board of Stationary Engineers allows the use of logarithms in making calculations, there are many engineers who would like to avail themselves of the help that logarithms afford. In making calculations involving long multiplication sums, the work is very much shortened, and a much greater degree of accuracy made probable, owing to the lessening of the liability of error in handling large quantities of figures.

A logarithm, usually called by the abbreviation log, is really a power to which a certain fixed number must be raised in order to produce the number required. The fixed number is known as the base, and may be any number at all, but in the system in general use, known as common logarithms, the base is 10. That is, to obtain any number at all, the base of 10 must be raised to a certain power, which may be a whole number and a fraction, or simply a fraction. Before studying the subject of logarithms, it would be well to study a little the theory of indices, which will enable the student to better comprehend the system on which logarithms are calculated.

Supposing we have a number which is to be raised to the power of two, or in other words squared. That is, the number is to be multiplied by itself. If we set this down in the ordinary way, it will appear, supposing the number is 2, as 2 x 2, which is 4. Now the first power of 2 is 2, and the second power of 2 is 4. Thus we may say that 2 to the first power, multiplied by 2 to the first power, is 4. Now suppose we take a letter instead of a number, and say a is to be multiplied by a. The product will be a^2. Now, how do we get the second power? We get it by adding together the index figures of the power of the multiplier and multiplicand. Although we do not put in the index figure, which is 1, we imagine it is there, and our sum would appear as:

$$\begin{array}{r} a^1 \\ a^1 \\ \hline a^2 \end{array}$$

Now, if we have, instead of a x a, we have $a^2 \times a^2$ the result would be a^4. Thus we should have $a^1 \times a^1 \times a^1 \times a^1$ which would give a result of a^4. Now if we have $a^2 \times a^3$ the result would be a^5 and if we have $a^2 \times a^4$ we should have a^6.

For instance, the first case would be a x a x a x a, and the second case would be a x a x a x a x a x a. Now let us substitute instead of letters, figures. Suppose we have 2 x 2, the result will not be 4, but 2. The sum would be

$$(2 \times 2) \times (2 \times 2 \times 2)$$
$$= 4 \times 8$$
$$= 32$$

Now, if we multiplied the figures and added the indexes, we would get $2^2 \times 2^3 = 4^5$ which would be entirely wrong. However, we see that if we wanted the power to which the number two would have to be raised to give 32, it would be 2^5.

This leads to the rule, that when a literary quantity, that is a letter, is multiplied with another letter, the indexes must be added together to give the index of the quotient. Now if you have a quantity like $2a^2$ multiplied by $2a^2$, the answer would be $4a^4$. That is the index of the letters would be added together, but the numbers would be multiplied in the ordinary way. Supposing now that the quantity was enclosed in a bracket, thus (2a), with the index outside the bracket, then this would mean that the whole quantity in the bracket would have to be raised to the 2nd power, and the answer would be 4a. Now if we had two of these quantities enclosed in brackets with the multiplication sign between them thus, (2a) x (2a) the answer would be 4a 4a.

This is arrived at as follows:—Take the first bracket, we have as a result $4a^2$, and this has to be multiplied by $4a^2$. 4 x 4 is 16, and $a^2 \times a^2$ is a^4, and the sum would appear in detail like this

$$(2 \times 2 \times a \times a) \times (2 \times 2 \times a \times a)$$
$$(4 \times a^2) \times (4 \times a^2)$$
$$16 \times a^4$$

and as 16 to 4^2 the answer would be 4^2a^4. Now if we were to take the figure 2 as the base of a series of logarithms from which we could determine any number by merely raising it to certain powers, we would find that these powers would be largely fractional. Thus if 2^2 were 4, and 2^3 were 8, then 2^4 would be 16. Now suppose we wished to find a number that lay between 8 and 16, it is evident that the power to which we would have to raise 2 would be a power lying somewhere between the 3rd power and the 4th power. The power required would be 3 and some fraction. Now if we were to denote our base 2 by a letter, say a, then to get the number required we should have to multiply the letter a by itself, and add the index of its first power plus a certain fraction together to get the number required. Thus if we wanted the third power of a, we should have $a^2 \times a$ which would give us a^3, and if we wanted the fourth power of a we should have $a^2 \times a^2$. If we want a power between the third and fourth power we should have to multiply a x a, each raised to a power of one and a fraction. Thus if we wanted a number corresponding to the 3½ power of two, we should have $a^{1.75} \times a^{1.75}$, which would give $a^{3.5}$ and the base raised to this power would be the number required. Now the common system of logarithms is a series of powers to which the fixed number or base must be raised to give any number required, only the base on which these powers are calculated is 10, and not 2 as we have stated. As the base is a fixed number, in the tables of logarithms it is not given, all that is given being the index of the power corresponding to the number. Now we have seen that when we multiply we are adding together the indices, it follows that if we know the indices corresponding to any number, and want to multiply, all we have to do is to add the indices of the two numbers together, and we shall get an index corresponding to a number which will be the product of these two numbers. Similarly, if we wish to divide, we shall have to subtract these two indices, to get an index which will be the index of the quotient of these two numbers. That is the theory on which the logarithmic table is based.

Base of Common Logs

Now the base that is used for the common system of logarithms is 10. The logarithm of 1, no matter what system is used will be nothing, for it is quite evident there can be no two indexes which added together would give an index corresponding to 1. If the base of the logarithm is 10, the logarithm of 10 will be 1, that is the index of the power to which it would have to be raised to give itself would be 1 or 10 x 1. Now the logarithms of all numbers between 1 and 10 must be fractional quantities, for the log of 1 is nothing, and the log of 10 is 1. The log of any number between 10 and 100 will be 1 and a fraction, because the log of 100 is 2, that is the power that 10 must be raised to in order to give 100 as the second power. Between 100 and 1000 the log of any number will be 2 and a fraction, because the power to which 10 must be raised in order to give 1000 is three, thus 10 x 10 x 10=1000. So we get for each multiple of 10 an increase of 1 in the index figure, that is in the integral number, not in the fraction. That varies with each number. We can now proceed to define a little closer just what a logarithm consists of.

Characteristic and Mantissa

We have said that every logarithm consists of either a fraction or a whole number and a fraction, or a whole number. The integral part, or the whole number of a logarithm, is called the characteristic of the log, while the fractional part is called the mantissa. Thus the log of 10 would consist of a characteristic, while the mantissa would be .0000000. The log of 1 would be .0000000, while the log of 100 would be 2.0000000. It is usual to carry the fig-

ures of the mantissae to seven places of decimals, in the interests of accuracy, but in many tables they are carried only to four places. From what has gone previously, it will be seen that there is a very simple rule by which the characteristic of the log of any number can be determined. The characteristic will always be one less than the number of figures in the number whose log is required, or in the number of figures into the left of the decimal point where there is a decimal fraction as well as a whole number.

When the number whose log is required is between 1 and 10, there will be no characteristic, the log consisting of a mantissa only. When the number whose log is required is a decimal number, then the characteristic will be a negative quantity. Thus the log of 20 is

1.30103

the log of 2 is

.30103

and the log of .2

$\bar{1}$.30103

The minus sign is written above the characteristic instead of preceding it as is usual in the ordinary way.

When the figure immediately following the decimal point in the number whose logarithm is required, that is of course a fractional number, such as .02, the characteristic of the logarithm will be —2 and the log would be written

$\bar{2}$.30103

and the log of .002 would be

$\bar{3}$.30103

and so on, every cipher following the decimal point adding one to the characteristic of the log, which is always a negative quantity.

In the ordinary tables of logs, the characteristic is not given, the mantissa alone being shown, and the decimal point omitted. This simplifies the table, and there is no chance of going astray on the right characteristic, if the rule is clearly remembered. That is the characteristic of the log of a whole number and fraction, or a whole number is always one less than the number of figures to the left of the decimal point in the number, and the characteristic of the log of a fractional quantity is always a minus quantity, beginning at minus 1 when an integral figure follows the decimal point, and adding one for each cipher that follows the decimal point, and adding one for each cipher that follows the decimal point before an integral figure is reached.

We will follow up this article with further ones in which examples of the working of logarithms are given, and the method of reading the table shown. If every engineer was aware of the help it would be to him to be able to calculate by this method, he would devote a little energy to learning it. A little practice is all that is required to enable any man to become quite familiar with the method, and further more there are some calculations that cannot be made very well without the use of logarithms. Take for instance the formula for finding the mean absolute pressure when the initial pressure, initial volume and final volume are known, which is as follows:

$$Pm = p^1 \frac{1 + \log_e R}{R}$$

where Pm = Mean abs Pressure

p^1 = Initial abs Pressure

m R = Ratio of expansion ($v_2 \div v$)

(To be continued)

UNIQUE ELECTRIC TRAVELING CRANE

When the first electric traveling crane was built, the builder in all probability did not realize the tremendous possibilities that were opened up for a material-handling appliance of this nature as a labor saving device, and the economical advantages which were to be gained by its use. The diversity of applications of the electric traveling crane and the variety of materials which it will handle to advantage are too numerous to mention here.

One unique application may be seen at the Power Plant of the Union Gas and Electric Company at Cincinnati, Ohio. This crane which was built by the Whiting Corporation, Harvey, Ill. according to specifications issued by Sargent and Lundy of Chicago, who were the Engineers on this work, served as a dredge for an intake well of river water for cooling turbo-generator condensers.

Water is supplied from the Ohio River to the intake well through tunnels and is first cleared of water-logged debris and silt by means of a heavy bar iron grill before reaching the traveling screens behind. This debris and silt is removed from the bottom of the well by means of a grab bucket operated by the crane, and deposited into a hopper. This grab bucket is often called upon to remove heavy water-logged objects such as tree trunks, and it may incidentally be mentioned that on one occasion it brought up a dead cow, very much bloated, from the bottom of the well.

The shape of the intake well is that of a sector of a circle. The crane spans the well radially, having one end truck pivoted at the center of the circle (rotating on a roller bearing at this point), its other end truck traveling on a circular track at the outside edge of the well. This truck is fastened directly to the floor at this level, and a pipe railing is provided around the crane and the operating mechanism of the traveling screens as a safety measure. The crane trolley with its suspended bucket travels along the entire length of the crane bridge or as far in towards the center of the circle as efficient operation of the bucket will permit. The operator's cab is fastened to this trolley extending above the top of the bridge girders and in such a manner as to give the operator an unobstructed view of the bucket and well.

The span of the crane is 49 ft. 10 in., and the trolley is designed for a lift of 100 ft. of the grab bucket which is of ¾ cu. yd. capacity. Two motors of 7½ H. P. each operate the bridge and trolley travel respectively, and two 45 H. P. motors operate the bucket hoist, each one of these motors being equipped with an electric brake.

NEW FORMULA

The Du Pont Company has developed and perfected a formula for the manufacture of straight dynamite which results in that explosive being proof against freezing even in zero temperatures. As a consequence of this development, they have determined to discontinue the manufacture of their former straight dynamite and hereafter all this kind of explosive will be made by the new low-freezing method.



Combined Electric Crane and Dredge.



WHAT OUR READERS THINK AND DO



DRILLING CROSS HOLES IN TUBING

By DONALD A. HAMPSON

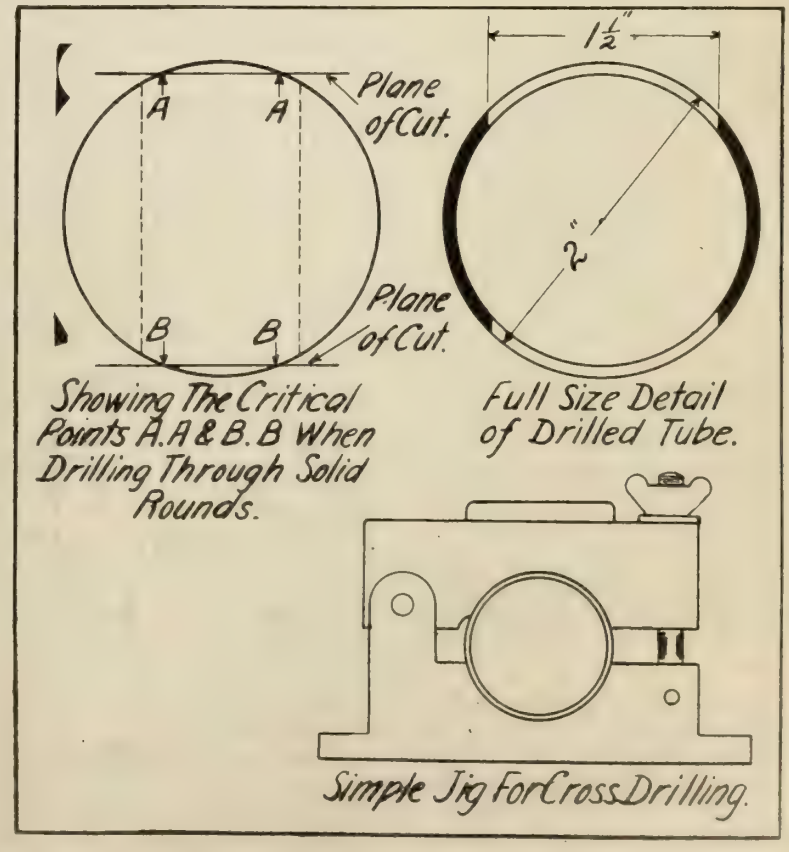
Everyone familiar with shop practices knows what a mean sort of job it is to drill holes through round bars at right angles to the axis. Starting the drill point on the crown of the piece, intermittent cutting until the drill gets in to full diameter, and (worst) breaking out at the under side with another intermittent cut with the curve of the work nearly approaching the angle of the drill—these are the features of difficulty and they increase as the diameter of the drill nears that of the round bar. End play in the drill spindle greatly aggravates the troubles. On manufacturing work, the use of jigs and the general better physical condition of the machine tool help to some extent but they do not alter the conditions resulting from drilling on and off the rounded surface.

Bearing the above facts in mind, one can readily picture the troubles in store for anyone who has to drill through tubing. Added to the peculiarities of the solid bar, we have those due to two cuts through the inside wall, one of which—the upper cut, entering the concave surface—is the most vexatious of all. The thin wall of the tube, the drill point angle, the drill twist angle, and the nature of the cut (on and off both an inside and an outside inclined face in less than half a revolution) all conspire to try the mettle of drill, machine, and workman.

Manufacturers of beds, hospital furniture, and similar equipment have some drilling problems of their own. The materials used are of low grade, well adapted for the class of work but hard to machine. The angles and other shapes used are of re-rolled stock, generally old rails worked over. The tubing used is often re-rolled from defective plates and is fire-welded along a longitudinal seam the same as pipe is made, though without the same care, as the finished piece does not have to stand any water test and surface imperfections are later hidden beneath coats of white enamel. The tubing arrives on the floor with all the scale intact.

This grade of material is best machined by press work. Of course punches are susceptible to impurities and hard spots but not to the extent of ordinary cutting tools. A drill, in passing through part of an old rail, will encounter hard spots that would not phase a punch and die; and the same is true of the tubing. And there is a large amount of drilling that has to be done in such plants in getting out small orders, samples, and experimental work.

One of those sample jobs involved the drilling of several hundred 1½ in. holes through 2in. tubing of 12 gage. Put up to drill makers to supply proper tools for the job, they all insisted that an end mill was the only tool that would work successfully. The plant didn't possess a milling machine and the kind of work a milling machine does in the average drill press is well known. While waiting for further advices, the engineer did some experimenting to such an end that no tools outside of regular equipment were needed. A jig was made from two castings as shown. This was bolted to the table of a 20 inch upright drill and various forms of tools tried, guiding them through a hard steel bushing. An 1½ inch carbon steel drill was ground with various cutting and clearance rake angles, the best of which proved to be an included angle at the point of 155 degrees with very little clearance and with a rake left just as the spiral of the twist. This almost flat pointed drill was run at a speed of 45 H. P. M. A stream of lubricant was supplied. It was necessary to change the belt drive so that the speed given could be obtained through the back gears because more power was required than could be realized through the open belt. Clean, round holes were obtained in this manner without injury to the tubing and at a satisfactory production rate. The workman turned out 115 holes in a ten hour day on this job, working by the hour, and this included the handling of tubes in eight foot sections.



Showing Detail of Jig Used for Drilling Steel Tubing.



DEVELOPMENTS IN SHOP EQUIPMENT



SMALL ELECTRIC GRINDER

Forbes and Myers of Worcester Mass., have put on the market a small electric grinder head adapted to either bench or pedestal mounting. Model No. 42 is driven by a ¼ h.p. motor and is equipped with two 6" by ½" wheels. Model No. 62 is driven by a ½ h.p. motor and is equipped with two 6" by 1" wheels. The grinding wheels are mounted at each end of the motor housing. Straight, round, or bevel faced wheels can be used.

HARDNESS TESTING MACHINE

Riehle Bros. Testing Machine Co. of Philadelphia, Pa., have designed and developed a hardness testing machine which is a combination of the Brinell and scleroscope methods. It was designed primarily for the use of the Association of manufacturers of chilled car wheels who were making a study of the hardness and comparative wearing and breaking qualities of chilled wheels. The machine enables both the Brinell and the scleroscope tests to be made on the same spot.

HIGH SPEED GRINDER

The Onsrud Machine Works Inc., of Chicago, Ill., have produced a high speed grinder operated by compressed air at a pressure of from 70 to 100 pounds. The complete unit weighs only 5½ pounds and is intended for small grinding wheels. Provision is made for attaching the unit to standard machine tools. It, of course, can be held in the hand and operated as a portable grinder

SPRING TOOL HOLDER

The Willard Tool Co., Inc., of Stratford, Conn., have designed and offer for sale a spring tool holder of the gooseneck type made of drop forged steel and hardened to a spring temper. This holder is made in several types and sizes and is so designed that the tool will yield or recede in a practically straight line from the work, without causing chatter marks or breakage when taking a heavy cut.

VARIED PURPOSE MACHINE

The Sawyer-Weber Tool Manufacturing Co., of Los Angeles, Cal., have placed on the market a machine for performing several varied operations on connecting rods. The frame of the machine consists of a face plate on which may be located clamps, V-blocks, boring tools and other equipment such as is required in babbitting connecting rods, straightening the rod, and boring the bearing to size.

SMALL WORK BENCH

A rather small work bench designed for use in garages and by mechanics in their homes has been placed on the market by Pollard Bros., 4034-4036 N. Tripp Ave., Chicago, Ill. The top is made of selected Norway pine. The legs are one and one-quarter inch angle iron. Each pair is joined by three cross braces welded together. The legs are punched and arranged so that they can be bolted to the floor. There are two stringers of three-inch flat steel bars bolted to the legs which is said to eliminate side or end sway. A large drawer is provided, twenty-three and one-half inches wide, fifteen and one-half inches front to back, five inches deep. The top of the table is thirty-three inches above the floor, forty-four inches long and sixteen inches wide. A semi-steel machinist's vise with three-inch jaws opening four inches, is mounted on the bench. The weight is sixty-five pounds.

PORTABLE CYLINDER REBORING MACHINE

The Bridgeport Cutter Works of Bridgeport, Conn. have recently completed a portable cylinder refinishing machine for reboring and refinishing cylinders of automotive vehicles. It is electrically driven from any lighting circuit. The machine consists of a sliding head on a guiding way that is mounted on top of a cylinder block by means of suitable brackets. Special provisions are made for the locating of the guiding way over the centre line of the cylinders, and also for the locating of the head over the centre of the cylinder to be refinished.

The boring bar is driven at slow speed through reduction gearing. A geared power feed of 1/32" per revolution is provided. However the power feed can be released and a hand feed can be used when required.

The cutters used are of the herringbone staggered type. There are two distinct cutters on the arbor. These cutters both have spiral flutes. The lower cutter, being the rougher, has a right hand spiral so that it will bite into the glazed surface likely to occur in the bore. The upper cutter is the finisher and has a left hand spiral, the teeth of the two cutters being staggered. The finishing cutter is slightly larger in diameter than the rougher and acts as a guide or pilot for it. Cutters can be finished for practically any make of car and in standard oversizes of ten, fifteen, and twenty one-thousandths. The sizes vary from 2¾" to 4". Larger cutters, as they become worn, can be ground down to smaller sizes.

Cylinders with removable heads can often be refinished without removing from the car it is stated. But in the case of cylinders with solid heads, the block must be removed from the car. The makers claim that straight holes, true to size, are possible and that the cost of upkeep is small. The finish is said to compare very favorably with that of grinding.

BALANCING MACHINE

The Precision Balancing Machine Co., of Minneapolis, Minn., have developed a highly scientific balancing machine of the precision type. The machine, it is claimed, applies the principle of dynamic and static balancing invented by B. L. Newkirk. It enables complete static and dynamic balance to be obtained by two single corrections, individually measured and located near the ends of the body. The determinations, it is claimed, can be correctly made by operators, irrespective of their skill, and with great speed, the machine thus lending itself to interchangeable work manufactured on a production basis.

A spring mounted and pivoted frame carries a special type of headstock, and adjustable rollers to support the work. By the form and location of the springs a free vertical vibration of the free right hand end of the frame may take place about the pivot springs as a fulcrum point. All revolving parts of the machine are mounted on roller bearings. A speed of rotation above the "critical speed" of the frame is first used, the driving power is then disengaged, permitting the gradual reduction in speed down to and through the critical speed" of the frame. At the point of critical speed there occurs the maximum vibration and it is proportional to correction required in the overhanging end of the work, irrespective of any unbalance having a resultant in the place of the pivots. From an observation on the dial indicator mounted on the column at the left the amount of the required correction is determined.

A disc carries a standardized 10 oz. weight which is adjustable radially by means of a vernier to .01 of an inch. This disc is exactly balanced when the weight is at zero. The disc is adjustable to any angle, with reference to a protractor dial, which engages the other revloving parts by means of a jaw clutch. This permits adjustments to be made without first bringing the work to rest. With a correction thus made the system is again speeded up and allowed to pass through the critical speed as before. The second amplitude bears a relation to the first amplitude dependent on the angle between the point of ap-

plication and the point required. After determining and setting of the angle a third run will check the result. For determining the corrections proportionate to amplitudes, taking ratios, and ascertaining angles a special calculating rule requiring but two settings is installed at the top of the instrument column.

After completing the first determination, the work is reversed in position and the correction determined for the plan initially over the pivots, thus completing the operation. As critical speeds of from 100 to 110 r.p.m. are said to give the best results the machine can be manipulated by hand or by an electric motor. The low speeds used permit visual observations of the amplitudes and prevent distortion of the work from centrifugal forces.

The machine is adapted to a wide variety of work including the balancing of automotive crankshafts, flywheels and all parts readily mounted on arbors. It can take care of pieces up to 24" swing and take 32" between bearings and is sensitive enough to give extremely accurate results on small and light work.

NEW STEEL FOR DRILLS

A new form of steel has been developed by the Cleveland Twist Drill Co., Cleveland, Ohio. This steel is to be used in the manufacture of their drills, and such drills are to be known under the trade name of "Mezzo." Speaking on the new steel, the Cleveland Co. say that it possesses some very unusual qualities, and that these are the result of a special heat treatment. The word "Mezzo" is intended to convey the meaning, midway between carbon and high speed steel. Drills made from this material are said to be well adapted for drilling cast iron at greater speeds and feeds than can be used for carbon drills. They will also speed up work on machine steels and the softer alloy steels, but are not recommended for use in extremely hard materials. These drills should be operated at approximately double the speed of carbon drills. They are not intended to supersede high speed drills, but rather to furnish a type midway between the two extremes.

SPIRAL BEVEL GEAR PLANES

A true spiral bevel gear planer has been developed by Messrs. Smith & Coventry, Ltd., Gresley Iron Works, Manchester, England. This gear planer has been so constructed that the time of setting up has been reduced to a minimum. The adjustments are few and simple, and in practice is said to take no more time than the set up of an ordinary gear planer. The spiral adjustments are taken care of by gear trains, in a way very similar to that employed on a screw cutting lathe. Thus the spiral on gear and pinions must agree. The true spiral gear always causes less end thrust than a spiral of arbitrary curvature. The gears of arbitrary spiral curvature present some difficulties in the machining which are not present in the S. & C. gear planer method of producing true spiral gears, and it is claimed that the machine can be set up to profitably cut one pair of gears. The machine belt is driven through a three step cone. It is known as No. 16, will cut spiral bevels up to a limiting blank diameter of 17", and will cut up to a ratio of 6 to 1. It will produce teeth having spiral angles up to 35 degrees, which is sufficient to cover the full pitch of wheels whose face is twice the circular pitch at the large end. It deals with gears up to 3" face. The three step belt cone connects to the cutter slides by an improved "quick-return" mechanism, specially designed to give a slowing down towards the end of the cutting stroke, in order to reduce the "breaking out" which occurs at high speed cutting, especially in cast iron blanks.

A grinding attachment is supplied with the machine and can be fitted to any cutter grinder taking a cupped wheel. With this attachment the grinding of cutters is made easy. A simple system of gauges for setting the tools is supplied with the machine. Twenty-one dividing plates are supplied, dividing all numbers up to 50 and many others up to 120, and also full set of change gears for dealing with all the numbers covered by the dividing plates. Spanners, charts, and operating instructions form part of the regular equipment.

TRACK TORPEDO

The old type of track torpedo which has served its very useful purpose for many years, has been officially superseded by a torpedo of radically new design, on all lines of the Canadian Pacific Railway. This new type is called the "Meteor." A more reliable method of attaching this torpedo to the tracks, than the soft metal bands, is used. It is fastened by means of two spring rail clips made of tempered steel or spring brass, this gripping the rail head firmly, and at the same time being promptly applied. Furthermore, assurance has been made trebly sure. The new torpedo appeals to three senses instead of one, not only hearing, but seeing and smelling. It not only produces a loud report on detonation, but simultaneously a brillant flash and pungent smell.

It is completely waterproof, will stand any atmospheric conditions of heat, moisture and frost. It has been subjected to one hundred hours immersion, and one hour in moist steam at 120 deg. Fahrt. without deterioration, and has been used where the temperature was many degrees below zero with complete success. Special tests have been carried out to ascert in its holding power when placed in position on the rail, and for flying particles likely to cause injury to bystanders. These have all been carried out with satisfactory results.

SELF-SETTING CLAMP

Chas. P. Archibald & Co., Montreal, have secured the agency for an English made self-setting lathe or planer clamp or dog. It is known to the trade as the AUTO-SET. This clamp is made from a steel forging and when used as a clamp can be instantly adjusted to any height range within the limits of its capacity. All surfaces are ground and the clamp comes fitted with a bolt. The bolt has a specially designed head and fits into a specially ground seat which allows all set-ups to be made without any angularity of the bolt. It may be mentioned that the clamp requires nothing in the form of a block when used. It is claimed that it is entirely free from slipping. Its strength is guaranteed, and it is guaranteed against breakage if the bolt supplied is used. It is made in seven sizes ranging in capacity for clamping work varying in thickness between three-eighths of an inch and two and three-quarter inches. Special sizes are made to special order.

DOUBLE SPINDLE GRINDER

The Chas. H. Bisley Co., Chicago, have recently placed on the market a direct-motor-driven double spindle ring wheel grinding machine. The machine is equipped with two 7½-horsepower alternating-current motors of a fully enclosed type. A push-button control is provided for stopping and starting the motors, the starters being attached directly to the motor frames. The motors are mounted on plates which slide on vees planed on top of the bed. This arrangement permits the motors to be moved longitudinally to accommodate different widths of work, the movements being accomplished by means of racks and pinions.

The principle of operation is of course to grind simultaneously both sides of a part parallel, either by dry or wet grinding and the machine can be equipped with different types of rests. A direct-connected motor-driven pump is attached to a leg of the machine directly under the water pan. The starting apparatus of this pump is also controlled by a push-button. The pressed-steel chucks with which the machine is equipped are intended for ring wheels 18 inches in diameter, with faces ranging from 1½ to 4½ inches in width, but 20-inch diameter disk wheels may also be used. The maximum distance between the ring wheels is 10 inches, and the height from the floor to the center of the spindles, 39 inches.

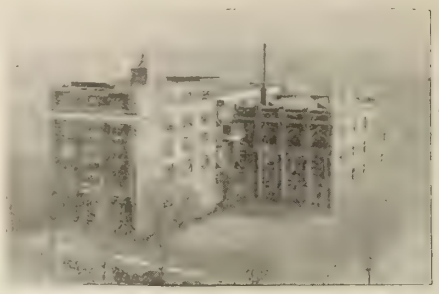
E. J. Codd Co., Baltimore, MD., have issued a small booklet which describes the Wiegand patent chain screen door as used for furnaces and ovens. The method of usage together with details of construction is given.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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B. G. NEWTON, Manager
J. H. MOORE, Editor
T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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There Is Always a Way Out

CANADIAN manufacturers are as resourceful as those of any other country. During the present depression in business many firms have branched out into new lines; products previously unthought of have been made, with the result that shops which otherwise would have been idle have been kept running.

Here is a case in point. A certain firm had been engaged in shipbuilding during the boom years. Modern machinery was installed, an up-to-date foundry was started, and a first class boiler shop put into operation. Some 1400 men were employed during the busy period. At the close of the war the demand for ships suddenly ceased, and the management were confronted with the problem of keeping the plant in operation.

After a short period of inaction, it was decided that some other lines of manufacture should be taken up. Expert engineers were sent throughout Canada and the United States expressly for the purpose of discovering good lines to handle. A conference was then held, and it was decided to manufacture three new lines: (1) A machine used extensively in mining operations—(2) certain lines of improved pulp mill machinery, and—(3) a line of heating boilers. Thus, foundry, machine shop, and boiler shop were provided with work. Each line has proved a decided success.

We do not suggest that every manufacturer faced with a shut down can adopt exactly the same course, but we do believe that in many cases a careful study of conditions would bring to light side lines, which if manufactured, would keep the plant in operation until normal times returned. The chief danger to avoid is the choice of some product that requires special tools and fixtures. Keep your existing equipment in mind when considering a new line. Ask yourself the pertinent question "Can I make this new product at a profit without tying up too much money in special tools?" If the answer to your own question is satisfactory, and you feel there is a market for the article after you make it, then you will have provided a "resourcefulness" tablet for another niche in the Canadian Manufacturer's Hall of Fame.

A Good Idea

There is a regulation affecting motor or horse drawn vehicles, that a red flag must be displayed at the back of any load that extends over the truck itself. Usually an old piece of bag or a dirty rag is tied on carelessly to the protruding load. This is very poor policy, and is not following the true meaning of the regulation.

The other morning a load of structural steel on a large motor truck moved down the street. Dangling from the rear end was a neatly painted board about 6 in. by 8 in. This was painted a brilliant red and was attached in a business like manner with a stout piece of wire. The arrangement allowed the danger sign to swing with the truck and it was constantly in motion. Here is an idea, that while not exactly new, is not used as often as it should be. Manufacturers should see that their shippers are supplied with such a sign, and that whenever a load extends over the edge of truck, that the sign be used. The word DANGER should be largely displayed. Thus both the public and manufacturer will be protected, for a pedestrian injured by a load not properly flagged could make it hot for the manufacturer who owned the truck.

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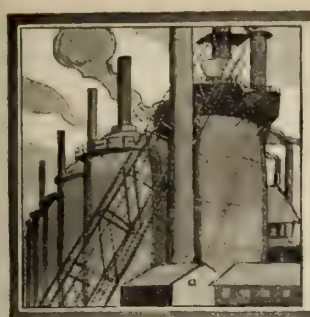
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MARKET DEVELOPMENTS



Steel Production Keeps Up With October Rate

Production of Steel Is Around Forty-Five Per Cent. Mark—Pipe Mills Show Highest Production Figures—Steel Market Prospects Brighter—Pig Iron Dull, Also Machine Tools

ALTHOUGH some people would have you believe the steel market has gone to the bow-wows, production figures give such a statement the lie. The present rate of steel production is approximately 45 per cent., this being one per cent. over the October rate, which was the highest since last February.

At the beginning of October, sheet mills showed the highest operating rate, but now the pipe mills hold top position with a rate of about 70 per cent. Tin mills are running at between 60 to 65 per cent., and while the operations at bar, shape, plate and rail mills are decidedly light, they have improved a trifle in the past few weeks.

Blue annealed sheets are selling at $2.25; black at $3.00, and galvanized at $4.00. Prospects are that these prices will hold. Prices on standard steel pipe and oil country goods are maintained by the steel corporation pipe subsidiary, but are being cut a trifle by nearly all the independents.

Steel market prospects generally are distinctly better than three or four weeks ago, and from present outlook it is unlikely that any material drop will occur in production this winter. This means that the Spring improvement will start at a correspondingly higher level. Pig iron continues dull, and coke prices are softer again.

Both Montreal and Toronto report business as dull. Outside of a very light activity in some lines, there is nothing of importance to mention. The only bright spot, so far as Montreal is concerned, is the order to build an ice-breaker for the Canadian Government.

Machine tools and the small tool market are also quiet. Montreal says that small tools are selling best of these two lines, but in Toronto's case, neither shows any decided activity.

STEEL PRODUCTION ABOUT THE SAME AS IN OCTOBER, 45 PER CENT.

PITTSBURGH, December 1st.—Despite the allegedly dull steel market in the past six weeks production is fully up to the rate in October, and of course the production is entirely against orders since the mills would not think of stocking any steel. It is a matter of comment in the trade now that there is quite a divergence between the tales that are told of the market being "dull" and the circumstantial evidence of the actual production. One point that helps to explain is that a few weeks ago, when mills were making a drive to fill up so that they could advance their prices, there was some business placed for delivery to the end of the year, and the mills are making shipment of such tonnage now while the buying does not count as present day business.

Rate of Production

The Steel Corporation has been operating at between 50 and 55 per cent in the past three weeks. Some independents are running at approximately this rate, while rates in other cases range down to 40 per cent.. and as for many months past a number of small independents are closed entirely. All told, the steel industry seems to be operating at fully 45 per cent of capacity, or within a couple of points either way of that figure. October showed an average operation of 44 per cent, the highest rate since last February.

At the beginning of October sheet mills showed the highest operating rate among finishing departments, wire mills and pipe mills coming next and being approximately on a level with each other. Since then sheet mill operations have fallen off very considerably while wire mill operations have fallen off a trifle, pipe mill operations have greatly increased, so that the pipe mills are well in the lead of other finishing branches. There has been consistent improvement in demand both for standard pipe and for oil country goods generally, while there has been very fair buying of line pipe. The pipe mills are operating at an average rate of 70 per cent or higher, while sheet mill operations fall somewhat below 70 per cent. and wire production is lighter still. Tin mills are running at between 60 and 65 per cent. Operations at bar, shape, plate and rail mills are decidedly light, but on the whole have improved a trifle in the past few weeks.

Last Friday the American Sheet & Tin Plate Company (Steel Corporation) opened its books for first quarter business in sheets, prices being 2.25c for blue annealed sheets, 3.00c for black sheets and 4.00c for galvanized sheets. Prospects are that these prices will hold and the market be stabilized. If the independents cut the prices the Steel Corporation wil experiment with lower and lower prices until it finds a schedule the independents do not cut. A week before the announcement was made that books were open for first quarter business some independents were quoting black sheets at 2.75c, possibly less in a few instances, and galvanized at 3.75c, but the extreme prices were withdrawn, presumably in fear that the corporation would name them for first quarter. The black and galvanized sheet prices are those reached by the advance in September, but the blue annealed is the old price, ruling prior to the September advance, which did not hold. It is needless to remark that the advance attempted in October by some independents, to 2.75c for blue annealed, 3.25c for black and 4.25c for galvanized, turned out a joke. If an advance of a reasonable amount had been attempted there is a bare possibility it would have succeeded.

Prices on standard steel pipe and oil country goods are maintained by Steel Corporation pipe subsidiary and are being cut a trifle by nearly all the independents, though perhaps no more deeply than a few weeks ago. The differ-

ence is not enough to draw trade away from the corporation. In line pipe the cutting is very deep, below the regular cost of production, but the mills taking business at the extreme prices probably count upon the increased operation reducing their costs in the aggregate, and thus making up in that manner.

Bars, shapes and plates are a shade easier each week, though there are no regularly quotable declines. There is merely a gradual softening. It at one time a certain price applies on a given tonnage a little while later a buyer can get the same price on a smaller tonnage, and so on. Plates can easily be bought at 1.50c, though it is not certain but that a trifle more would have to be paid for a car load. Bars generally go at 1.60c to 1.65c on carloads, while especially desirable orders bring out a price of 1.50c or thereabouts. Structural shapes show a wide range of prices according to tonnage, etc., the average being 1.55c or 1.60c.

A few more freight cars have been bought. Including orders noted in last report, the buying in the past three weeks now totals about 7,000 freight cars, with enquiries going the rounds for 13,000 cars and with 8,000 cars reported as about to come into the market.

Prospects Are Better

Steel market prospects, at long range view, are distinctly better than three or four weeks ago. At that time it was expected that demand and production would fall off during the remainder of the year, and while an improvement was counted upon for the early part of the new year, the improvement would have to start from a lower foundation. Now the outlook is improved in that there is unlikely to be any material drop in production in the winter, and the spring improvement will start at a correspondingly higher level.

Seeing that the steel market is quite unlikely to lose ground to any extent, and that there are no unfavorable developments, recent or in prospect, favorable influences only are to be considered. These are:

(1) Gradual improvement now occurring in business generally.

(2) Continued easier condition in money, with interest rates falling.

(3) Gradual decline in the commodities that have remained at fancy prices, steel prices having long ago reached a very moderate level.

(4) Improvement in the financial condition of the railroads, deficiencies under the expected earnings return being now quite small.

Thus the steel industry is likely to come up to February 1 with a good foundation, ready for development of the increased consumptive demand that normally comes with the approach of spring. There is a distinct possibility that in addition to consumptive demand there will be demand for partial restoration of stocks, which all steel buyers have reduced to the extreme. By March steel mills operations to 70 or 75 per cent. while if there is any stocking of consequence the rate may get up still higher for a time. By advancing prices at such a time the mills could encourage the stocking, having a full operation for a while and then a long period of liquidation again.

Pig iron continues very dull, with prices, generally speaking, not overly firm. The valley market remains at $20 for Bessemer, $19 for basic and $20.50 for foundry.

Connellsville coke is softer again. Spot furnace is down to a range of $3.00 to $3.10, depending on tonnage and brand. Spot foundry coke is $4.00 to $4.50, the reduced range quoted a week ago, and as rather soft at those prices, there being scarcely any demand.

POINTS IN WEEK'S MARKETING NOTES

The steel corporation have been running at between 50 to 55 per cent, during the past three weeks. while independents range from this rate, down to 40 per cent. All told the steel industry can be said to be running at about 45 per cent.

Pipe mills are now well in advance of other finishing branches, the rate of production being around the 70 per cent. mark. Operations at bar, shape, plate and rail mills are decidedly light, but on the whole have improved a trifle in the past few weeks.

Pittsburgh reports that blue annealed sheets are $2.25; black sheets, $3.00, and galvanized sheets $4.00. Prospects are that these prices will be held.

A few more freight cars have been bought, this bringing the total up to about 7,000. Enquiries are going the rounds for 13,000 more.

Pig iron remains very dull, with prices none too firm. Connellsville coke is softer again, and spot furnace is down to $3.00 to $3.10 depending on tonnage and brand. Spot foundry coke is $4.00 to $4.50.

A new ice breaker has been ordered by the Government, and the Canadian Vickers, Ltd., Montreal, have received the contract. The cost will be around $1,580,000.

Montreal reports a quiet market in all lines. Bars are moving, but slowly, pig iron prices have not altered, and machine tools are not in great demand. Small tools are selling at a fair rate. This field is the only bright spot on the market.

Toronto duplicates the above report. Apart from sheets, which are in fair demand, there is nothing of interest to report. Even small tools show a decline in demand this week.

NOT MUCH TRADE IN LOCAL CIRCLES

TORONTO, December 1st.—Compared with last week's activities, the market locally, cannot be said to shine. Things are not dead by any means, but on the other hand orders are not piling up on the desks. If orders were coming in bulk sufficient to cause a heap on the desk, dealers generally would be a happier lot. As one man expressed: "It's the funniest market I've ever bumped up against. Just when you feel you're out of the woods you get a set back. You work up prospects to a certain point; you feel they are ready to buy; they as much as say so, and then—cold feet set's in, and your spirits drop in like fashion."

The above statement covers the situation like a blanket. Every dealer has a list of prospects that would satisfy, if they would only become buyers and not merely prospects. "Time and again," said another dealer, "I have had (here he mentioned a certain firm) ready to buy. Instead of closing however, they take time to think it over, the result being no business. They decide to wait until better times." This timidity seems to be the real obstacle. Some think that after election, this state of affairs will change and business open up, which is a consummation devoutly to be hoped.

The steel market is still featureless. A certain amount of business is being closed, but nothing of importance. Sheets are the strongest of all lines, but this is to be expected. Prices remain the same and with the cold weather settling in, structural steel is lessening in demand.

Non-Ferrous Metals

Non-ferrous metals have taken on a firmer tone this week, thanks to the New York market. In fact there is more active interest shown than has been the case for some time past. Prices have not changed and dealers who have any stocks at all seem quite content to hold fast, refusing to purchase further material except at very low figures. The scrap market generally is more active, but nothing to boast about. Stocks must be getting pretty low throughout the country, and dealers are looking forward to a change for the better before many months have passed. Such an improvement wil be gradual but will be welcome nevertheless.

Machine Tools

The demand for machine tools is conspicuous by its absence. What little demand exists seems to be among the smaller manufacturers, who unfortunately have not much money behind them. Have you ever heard of buying a machine tool on the same plan as you would a phonograph or a piano? If not, listen to this one.

A gentleman sauntered into a dealer's during the past week and said he was in the market for a certain class of machine tool. He was shown something that suited him, said so, and asked if he

could have terms. "What terms would you like," asked the dealer, and back came an off-hand reply to the effect that 20% down and $100.00 a month would suit him, if the dealer could see it that way. The dealer pointed out how long it would take the man to pay off the tool at such terms, how he could not afford to carry him for such a period, etc., etc., but without success. "It was that or nothing" challenged the prospective buyer, and needless to mention, it was "nothing."

An important question which one dealer discussed with Canadian Machinery this week, was that of the proposed new "Machinery Hall" for the Toronto Exhibition. "We are very anxious to get in on this," said the dealer, "but the ten year clause puts us outside entirely. We cannot afford to sign any such obligation, as our principals are not in favor of any such move. To my mind," continued our informant, "a better proposition would be to have a two year guarantee clause. This would not tie anyone up too long, and by that time the exhibition authorities would see what a wonderful need they had satisfied, and would no doubt wish to embody other clauses to cover the situation thoroughly. We need a building of this nature. No one will deny, or even dispute that fact, but it is hardly fair to shut out, through a long period clause, dealers like myself who are anxious to get in, but cannot sign up for ten years."

This viewpoint is worthy of consideration. One thing sure, we must have a building, but on the other hand, if it is to be truly representative, no one anxious to show their wares should be discouraged. Surely there is some way in which the exhibition authorities can cope with this ten year clause. There is no reason why the new machinery hall cannot be a credit to the exhibition, and there is only one way to make it so, viz., encourage everybody to come in on the proposition. The dealer who has spoken so plainly on the matter, would take a good sized space, exhibit machines under power, and in every way add to the attractiveness of the display as a whole.

We hope that by the date of erection, some satisfactory solution will have been arrived at. Of course there is always this ray of hope. If sufficient manufacturers sign up for a ten year period to warrant the erection of a new hall, the building would be made large enough to accommodate more than the original backers, and no doubt others could get in on a yearly rental scheme.

If this is so, then the objections as stated above would be automatically wiped out.

The small tool field reports a slight easing off in demand this week, and one dealer thinks manufacturers are so busy giving their wives money for Christmas presents that they have forgotten the small tool merchant altogether. Seriously speaking, the outlook this week is not so good, and dealers do not look for any decided improvement until after the Christmas season.

New Ice Breaker to be Built; Machine Tools Are Still Quiet

MONTREAL, December 1st.—This week has seen the placing of another large contract with a local firm. The Hon. C. C. Ballantyne announced on the evening of the 24th, that the lowest tender for the proposed new Government ice breaker was that of the Canadian Vickers, Ltd., and that the contract would be awarded that firm shortly. It will be remembered that an ice breaker was constructed for the Government in 1914 but owing to the conditions existing at the time, it was sold to the Russian Government. It has ben felt that a new ice breaker would be constructed at an early date to replace the original one. Figures on the ice breaker were obtained some eighteen months ago and it was found that it could not be constructed at a reasonable cost. The lowest bid at that time was in excess of 2,000,000. The recent bid of the Canadian Vickers firm is $1,580,000, at which figure the contract will be placed. By waiting the year and a half it has been able to place the contract for a sum of $700.000 less than the tenders received early in 1920. The contract has been let at a most opportune time as there is a great deal of unemployment in the class of labor that will be employed on the ice-breaker. The breaker will be employed on the St. Lawrence and through its operations it is thought that considerable time can be added to the length of the navigation season. The contracts that have recently been placed for work of various natures in the engineering field has done a great deal to restore plants to their usual activity. The steel for the new Mount Royal Hotel has been delivered and is being rapidly passed into the Dominion Bridge Co. shops. It is announced that the erection of steel will be started on Dec. 15th. The sale of steel, sheets, bars and pig iron seems to be about as active as has been usual for the last few weeks. Generally, the whole steel and iron business is in a very satisfactory condition when all things are considered. The placing of the large orders has given consumers and shop men a great deal more confidence in the markets and will have a good influence in starting 1922 off at a good pace.

For the past few weeks there has been very little change in the volume of business. From some quarters a slight gain is reported, while in a few instances a slight decrease is reported. On the whole there is probably a net gain. There is a steady demand for a large tonnage of steel in spite of the reports of slack business. In fact the output of steel cord for the year at 72,204 long tons, is an increase of nearly 16,000 long tons over the production during the preceding month and some 200 tons more than the output for August, when the previous high record for the year was made. During the latter part of the month there was a favorable turn in the steel making industry closely following up the increased production across the border.

Business in bars is quiet. There is, however, a slightly better demand for small bars, and cold rolled steel. The demand for cold rolled steel is keeping up better than was expected. A certain amount of building in a small way is going on in nearly every quarter of the city and this coupled with several large buildings going up, really puts the building activity in the city as one of its live industrial factors. The weather this autumn has been ideal for outside work and contractors have taken every advantage of it. Sheets and plates are fairly active. The demand for the last week has fallen off a little after its increased activity just previous to the announcement of the close of navigation.

Very little of interest has taken place in the pig iron market in the last week. Prices have not altered and the demand continues to be about the same. Statistics show that in October the production of pig rose to the August level which was somewhat above the September total. The decrease in freight rates on the first of the month may be the forerunner of a slight shaving of the price, but as present quotations are not much above the production costs it is felt that the producers will be somewhat tardy in making a further cut. The foundries have not come into the market to any noticeable extent. The recent placing of several contracts for the repairing of cars, the ice breaker and several other activities, should create a demand for castings. It is confidently expected that there will be a decided increase in the volume of foundry work offering, within the next two months.

Machine Tools

Very little has occurred during the last week to change the position of the machine tool market. The announced price reductions on several internationally known tools does not seem to have stimulated their sale to any marked extent in Canada, at least not locally. It is pretty well acknowledged that price does not often sell a machine tool if there is a legitimate demand for it. The railways have not given the indication that they will come into the machine tool market. The large volume of motive power and rolling stock that is idle at present will enable railways to

(Continued on page 66)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shaues, Pitssburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	36 00	37 00
Spelter	7 25	7 50
Lead	6 25	7 50
Antimony	6 75	8 25
Aluminum	27 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT
Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 88	14 71	17 77
⅝ in.	6 50	8 03	7 95	9 48
.....	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 25
Cut nails, base	4 85
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	55	68
Class B	23	33
Class C	15	23

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	7 75	....
Flerur-de-Lis, 28 B.W.G.	7 25	....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	8 50	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	12½	Popular	.10
Standard	.11	Keen	9
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White	20	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Arctic Co., Winnipeg, Man., is now erecting an ice plant costing $200,000.

The Sea-Sled Co., Montreal, Que., has been incorporated to build boats, etc., with $1,000,000 capital stock.

The Crystal Dairy Co., Lethbridge, Alta., are building a manufacturing plant costing $100,000. Building will commence early in the New Year.

The erection of a factory is contemplated by the Cyclone Fence Company of Canada, Canada Cartridge Plant, Hamilton, Ont.

The Ontario Hydro Commission will build a Hydro-Electric system for power and lighting for the Yarmouth Township in the province of Nova Scotia. The cost will be about $115,000.

The London and Port Stanley Railway is having plans prepared for installation of additional power units, enlarging terminals and construction of additional siding. The cost will be about $100,000.

The Cole Mfg. Co., has been incorporated to manufacture wood and metal products, etc., at 40,000 capital stock. The above firm is situated in Lindsay, Ont.

Mongeau & Rubber, Ltd., Montreal, Que. have been incorporated to manufacture iron, steel and copper, brass Iron, steel and other metals, with $99,000 capital stock.

Lubri-Gaitors, Ltd., Montreal, Que., has been incorporated to engage in business as iron founders with $100,000 capital stock.

The Civic Works Committee of the City of Toronto, has approved of the Bloor Street widening project, involving an expenditure of $1,250,000, of which $937,500, or 75%, of the cost is to be paid by the tax-payers.

The C. N. R. Railway board announces a reduction of 10 per cent. in freight rates, this reduction also extends to Pullman and sleeping car rates.

Truro, N. S.—Mr. Frank Stanfield of Stanfields' Ltd., reports their mills very busy with the outlook for the winter excellent. The prospects are that to meet the increasing demands their premises will have to be extended.

Rights for the manufacture and sale in Canada of an Electric Vibrating Screen, has been secured by the Engineering Equipment of Montreal, of which James W. Davis, formerly with the Canadian Ingersoll-Rand Co., has become general sales manager.

The Canada Hotel Co. intend erecting a hotel in Quebec City at a probable cost of between $1,500,000 and $2,000,000.

A contract for reinforcing steel for Collegiate costing $700,000 for Ottawa Collegiate Board is placed with Dominion Reinforcing Co., Ottawa, Ont.

Reinforced steel contracts for high school costing $450,000 for the Walkerville Board has been awarded to the Trussed Concrete Steel Company, Walkerville, Ont.

Steel contracts for rink costing $30,000 for Grimsby Arena Limited has been awarded to Hamilton Bridge Co., Limited, Hamilton, Ont.

Ruggles Motor Truck Co., Hamilton, Ont. is again operating on full time. It is expected that the factory will continue on the present schedule.

There is a possibility that work may start on the construction of a $500,000 building at London, Ont., early in December.

Col. Gideon Miller, Salvation Army architect, Toronto, says that contracts for the construction of the $15,000 addition to the Grace Hospital, Windsor, Ont., will be let shortly.

Repairs are being made to the Manitoba Government telephone building in Winnipeg, Manitoba. The total amount expended will be around $110,000.

The following firms have been incorporated with Dominion charters Molybdenite Reduction Co., $2,0,000; Consolidated Bullion Hydraulic Mining Co., Vancouver, $5,000,000;

The Dominion Incinerator Co., with head office at Montreal, capital $250,000, to carry on the business of building and engineering, specializing in construction of incinerator plants and other public works. This is one of the recent trade incorporations.

Expenditures on roads in the province of British Columbia for the past six years have been on an average of $3,264,301 per year. For a period of three years ending May 31, 1921 over 1207 miles of pavement has been completed in this one province alone.

The L. R. Steel Development Corporation of Canada will immediately start work on the construction of a three storey building in Brantford. The work of wrecking the old buildings already on the site has been let to the Sullivan Construction Co.

A general reduction of 10 per cent. in freight rates on all steam roads under the jurisdiction of the Board of Railway Commission will go into effect December 1st.

The Columbus Rubber Co. of Montreal, Winnipeg Branch, are moving from their present location to larger premises in the Stobart, corner of King Street and McDermott Avenue, shortly after the first of the new year.

W. H. Banfield & Sons, Toronto, are finding a rapidly increasing demand for metal stamping and special machine work as well as for their standard lines of phonograph motors. electrical fixtures and supplies.

A Cotton mill that will employ 200 or more will be established in Welland, Ont. P. T. Granthan former manager of the Empire Cotton Mills, has the plans in hand. The product of the proposed company will be cotton yarn and other cotton products.

The third enlargement of the plant of the H. H. Crosby Co., Hebron, N. S., within the past few years is just being completed. The additional space and equipment will make possible a daily output of from 8 to 10 hundred pairs of shoes.

The Canadian Export Paper Co., Montreal, Que., announces the completion of reorganization, influential men connected with other paper concerns being in charge. The organization now controls for export purposes approximately 800 tons of newsprint per day. Their prices for the first quarter of 1922 will be $35,00 a ton which is a reduction of $5.00 from current prices.

A new building has been erected to house the steel foundry department of the J. W. Cumming Mfg. C., New Glasgow, N. S. The department has now been in successful operation for six months and the electric steel furnace has a capacity of 3,500 pounds per heat. Miscellaneous castings, etc., are being manufactured.

Mr. L. M. Wood, of Wood, Fleming & Co., Toronto, has prophesied that 5,000 to 6,000 men will be employed within the next two years the automobile industry situated at Leaside, Ontario with the plant of Durant Motor Company. If Mr. Wod's prophecy proves true then the above concern will be considered as the largest industry of its kind in Canada.

During the first eight months of the current year Canada sent some $27,000,000 in gold out of the country, ranking fourth among the list of exporting countries.

Chapmans, Ltd., Kent Building, Toronto, has awarded the contract for the construction of an artificial ice plant. Estimated cost $70,000. Location is not settled as yet.

Fire losses in Canada for a period covering from August 1914 to December 1916, amounted to $52,027,000. The average total fire loss for the past three years was approximately $27,000,000 per annum.

The Monarch Tractors, Brantford, Ont., are planning to reorganize. The name of the new company to be formed will most likely be "The Monarch Tractor Ltd.," or any other such name as may be approved. The company is capitalized at $1,000,000.

Sydney, N. S.—Maurice Murphy, chief mechanical superintendent of the Dominion Coal Co., becomes assistant chief engineer of the British Steel Corporation. A. Stewart succeeds Mr. Murphy, Jas. Pristine becomes round house master mechanic, Rod Livingstone construction foreman, and R. W. Carmichael becomes car shop foreman.

North Sydney.—Shipping is still brisk at North Sydney, many steamers are in for bunker and coal cargoes. The steamer Canadian Ranger after bunkering sailed for Russia with railway equipment. The Canadian Rancher after bunkering sails for United Kingdom with a cargo of pulp.

Halifax, N. S.—Halifax Board of trade and representatives of the Halifax shipping men, after a meeting here telegraphed L. S. Brown, Eastern supt., of the C.N.R. urging for better facilities for handling the greatly increased traffic expected this winter. According to schedules submitted to shipping men there will be 160 sailings to this port this winter, exclusive of Royal Mail Boats and other established lines. In this connection it is hoped that work will be commenced on the south end deep water terminal shed.

Sydney, N. S.—Considerable stir has been caused in Cape Breton coal circles by the announcement that foreign going steamers have been bringing return cargoes of United States coal to St. Lawrence ports, particularly Three Rivers and Montreal, where it is sold at $1.00 per ton below the price of Nova Scotia coal. Several thousand tons of coal were discharged from the freighter Northern Pacific at Three Rivers which was landed at Newport News, and it is understood that shipments of similar nature will continue as long as navigation is possible on the St. Lawrence.

The incorporation of G. B. and H. B. Robinson, Ltd., is gazetted today, with head office at St. John and capital stock of $25,000. The company is authorized to take over the business now being carried on in St. John by Henry B. Robinson under the name and style of G. B. Robinson as insurance agents, and to carry on a general business as insurance agents and brokers. Nicholas J. Thibodeau and John A. Kennale of Bathurst, doing a machine shop and garage business under the name of Thibodeu and Kennale, have dissolved partnership from date of November 9, Mr. Thibodeau retiring. John A. Kennale and Herbert Kennale will continue the business as Kennale and Thibodeau Garage.

London, England.—The International Shipping Conference at its second session yesterday adopted a resolution recommending the Hague rule of 1921 concerning bills of lading for voluntary international application and as far as may be necessary for adoption by an international convention between the maritime countries.

Reversing Falls, N. B.—The new bridge over the Reversing Falls, N. B. has been officially turned over to the C.P.R. for operation by G. A. Mountain, chief engineer of the railway commission. The first passenger train to pass over the bridge being a special of three cars and an engine.

Ryrie Bros. of Toronto, along with Birks & Company, of Montreal, have acquired the Bank of British North American Building at Hamilton, Ontario, which has been owned by the Bank of Montreal for several years. The deal involved between $150,000 and $200,000. Extensive alterations are planned for the present site.

The Advisory Industrial Committee of the Board of Education, Toronto, Ont., at its regular meeting the past week, recommended that the new east end branch of the Technical School Building on Greenwood Avenue, be proceeded with as early as possible, and instructions have been given to apply to the Government for its quota of 50% of the cost of the work.

The Management of the Dominion Match Co., is now being assumed by the E. B. Eddy Co. of Hull, which purchased the factory of that concern at Deseronto, Ont., in July 1920. Changes in the management are now being made. At the present time about 120 people are employed and it is stated that during the past six months business with them has been normal showing a decided increase for the past two months.

The October statement of the Industrial Department of the Harbor Commission reports a decided increase in business optimism, and unless something unforeseen is experienced there is likely to be little unemployment in Ontario in 1922. Fourteen or fifteen firms are considering locating sites owned by the Harbor Board and a number have definitely decided to establish plants in Toronto.

A new rough stock room for handling new material has recently been completed at the works of the Canadian Drawn Steel Co., Hamilton. An overhead electric traveling crane, passing over the C. P. R. tracks at the south, and the G. T. R. tracks at the north gives excellent facilities for quick and economical unloading of raw material. The company also have a very heavy drawing machine on the way but the erection of this has been stopped for a time.

A special meeting of the Public School Board of Kitchener, Ont., have accepted the plans for the remodelling and enlarging of the Sudaby School at an estimated cost of $135,000, work to be begun early in the new year. The building will be about twice the size of the old one.

The establishment of an iron and steel industry in British Columbia is imminent, according to Hon. C. D. Patullo, Minister of Lands, who has stated that a representative of some British interest of thorough reliability was enroute to Victoria to discuss the matter. Proposals were to be submitted to the Government in this regard.

The automobile show in Windsor will be held the week of February 27 to March 4, 1922, at the Armouries, under the auspices of the Border Cities Automotive Dealers' Association. The officers of the association were re-elected for another year on Friday. F. L. Copeland is president; Fred Duck, secretary; A. E. Thompson, treasurer.

The Victoria, B. C. plant of the Cameron Lumber Co. has resumed operations after a shut down of nearly a year. They state that they have orders now on hand that will be sufficient to keep the mill busy for at least a month and they will cut about 500,000 feet of hemlock for Japan as the first contract. With the reopening of the mill 200 men will receive employment.

The Metal Stampings Co., 111 Adelaide St., W., Toronto, are in the market for the following machines: 3 spinning lathes, 28 in. swing, 6 ft. bed; 3 buffing spindles; 2 foot presses with deep throat for riveting; 1 automatic riveting machine with deep throat; 25 to 30 h.p. motor alternating current 550 volt, rotary sheer and 1 double action Toggle press 12 to 16 in. stroke, 30 in. between uprights.

The Winnipeg Top and Trimming Co. are at present erecting a new building in Winnipeg, Manitoba which they expect to occupy very shortly. A new limited liabilty company is being organized with a paid up capital of $20,000 an the stock and good will of the Auto Top and Supply Co., who have been doing business along this line, has been purchased.

The Windsor Machine and Tool Co., a $500,000 concern has launched into the manufacture of automobile pistons. The trade name of the product will be "Wilkie" after Lorne A. Wilkie, president of the company, but the pistons, made of gray iron will be of the same model as a well known American type. Sizes to fit every model of car now on sale in Canada will be supplied and Mr. Wilkie calculates that 500,000 pistons are sold in Canada every year, and that 90% of this number are imported from the United States.

Montreal may have a new hockey arena next year. If it is decided to erect such a structure, operations will commence about April.

The Canada Machinery Corporation are building an 80-inch driving wheel lathe for the Manchurian Government railways.

The Oak Tire & Rubber Co., Oakville, claim that they have over $100,000 of unfilled orders on their books at the present time.

The Stevens Co., Galt, are building two special machines for the Ford Co., Walkerville to be used in connection with Mud-Guard operation.

The Goldie & McCulloch Co., have secured the contract for installing new pumping units in the Georgetown municipal waterworks plant.

The Bishopric Lamp Co., Cin., Ohio will erect a sulphate plant near Dunkirk and has awarded contract for the erection of same. The project included power plant, equipped with steam engines, boilers and generaters, and will cost $100,000.

If present plans of the Bell Telephone Co., go through, a telephone exchange having an estimated cost of nearly a quarter of a million dollars will be erected in the city of Hull. This move is not expected however for a year or so.

There was a total attendance of 20,000 at the Made-in-Galt exposition, and that with only a few days preparation. Given a couple of months advertising a much larger outside attendance will be there at the next event.

The Dominion Tack & Nail Co., are filling an order for Australia for three hundred thousand brass tacks. This plant produces about 650 different kinds of tacks and special nails and consume 500 tons of metal yearly. The demands of the motor car, furniture, boot and shoe, and upholstering industries alone accounts for a large consumption.

Pembroke: W. A. Nichols, who owns a sawmill at Carleton Place has purchased 300 acres of fine pine. When this lumber is cut and they have already started to chop it down, sufficient logs will be secured to keep the above mentioned mill busy for several seasons.

The Herbert Morris Crane & Hoist, Co., with head office and factory at Niagara Falls, Ontario, have found it necessary to open a branch office in Hamilton to take care of its increasing business in that city and surrounding district. Mr. F. C. Simpson is resident engineer in charge of the new branch, which is located at 512 York Street.

With the R. McDougall Co. operating an inexhaustible jug having no visible sources of supply, for its rich brown liquid, and the Hinman Milker producing milk from an invisible cow, the made in-Galt-Exposition was not without an air of mystery. The McDougall pitcher seemed to have the edge in popularity for as one sightseer declared, "Yon milk is o'wer blue to come frae ony coo; but this is aye a bonnie color that Andy has here. Hoo he diss it I dinna ken."

The Carbon Alloy Steel Co., of Niagara Falls, Ontario, is reported to have leased 33,000 acres of land in the neighborhood of Malone and Eldorado for the purpose of mining iron ore. It is said that twelve properties have been leased, nine of which have deposits of hematite iron ore and the other three magnetite. The deposit of ore is said to be very large and if present plans are carried out it will be mined and smelted on a large scale.

"Our business for the year is ahead of 1920 business." An average volume of business is coming in daily and prospects for 1922 are up to normal if not a little better than previous years"—states the American La France Fire Engine Co. of Toronto. The company are completing a new type of hand drawn gasoline engine.

The Laing Mfg. Co., Guelph will build a public garage, 90 ft. by 50 ft., adjoining their machine shop. This concern has been specializing in the production of park and golf benches also machine shop vises. A recent change occurred here whereby J. Skidmore became manager, and R. B. Laing severed his connection. A co-operative plan is adopted, stock being held by the employees.

W. R. Stewart, who has been connected with Jenkin Bros., Montreal, for 21 years has severed his connection with the above mentioned company. He has taken over the agency for the Kerr Engine Co., Walkerville, who are also manufacturers of brass and iron valves, fire hydrants and improved sprinkler equipment. Mr. Stewart has charge of the district east of Hamilton, also the province of Quebec. He is located at 58, Manning Chambers, Toronto,

A demonstration of an improved flax scutching machine was given by representatives of Vickers, Limited of London, England, at H. W. Petrie's, Toronto. A number of flax specialists, including representatives of the Department of Agriculture at Ottawa, have inspected the machine in operation and have passed an opinion on the flax fibre produced. There are approximately 70 flax mills in Ontario. The Vickers representatives are planning on making demonstrations in scutching before American flax men, and if the market situtation warrants they are prepared to manufacture machines in Canada.

The London Concrete Machinery Co. of London, Ontario, have purchased the business of the Ideal Concrete Machinery Co. of Windsor and are moving the entire plant to London. The Ideal line consists of a line of concrete block machines, power tampers and ornamental moulds. The London Concrete Machinery Co., who already have a large business covering concrete mixers, hoists, pumps and other contractors' equipment, are making provision for increasing the output of the Ideal concrete block machines. Their new catalogue covering this line will be issued about December 1st.

Mr. C. C. Laporte, manager of the Montreal branch of the K. & S. Tire and Rubber Goods, Ltd., states that up to date they have increased their 1921 sales one hundred per cent over the 1920 sales. This was accomplished in spite of keen competition, the general business depression, and an average all around reduction in prices of about twenty per cent. The reason that Mr. Laporte assigns for the remarkable showing is that he has a good line of goods and he has honestly pushed their sale day in and day out. "We never let up," he says, "The business is there, but you have to dig it up."

It is reported from Winnipeg that the grain shipments in 1921 over the Canadian National Railway Western Lines increased more than one hundred per cent over those of 1920. Officials stated that 80,000,000 bushels of wheat had been handled between September 1st and November 19th this year.

Automatic lathes for the manufacture of wooden sporting goods have been installed in the factory of the Harold A. Wilken Co., Toronto. They state that the quality and style of these products are first class and that they are able to manufacture at a price 25 per cent. to 30 per cent, lower than imported goods

New equipment installed during 1921 at the plant of the Canadian Roofing Mfg., Windsor, Ontario. will triple its capacity. The entire installation will be ready to operate by the beginning of the new year. A new product produced by the added equipment is the paper asphalt shingle, which the makers state promises to be one of the greatest developments in the roofing industry.

Extensions are under way at the plant of the Thomas Watt Co., Vancouver Machinery is being installed for the manufacture of rivets, bolts, nuts, tacks screws, ship-chandlery, etc. The company also intend to enlarge their galvanizing branch so that they can increase their output and make a speciality of galvanized goods. They expect to build up a export business on the Pacific Coast.

A representative of Canadian Machinery who visited machine manufacturers in Western New York recently, reports much better feeling there than was the case two months ago. Orders are coming in, and wheels are buzzing where for a while they were quiet. There is a tendency to fasten great hopes upon the disarmament conference as a means of stabilizing unsettled European conditions and again making world markets worth while.

Readers of Canadian Machinery will be interested to learn that the affairs of the Garlock-Walker Machinery Co. have now been satisfactorily arranged. From now on, the newly organized company will be known as the Garlock Machinery Ltd., and the assets of the new company will be used to pay off creditors of the old company at 100 cents on the dollar. In other words all accounts will be paid in full. The premises and organization of the former company have been taken over, and business will be carried on, as Mr. Garlock, Jr. puts it, in as thorough a manner as is humanly possible.

The Kerr & Goodwin Machinery Co., Brantford; Ontario, are building up an export trade in Oil Engines. Repeat orders for them have been received from France and shipments have recently been made to the British West Indies and South America. The engines are also in use throughout the Dominion. The engine is a semi-Deisel and is purely an oil burning engine, developing a dependable power, at a great saving in fuel.

The rapid increase in business has caused William Shannon Co., Toronto, to become too crowded and they have prepared plans for a new factory which they expect to occupy next May. The building will cost about $35,000 and contain approximately 22,000 square feet of space. Provision has been made for an additional 15,000 sq. ft. when required. The company will manufacture decorative work, drapery trimmings and cords for fancy work, etc.

The contrast in cost of exhibiting at the Galt Exposition and at the National Exposition in Toronto is striking. The former's charge of $6 for a space of 7 square feet made the show available to the most unpretentious concern, whereas the charges for space in the so-called Machinery Hall at the National are said to be discouraging if not prohibitive to small concerns. The proposition is to build a new Machinery Hall at Toronto on the undertaking of prospective exhibitors to guarantee the rental of certain spaces for 10 years. It is estimated that the building should pay for itself in twenty years. In the meantime the suggestion that there should be a special Galt building at the National Exposition is more than an idle whisper.

"Some depth of satisfaction is sounded by American manufacturers in the straightforward kind of diplomacy that has developed at the disarmament conference in Washington," said W. P. Andrews, of High Speed Hammer Co., Rochester, N.Y., to Canadian Machinery recently: "After all is said and done, blood is thicker than water. Great Britain will win great admiration throughout this country for the enthusiasm she has shown, her willingness to consider and the absolute freedom from prejudice of any kind. No "ante" propaganda can spoil the spirit that is shown and great good is going to result. If they permit Germany to sit in, as has been suggested, surely some way can be found to meet the French requirements, and of course there should also follow a solution of problems affecting China and Japan. The old world is on the brink of great things."

We have received information to the effect that by an act amending the Patent Act, it is possible to file Canadian applications for patents on inventions that have been in public use since August 1st, 1913. Under the original act applications had to be filed within a year of such public use. Owing to the war and conditions arising therefrom, it has been found that many manufacturers have neglected to secure protection from 1914 to the present date and such protection can now be obtained, Our informant also adds that any manufacturer having a working arrangement in regard to patents with an American company, where the American patent has been issued since August 1st, 1914 is now able to secure corresponding protection in Canada. The privilege of filing such applications in either case expires on December 4th.

Newcast'e, N. B.—The town of Newcastle have contracted with New Brunswick hydro power commission for the entire supply of electric power for the town. The power will be supplied by the Bathurst Lumber Coy's development on the Nepisiquite river. They will close down the steam plant and will install Allis Chalmers centrifugal power driven pumps of 600 Imperial gallon capacity for the town water system.

A contract for important additions to the pumping and distilating system of the Montreal water works department has been placed with the Dominion Engineering Works, Montreal, who specialize in the manufacture of hydraulic machinery of large capacity. This company have lately taken up the manufacture of large gate valves and at the present time are building a Johnson hydraulic valve, 20 feet in diameter which is intended for installation at Shawinigan Falls under a head of 140 feet. This is the largest valve of this height yet undertaken.

The Canadian Car and Foundry will finish by the first of December all the track work for delivery this fall to the Toronto Transportation Commission. The company is the only manufacturer of street railway manganese track work in Canada and their sole competition on these orders came from the United States, principally from the United States Steel and Bethlehem Steel Corporation. The business has been claimed in a series of orders, the first one having been placed when the Commission first came into effect about the end of August. To date the business has totalled a half million dollars, and further orders are expected as soon as weather conditions permit further track laying. In addition to the ordinary car tracks the Canadian Car and Foundry have supplied material for 30 intersections on the Toronto jobs, all manufacturing having been done under a Montreal plant at Longue Point, and Pt. St. Charles. The special intersection orders included everything from turn-out's to grand union's. All special pieces are of solid Manganese. The company has been supplying steel to all the principal cities in Canada and presently expects to deliver a number of frogs and switches to the C. T. R. and C. P. R. This firm is also repairing 2,000 freight cars for the C. N. R. at Montreal, Ft. William and Amherst jobs.

BUSINESS BETTER IN UNITED STATES

The First National Bank of Boston notes a distinctly better feeling toward business, not in the sense that business is free, active and profitable—for it is not—but because many, and the most difficult, steps in the business readjustment have already been taken, and persistently, if slowly, the products of the farm are being brought more nearly into balance with retail prices of goods. The downward trend of commodity prices for the moment has been checked, and in fact the average has risen slightly in recent weeks, lumber, copper, cotton, oil, wool, and some steel products contributing to the increase. While building construction awards are increasing and are now in normal proportions, the recovery in steel is being blocked by scant buying on the part of the railroads. The reason is obvious. The railroads' gross earnings for September were $120,000,000, or 20 per cent. less than in September, 1920. Only by cutting down expenses in every way, including paring down maintenance materials, was this enormous shrinkage offset. Heavy buying of steel by the roads under these conditions is out of the question. Transportation charges form so large a part of the final cost of goods that the demand for lower railroad rates, meaning further reduction in railroad wages, is growing more insistent and is being recognized as the barrier to a revival of business. The eleventh-hour rescinding of the railroad strike order was mainly in response to this public demand.

OBITUARY

On Friday November 18th a cable from the south of France announced the death of Sir Frederic Orr-Lewis. He was at his residence, the Villa Viletta, and had been in poor health for some time. Sir Frederic founded the large ship-building plant of Canadian Vickers and at the time of his death was president of the company. He was also president of the firm of Lewis Bros., Hardware merchants in Montreal. In addition he was a director of the Merchants Bank of Canada, of the Bankers' Trust Co., the Montreal Cotton Company, and the Canada Steamships Lines.

Sir Frederick was born in Hamilton, Ontario in 1861, and started his business career in that city and after a few years as apprentice to a hardware merchant, moved to Montreal in 1887 where with two of his brothers established the Lewis Brothers Hardware. He was on board the Lusitania when she was torpedoed and was in the sea several hours. When picked up he was in an exhausted condition. He was ill for a long time afterward and never seemed to fully recover from the effects. Sir Frederic's connection with Candian Vickers, involved a great interest n the parent concern of Vickers in England. Of late years his time was about equally divided between Canada and Europe.

Have You Tried This Contest Yet? If not--- Do so Now

Below will be found twelve references to advertisements in this number. To the sender of the first correct set of answers to these we will forward one of these scales.
To win one is not difficult, and at the same time you will add to your store of knowledge. Read the details given below.



The scale is 6 in. long and is made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is also stamped on one side, and a table of tap drill sizes on the reverse side. This scale is well worth securing.

What You Have to Do

We publish every week a number of interesting facts or statements selected from the advertising pages for that week. The selections for this issue are given below. Read these through, then turn to the advertising section and see if you can pick out the advertisements to which they refer. The work is interesting, it will train your powers of perception and of memory, it costs you nothing, it will make you better acquainted with the various lines of machinery and tools in the market, and with perseverance you are bound to win one of these useful scales as a prize.

The present contest page will be the last. Starting with next issue, we will have a new form of contest, which will offer still greater inducements for readers to exercise their capabilities. Unfortunately no one submitted a correct list for the Nov. 10th contest. Question No. 6 was the stumbling block. Refer to Page 2 of the Nov. 10th issue for the answer.

CONTEST FOR DECEMBER 1ST ISSUE

Contestants are required to write us, stating to which advertisements we refer in this number.

1—How to save money every day.
2—Something built to handle large or small work.
3—How to simplify the output.
4—Something of which there are a number?
5—A case where you can't say too much.
6—Something that tells you why.
7—A claim that has never been seriously questioned.
8—Something said to be separate yet complete in itself.
9—How to survive the chiseling attack of?
10—Something that is popular.
11—How to save gas and oil.
12—Something that is the result of combined experience.

These are Correct Answers for List from November 10th Issue.

1—John Bertram & Sons Co.
2—Wisconsin Electric Co.
3—Dalton Mfg. Corporation.
4—Canadian Fairbanks Morse Co.
5—Dominion Steel Products.
6—Nicholson File Co.
7—Nova Scotia Steel & Coal Co.
8—Rice Lewis & Son.
9—Carlyle Johnson Machine Co.
10—Canadian National Newspaper & Periodical Association.
11—Fellows Gear Shaper.
12—MacLean Publishing Co.

Closing Date for This Contest is December 22nd.

Right on the Lead

GEOMETRIC

The Threading Machine that makes Quick work of Big Orders
for Small Threaded Parts.



There are three sizes—½-inch, ¾-inch and 1-½-inch

Not the ordinary bolt cutter, these machines duplicate threads rapidly, accurately, profitably, doing work that cannot be handled on the ordinary Screw Machine or produced economically in any other manner.

FOR DOUBLE QUICK THREADING
THE GEOMETRIC DOUBLE SPINDLE THREADING MACHINE

Is a very rapid producer, handling practically as much work as two single machines.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S.

New Machine Developed—Various Features

THE G. A. Gray Co., Cincinnati, Ohio, have developed a maximum service planer, some of the chief features being described in the following article. This new machine is equipped with a cantslip feed. As the name implies the feed is positive, and the method of adjusting is by turning a knob at the operator's end of the rail until the required feed is indicated on the graduated dial. A partial turn of the wrist gives any feed from .01" to 1" in steps of one hundredths of an inch. The feed dial is automatically locked as soon as the fingers are removed from the knob. The feed mechanism for the rail heads is mounted on the end of the rail; that for the side head is mounted on the head itself, thus it is always within convenient reach. Rail head and side head feeds are entirely independent so that one can be changed without affecting the other. Feed changes may be made while the planer is running.

Rapid Traverse

The rapid traverse embodied in these planers is applied to the side heads as well as to the rail heads. To move a head the operator simply shifts one lever. Shifting the lever disconnects the feed for that particular head, engages the rapid traverse mechanism and starts the small motor in the proper direction. Moving the lever back to neutral throws out the rapid traverse clutch, stops the motor and reengages the feed. It is not necessary to make use of a separate starter to start the motor, nor does the motor run while not actually in use. No part of the rapid traverse mechanism is in motion unless a head is actually being moved. As the traversing mechanism is entirely separate from the feed mechanism one head can be rapidly set for the next cut while the other head or heads are still feeding. Throwing in the traverse mechanism automatically disconnects the hand cranks so that these do not revolve and endanger the workman. The levers for actuating the rail heads are at the end of the rail. the lever for each side head is on the head itself. Shearing pins safeguard the traverse mechanism in case the rail heads are accidentally jammed together. Safety stops obviate the possibility of lowering the side heads too far.

To elevate the rail the operator pushes up a stirrup hanging near the end of the rail; to lower the rail he pulls it down. The stirrup is locked in the neutral position. A quarter turn of the wrist unlocks it. As this stirrup is suspended from a universal joint, the operator can stand out in front of the rail where he can see the position of work and tools. The motor that operates the rapid traverse also furnishes the power for the rail-setter. One movement engages the elevating mechanism and starts the motor. Bringing the lever to the neutral position disengages the elevating mechanism and stops the motor. Safety stops obviate the possibility of raising the rail too high.

The Rail-Lock

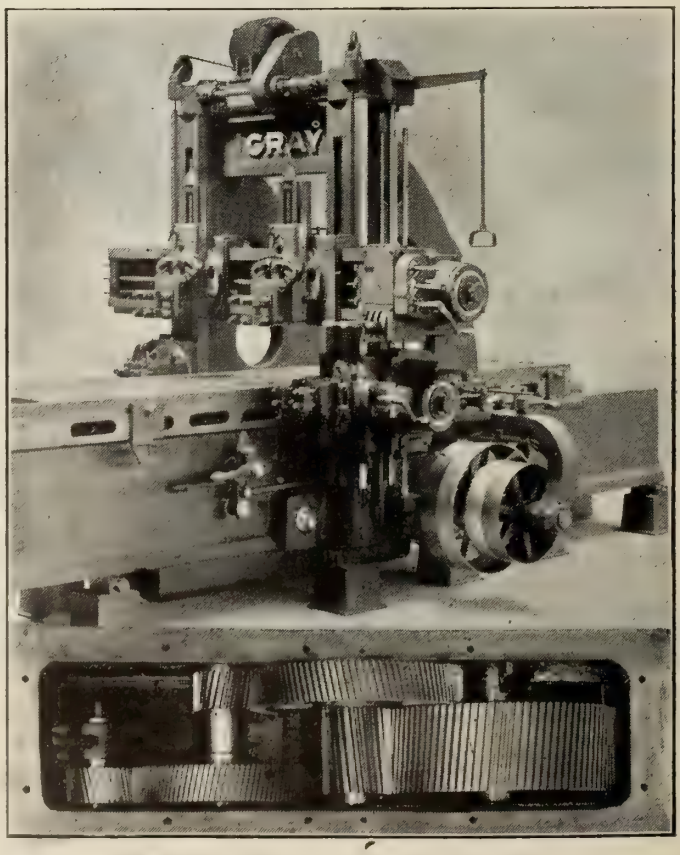
Turning a crank on the operator's end of the rail releases or tightens the clamps that lock the rail to the housings. Automatic adjustment insures that the rail is clamped equally rigidly at both ends. As the lever operating the rail-setter is also on the operator's side of the machine the planer hand can release this rail, raise or lower it and reclamp it without moving away from his operating position.

The net result of these improvements is to bring the control of practically all of the functions of the planer to the operator's usual position. Besides the raising, lowering and clamping of the rail, as described above, he can, without moving from his position, set the feed on rail or the right hand side head; traverse either rail head or the right hand side head quickly by power; set the micrometer collars on the rail screws so as to measure accurately the travel of the tool; and of course, use the tumbler which controls the movement of the table. In doing these things he is in a position to watch his tools and so avoid accidents.

The bed of this new planer is made full length, that is, the working surface of the table never overhangs, even when taking the maximum stroke. In this way the table is always rigidly supported even when run way out to the front end of the planer for setting up work. The table is of box section, with an interrupted center wall running the entire length and tying the top and bottom plates rigidly together. This design prevents endwise springing due to peining action that occurs when heavy work is clamped. The usual traverse walls and posts are also provided. All stop-pin holes open into the cored openings of the table are easily cleaned from the outside.

All driving gears run in a bath of oil so as to minimize wear and prolong their life. An oil pump is direct-connected to the drive shaft and delivers a flood

Continued on page 66



Showing the Planer, and Plan View of Its Main Drive.

ATKINS METAL CUTTING SAWS

Business Looking Up?

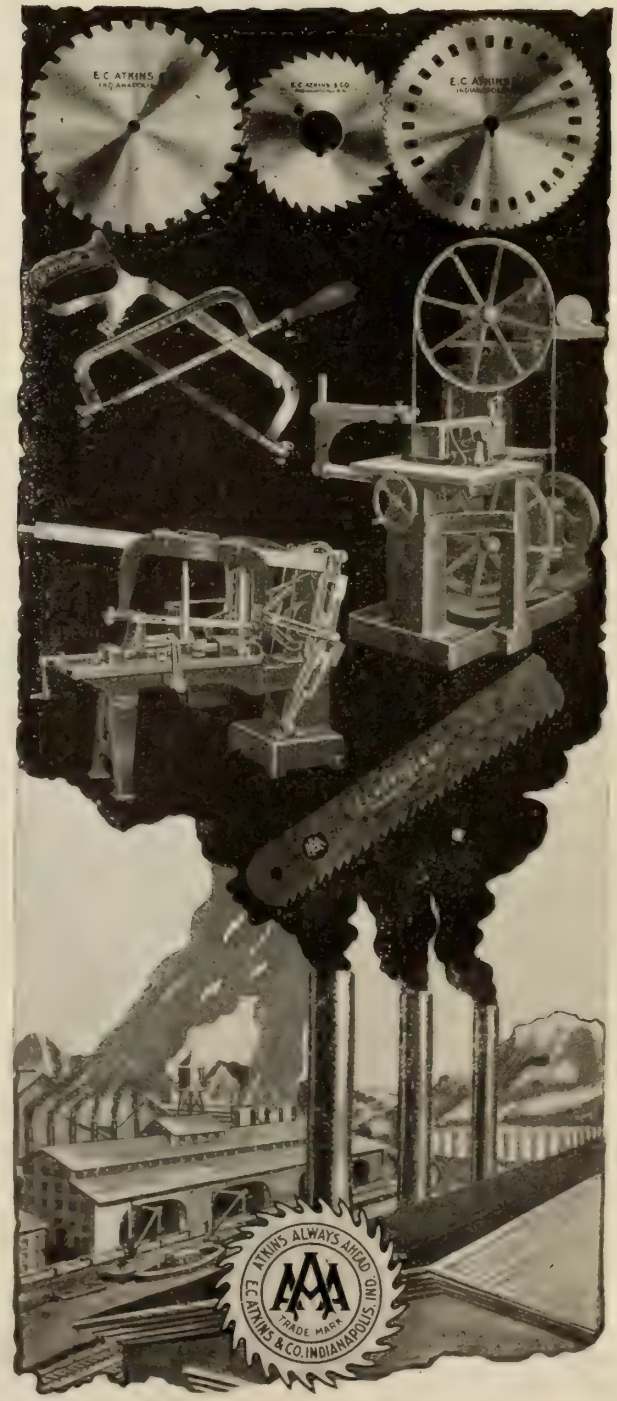
Building contracts are increasing; metal stocks are being depleted; factories are resuming; metal saws and machines must be ordered.

ARE YOU READY?

Put your plant in shape for a long run of good business. Write to the nearest point below for a catalog which will tell you why

Atkins Metal Cutting **Saws** and Machines are the BEST.

"A Better Saw for Every Use"



E.C. ATKINS & CO.

Est. 1857 "The Sterling Quality Saw People"

Home Office and Factory, Indianapolis, Indiana

Canadian Factory, HAMILTON, Ontario

Branch carrying complete stock, VANCOUVER, B. C.

MONTREAL MARKETS

(Continued from page 55)

keep operating without using all of the available equipment already in their shops. To a great extent the average machine shop is in much the same condition. The small shop man is really the busy man in the machine shop line and he is also the man who is creating quite a percentage of the small demand for machine tools. In many cases this type of customer buys new machines. The turn over of the second hand, or remanufactured machines, still continues. and no doubt will continue, until the surplus of machine tools has disappeared from the market. There has been manifest a very persistent effort on the part of the manufacturer of machine tools to improve his product. Dealers are daily receiving announcements of new features on old machines, and new designs of machine tools. There is no doubt that this activity on the part of the manufacturer will net him a dividend when conditions open up. At present the demand has not been visibly increased.

Machine Shop Supplies

As we have noted from week to week, the small tool and supply business has been the bright spot in the market. The generally normal way of doing business, (as was accepted as good practice before 1914), has been much in evidence in this department, and is to a certain extent responsible, for the volume of business. During the war years the machine shop man was educated on the value of good tools. It is perhaps this experience that has taught him that he must use the best tools to meet competition and still make a profit. There have been no price changes of any moment, although as the demand increases, and the price of raw material and labor comes down, there will naturally be many small reductions from time to time.

Non-Ferrous Metals.

A few price changes of a minor nature are noted in the non-ferrous metals. There has been but little activity in the business moving locally. Business is improving with the Northern Electric Company and they will no doubt be in the market regularly for more or less copper at a date early in the year. Tin, lead, and spelter have been quiet with a few minor price changes. There is a prospect that the market will witness a reasonably large increase in business early in the year. With the elections coming on, followed by the Christmas season, and the generally dull business situation, not a great deal is looked for until the first of the year.

It has been a long while since there was any activity in the scrap metal market, and it appears as if there will be little or no activity until the spring. There are practically no inquiries and hardly enough demand to produce a quotation.

LEARNING TO WELD

Continued from page 45

fusion and union of the ends have been produced the welder proceeds to fill in the vee with adding material to a depth of say one-fourth the diameter. The shaft then is turned over and the same procedure followed on the opposite side, the parent metal at the bottom of the vee being thoroughly fused together before starting to use adding material. Welding on this side should be carried up to about one-fourth the diameter also, and then the shaft turned over and the weld completed on the opposite side. When welding is finished on side No. 2 the contraction stresses will be well equalized and the alignment good.

On motor car repair work it is often advisable to throw away a short shaft section and weld on a new part which then will be machined to size. Time will be saved and a better job produced when the broken end is deformed or badly worn.

Use nickel steel welding rod on nickel steel motor car shafts, and heat treat after welding to refine the metal. The heat treatment should be fixed by the carbon content. If the carbon is in excess of 0.30 per cent., and the nickel is about 3.25 per cent., heat to a full red, quench in cold water bath and reheat to about 800 to 1000 degrees F., and let cool slowly. If the carbon is higher than 0.45 per cent. it may be advisable to quench twice, the second quenching being done at a low red heat. Then reheat for annealing as before.

Steel Castings

Heavy steel castings should be prepared for welding and preheated with all the care given to brittle metals. While steel castings are not so brittle as cast iron it is essential that internal stresses be neutralized in order that the strength of the parts when welded will not be seriously reduced. Moreover, preheating is economical, the amount of gases required being much reduced as compared to the volume required when welding the part cold. As before stated, preheating is a measure of economy as well as insurance against failure.

Steel castings in general may be beveled for welding with the cutting torch. Some grades high in carbon may resist the action of the torch considerably and make beveling somewhat difficult in which case beveling may be deferred until the parts have been preheated. Then usually no trouble whatsoever will be met in using the cutting torch.

Sizes of Welding Rods

One of the points to be observed in the use of welding rods is to choose a rod of diameter appropriate to the thickness being welded. The heavier the weld the larger the welding rod up to a certain limit but it is not common to use welding rods for steel larger than 3-8 inch diameter, and most welding is done with rods of from 1-16 to 1-4 inch. Thin steel up to 14 gauge should be welded with 1-16 inch wire; 14 gauge to 10 gauge with 3-32 inch wire; 10 gauge to 1-8 inch, 1-8 inch rod; 3-8 inch to 1-2 inch 3-16 inch rod, from 1-2 to 1 inch, 1-4 inch rod; and for greater thickness use 3-8 inch rod. The rule is not arbitrary but the welder can readily see that it is uneconomical and poor practice to use small welding rod on heavy work. It will cost much more for rod, and time will be lost in feeding the rod to the weld. Moreover, the smaller the rod the greater the surface proportionately exposed to the air and the greater the amount of oxide lost. On the other hand it is not good practice to use a large rod on small work because too much of the heat is absorbed in the welding rod, radiated and lost. The rule for welding is to make the heat of the puddle melt the welding rod; if the rod is very large and heavy so much heat will be abstracted that it will be difficult to keep the puddle in fluid condition with the appropriate size of tip and flame. Cast iron welding requires somewhat heavier rods or sticks proportionately, a 3-8 inch stick being commonly used on cast iron where a 1-4 inch rod should be preferred on steel. Cast iron sticks melt readily and less radiated and puddle heat are required than for steel rods of the same diameter. It would not be desirable to lay down a fixed rule because considerable latitude is allowable, and if a welder observes sound torch practice he cannot go far astray in the choice of welding rods and sticks.

NEW MACHINE DEVELOPED VARIOUS FEATURES

Continued from page 64

of oil not only to the V's but also to all the drive shaft bearings. This eliminates cutting and reduces friction and wear to a minimum. The operator's time is also saved as he does not have to oil these bearings. The pump is of reversible type, operating on the return as well as or the cutting stroke. From the pump the oil flows through a filter, thence to a hole in each "V" at the center of the bed. Each table "V" has a large oil channel running the full length but closed at the ends. From this channel the smaller supplementary oil grooves carry the oil to all parts of the bearing surface. By this means the oil supply is kept constant at all points regardless of the relative position of the table. Oil strainer, filter and settling basin are also provided.

Lack of space prevents further details. Description will be completed in next issue.

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WE have taken over the assets and good-will of the GARLOCK WALKER MACHINERY LIMITED, TORONTO, including the premises and organization. We will carry an extensive line of metal-working and wood-working machine tools and supplies, and wish to take this occasion to emphasize to the trade that our aim is to give prompt, efficient and courteous service on all occasions.

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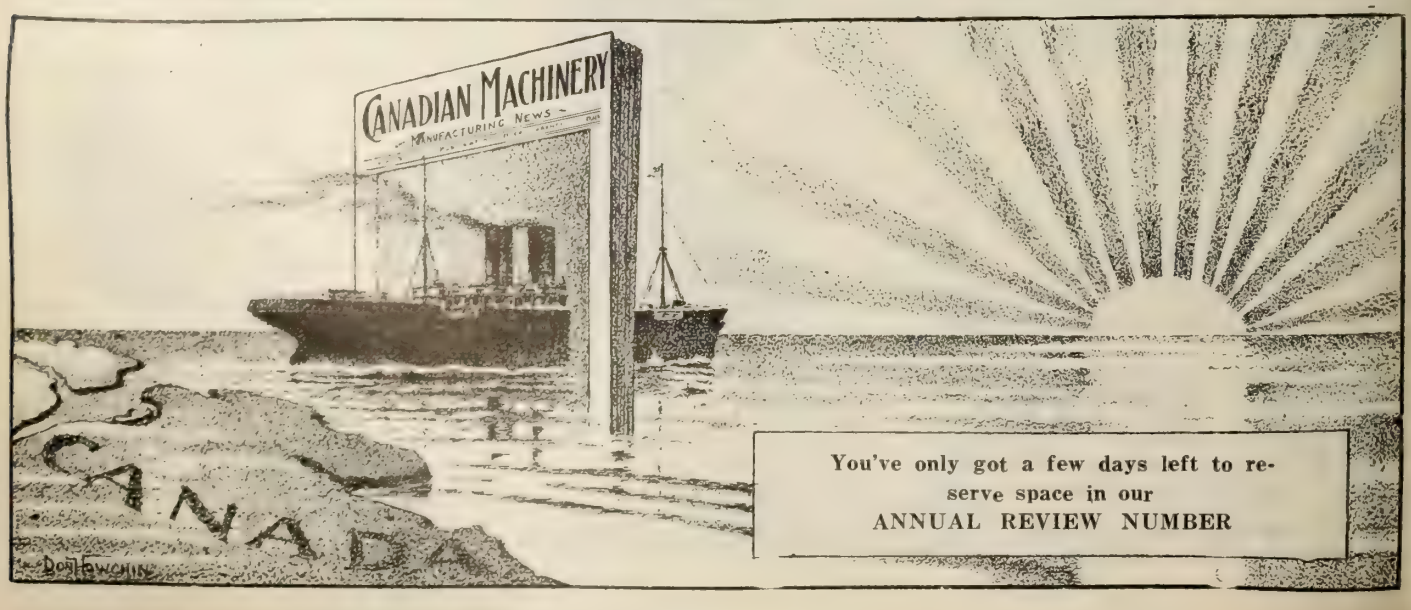
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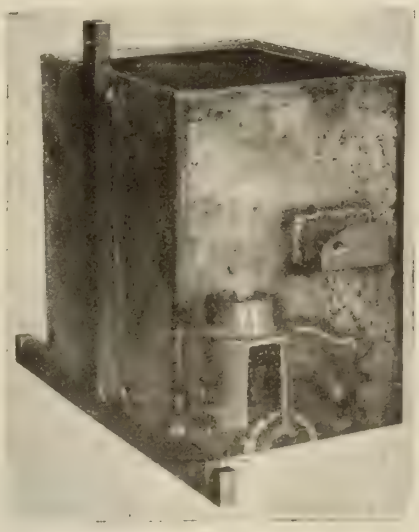
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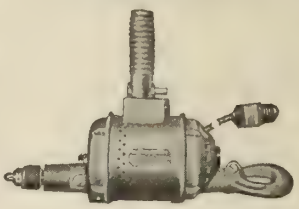
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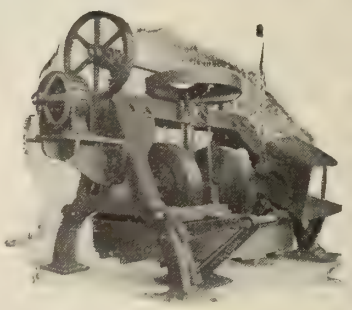
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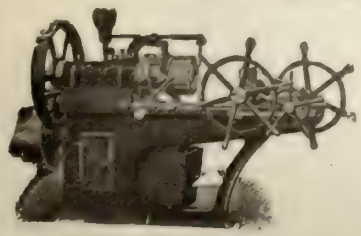
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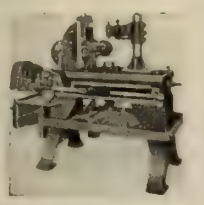
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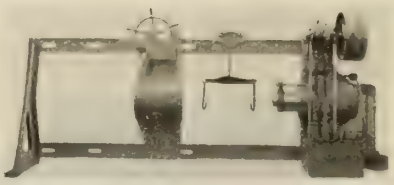
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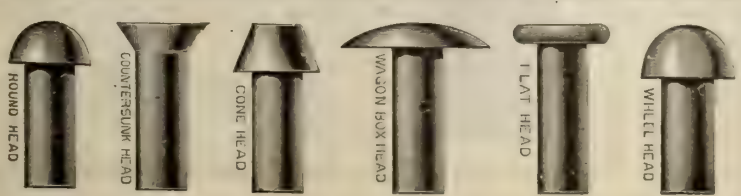
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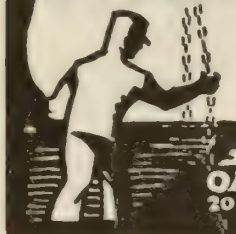


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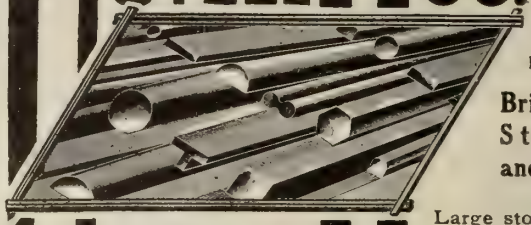
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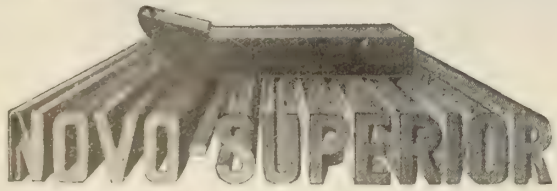
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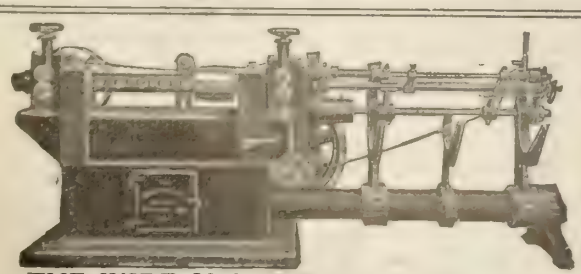
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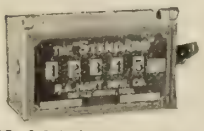
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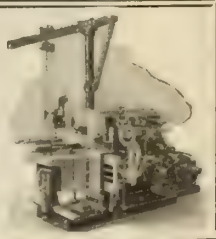



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A Great Day for Pipe Machine Users

IN CANADA when you think of pipe machines, the name Hall immediately comes to mind. In the United States it's the Williams machine that has won the reputation to thread pipe better, quicker and at lower cost. Now the advantages of both are combined in each. They have joined forces and the Hall is now the Williams of Canada.

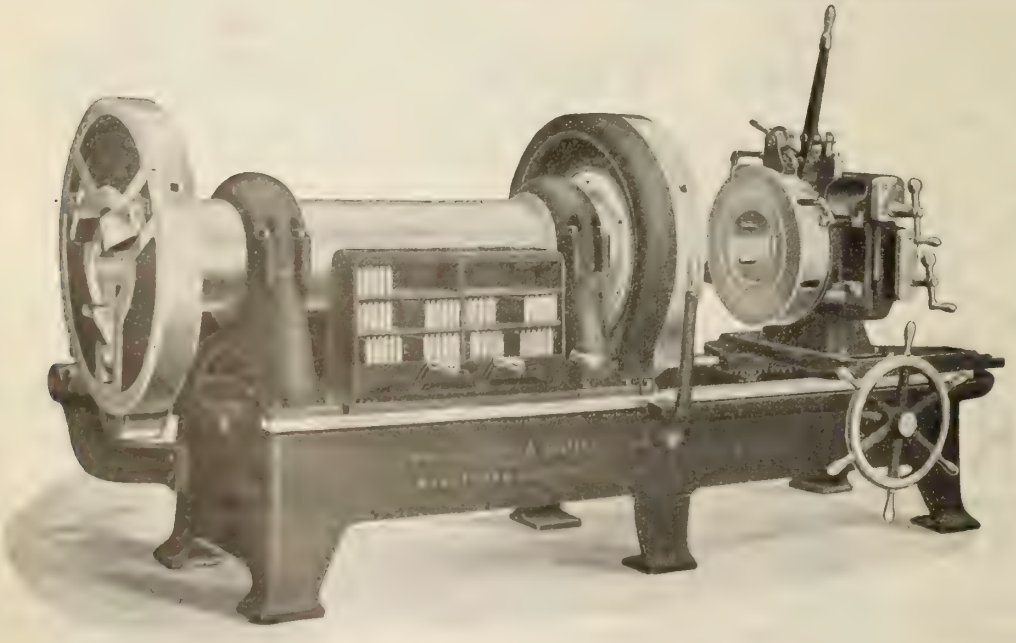
Whether it's 1-8 inch or 16 inch pipe or any of the sizes in between, there's a Williams machine just right for the job. Built in eight sizes and each size especially designed to meet the requirements of the case. And remember, each Williams machine is backed by the combined features, experience and service of Hall of Canada and Williams of the United States, each a firmly established leader in its field.

You who do or should use power pipe machines will do well to write for the details of how and why this merger means greater economy, production and efficiency in pipe threading practice.

Ask for the new Williams' handbook "Don't Let It Happen To You."

Williams Tool Corp. of Canada, Ltd.

U.S. Plant: Erie, Pa.



The illustration is of our No. 8 new improved Duplex Type Standard, capacity 2½" to 8" inclusive.

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Standard Dimensions

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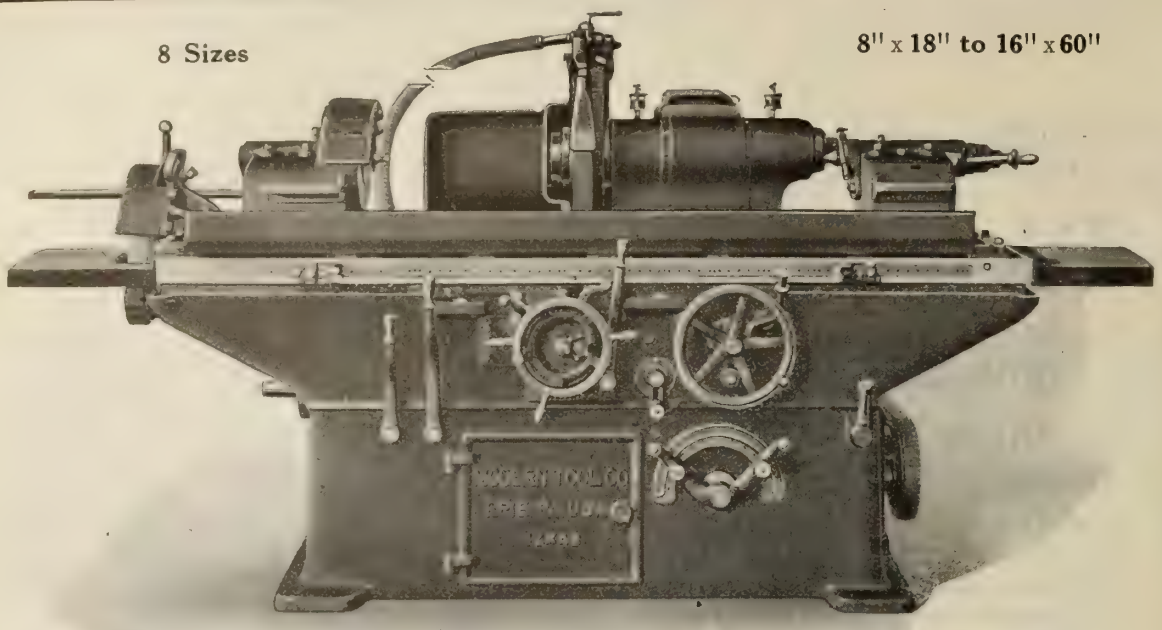
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8" x 18" to 16" x 60"



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Plain Grinding Machines

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The shaft is ground, and mounted on anti-friction bearings; runs at constant speed. Power can be applied from a line shaft or direct from motor. All parts are balanced to eliminate vibration.

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More powerful than other types of same rating. A 4 in. endless belt carries the full power from main shaft direct to wheel spindle, giving constant smooth drive.

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All Modern Plain Grinders are specially designed for most convenient connection to motor.

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Wheel spindle has bronze bearings with outside taper. Quick take-up for wear without dismounting is provided.

Main drive has anti-friction bearings.

Headstock has ball bearings.

Gear box has phosphor bronze bearings.

All provided with proper lubrication.

All shafts are ground.

MODERN TOOL CO., Erie, Pa.

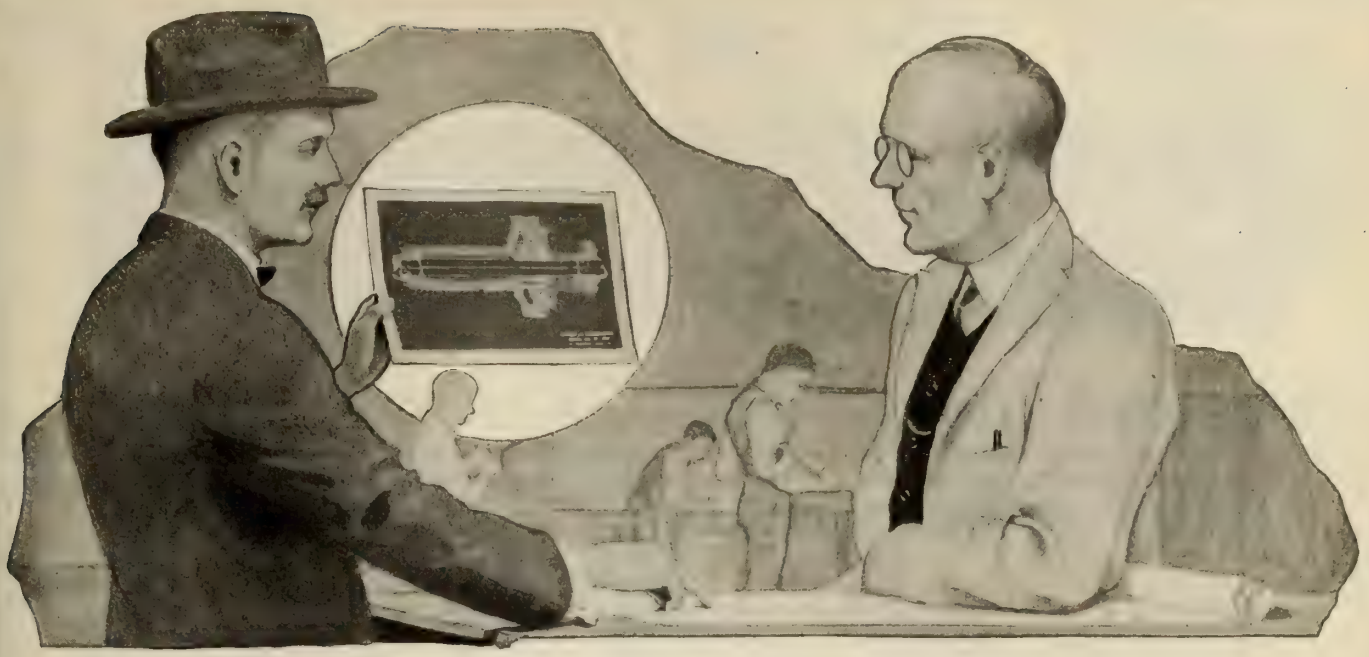
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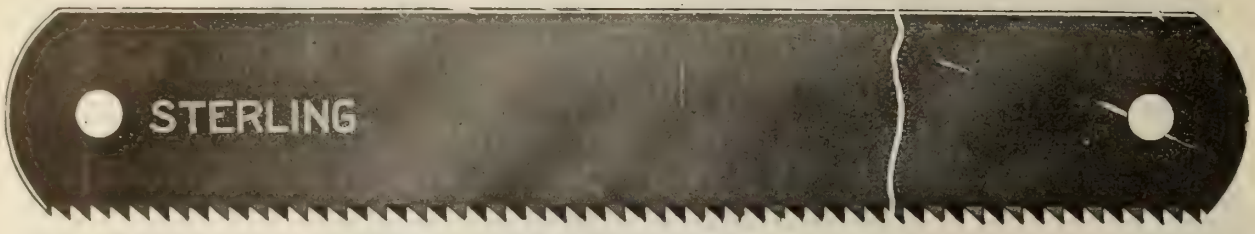
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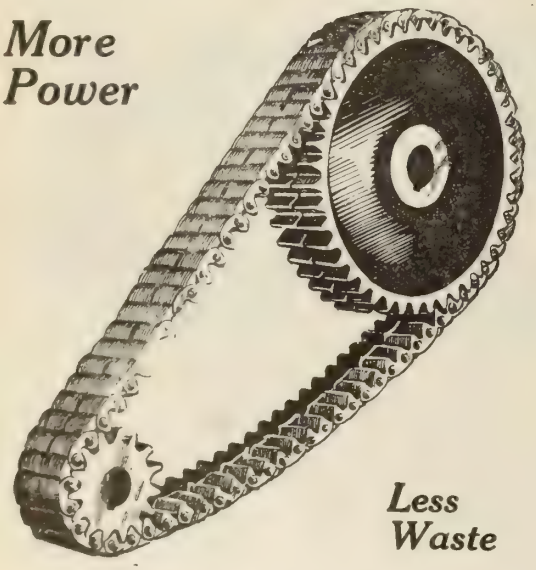
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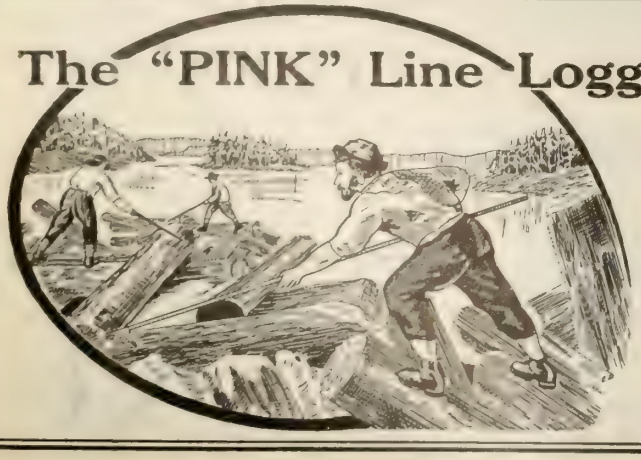
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Gear Cutting With the "IFS" Left Out

The Gear Shaper Way

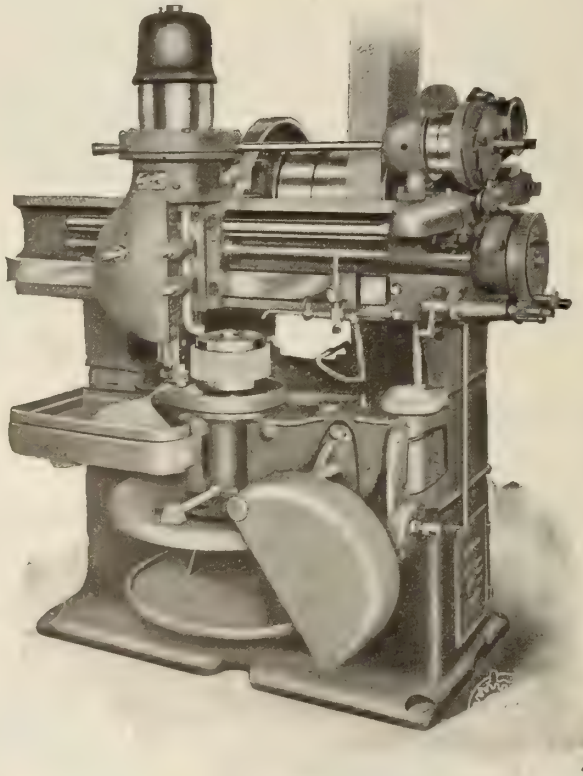
A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this little word "IF."

When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of Gear Cutting with the "IFS" Left Out.

Send for your copy to-day

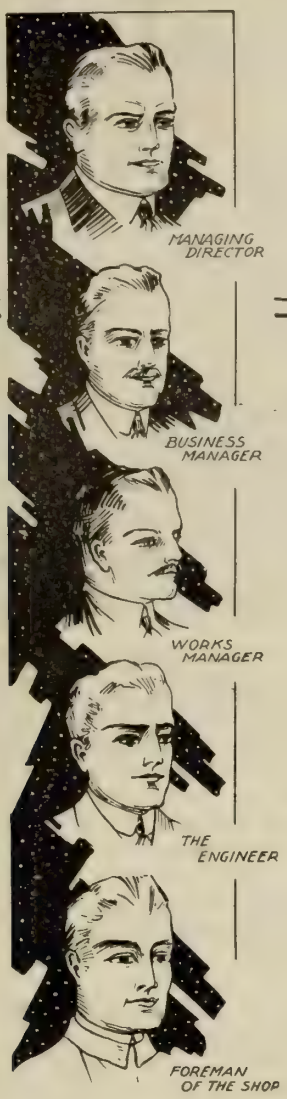


The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting

The Fellows Gear Shaper Company

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ACME
NUT TAPPING MACHINES

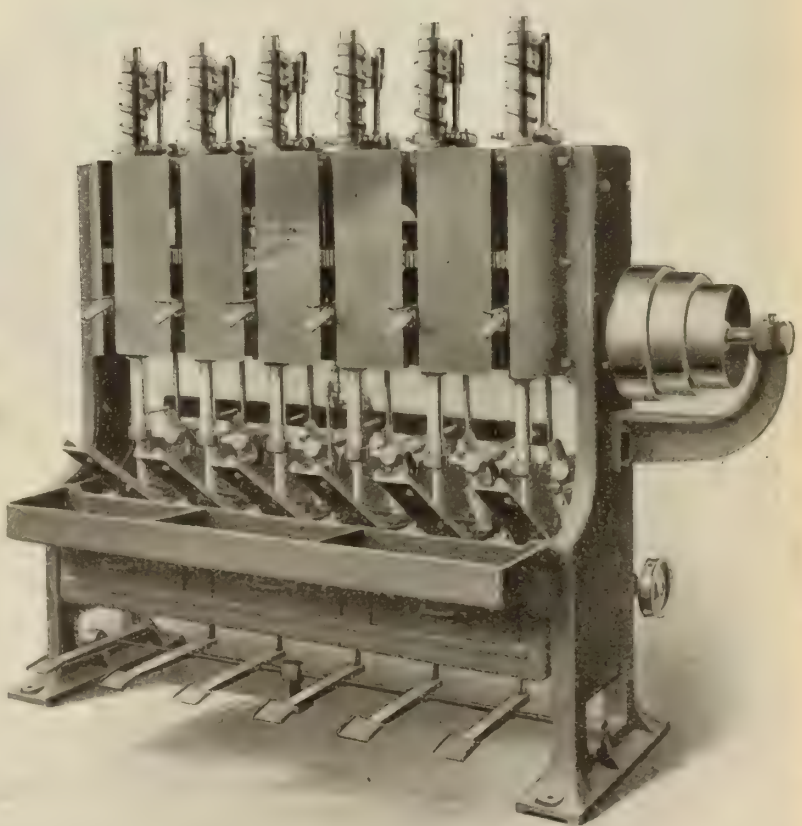
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---The Managing Director

"I unfortunately know that and I've taken it up with the Works Manager."
---The Business Manager

"I've spoken to the Engineer and he recommends Acme Tapping Machines."
---The Works Manager

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"One plant I know has been averaging 15,000 threaded nuts per nine hour day with Acme Nut Tappers. We need them here."

"I'm with you," says the foreman, "so I think there is satisfaction all round."



Acme Nut Tapping Machines most profitably meet to-day's demand because they are high-speed producers and capable of precision work under the most severe service. According to one leading manufacturer. "We get a spindle speed of 100 r.p.m. which is the limit of the tap endurance on the tough material used." **Wouldn't it interest you to know more?**

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"The Tools you buy again"

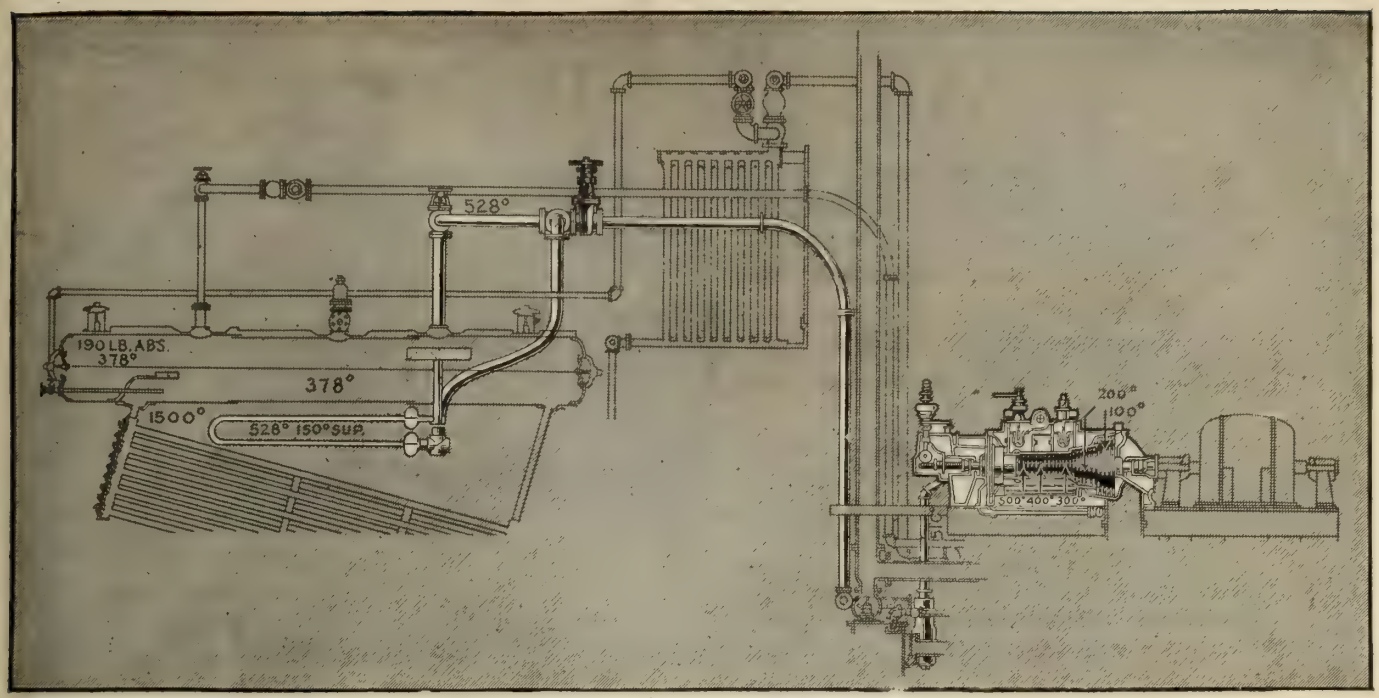


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Commonly used "steam" metals cannot survive the chiseling attack of steam, superheated and under high pressures. So leading designers specify Monel metal.

Monel is used for guide stems, wedges, seat rings, spindles, pistons, etc., in great valves built by Chapman, Crane, Jenkins, Lunkenheimer, Nelson, Pratt & Cady and others equally prominent. It is used as blading, poppet valve parts, etc., in large steam turbines.

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Especially is this true wherever large cumbersome sections are to be welded —Prest-O-Lite can readily be carried anywhere—it goes to the job.



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A chain of plants and warehouses is kept busy meeting the demand for this most useful of gases.

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Murchey Solid Adjustable Taps do not have to be scrapped when the cutting edge is worn. You simply buy a new set of chasers for a comparatively small sum and you have a new tap, equal in accuracy to the best solid tap and at a much lower cost. We give special service in supplying chasers.

Let us send you this tool on approval.

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Is Canada's Frozen North A Myth?

Vilhjalmur Stefansson, the Canadian explorer-author, in an article in MACLEAN'S MAGAZINE for December 1, entitled "Northward the Course of Empire," asserts that the stories of intense cold and other unendurable conditions in the sub-Arctics of Canada are all pure poppycock. He points out in this, the first of a series of four articles, that before the trans-continental railways were built, the same assertions were made regarding the fertile Prairie regions of Manitoba, Saskatchewan and Alberta that are now being made about the sub-Arctics.

Every Canadian interested in the development of his own country should be versed in the potentialities of the "wider Canada" beyond our present horizon of development.

The Christmas number of MACLEAN'S MAGAZINE, out

December First

is beyond doubt the finest in its history. There are contributions from such writers as Leacock, Agnes Laut, Alan Sullivan and Archie McKishnie; but MACLEAN'S did not gain its reputation by going after "names," and there are also other articles by lesser-known writers, including a delightfully poignant story by Frances Beatrice Taylor—her very first.

A Remarkable Offering of Timely Articles and Entertaining Fiction

Little Theatre of the Hills—Canada—by Agnes C. Laut: A plea for the development of Canadian national consciousness. Are we making the best of our national virtues and characteristics?

People Who Get My Goat—by Frederick Niven: A Canadianized Englishman has a few remarks to make about those newly arrived Old Country men who come out to Canada to make good and then indulge in bootless criticism.

Little Ukraine in the Canadian West—by Mrs. Charlotte Gordon: Something about one of our alien colonies which does not desire to remain alien.

Age and Occupation Determine Food Needs—by William Fleming French: An authoritative food article which answers the question "What Should Henry Eat?"—no matter what age Henry may be.

Is All Prayer Answered?—by Marshall P. Talling: A timely and entertaining article by a Canadian who has made a special study of prayer, what it means and what it achieves.

The Efficiency Christmas—by Zoe Beckley and Joseph Gollomb: A yuletide story with a laugh and a sob, a thrill and a heart-tug, about real people with the right sort of kiddies.

The Case of Jean Louis—by Maurice Le Blanc: The third of the Arsene Lupin series, by the master teller of fast-acting mystery tales.

The Ladies' Chain—by Alan Sullivan: A follow-up story on one of the most craftsmanlike pieces of fiction ever published in Canada, "Linen Sheets," which appeared a few months ago in MACLEAN'S.

The Usurper—By Archie P. McKishnie: The story about a lynx who was victorious in his battles with other savage things in the wilds and then challenged Man.

Pipes Over the Water—by Frances Beatrice Taylor: Three experienced journalists read this story before publication in MACLEAN'S and each voted it one of the most remarkable little stories of its kind he had ever read.

Mostly Sally—by Pelham Grenville Wodehouse: A big slice of the funniest thing which Wodehouse has written since "The Little Warrior."

The Yellow Streak—by Valentine Williams: The concluding instalment which unfolds the hidden-to-the-last secrets of this enthralling mystery story.

Stephen Interviews Leacock

By Stephen Leacock: Canada's premier humorist describes what happened when he was interviewed on his arrival in London; tells how the English questions left him all at sea because he missed the usual "bromides."

A Startling Review

"Can the White Race Endure in the Bright Sunlight of Western Canada?" Charles H. Huestis, M.A., D.E., here discusses the effect of light and warmth on our Western people. Twenty other reviews from British, French, American and Canadian current literature.

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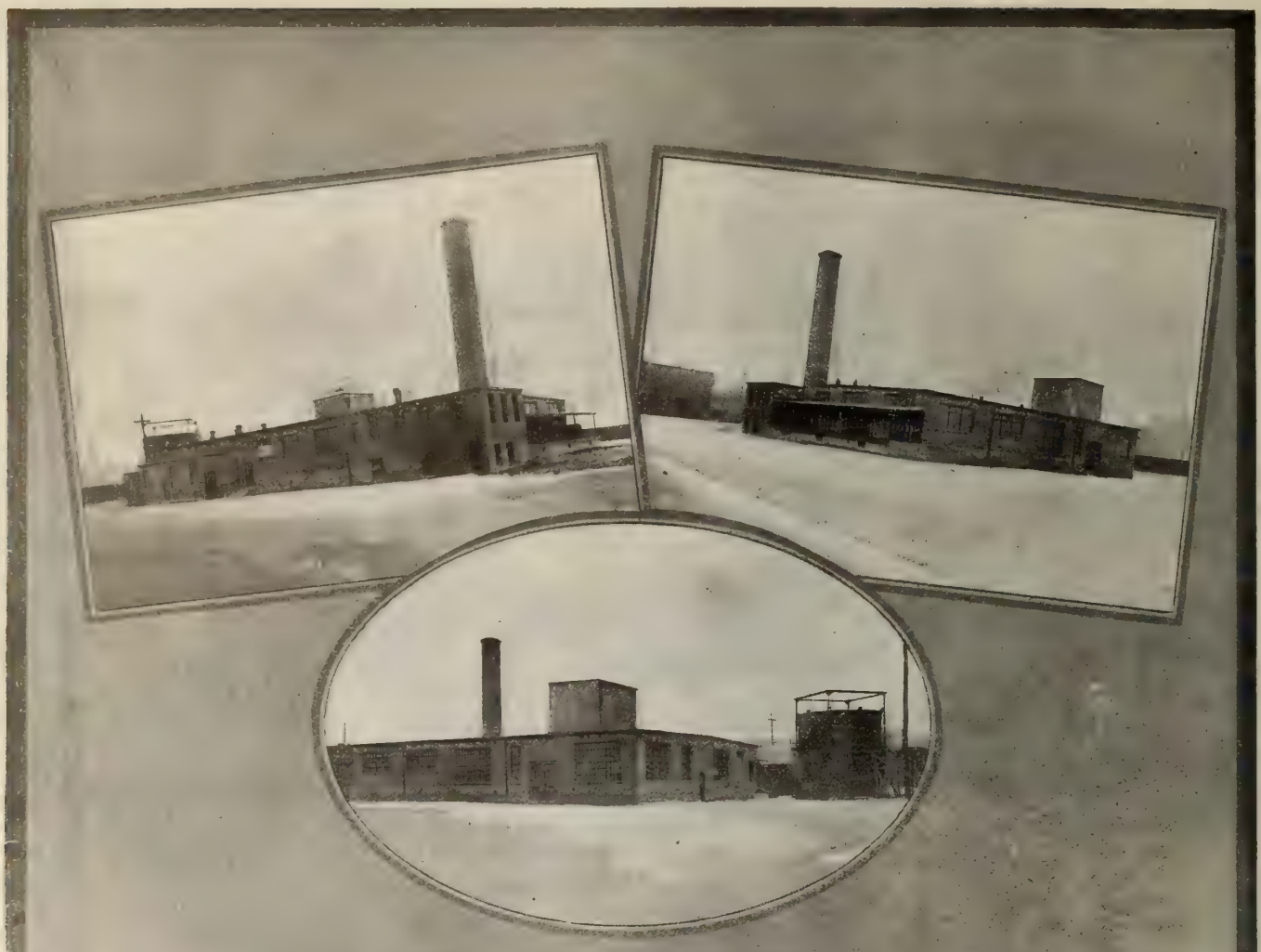
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Dominion Oxygen Company's New Plant at Montreal

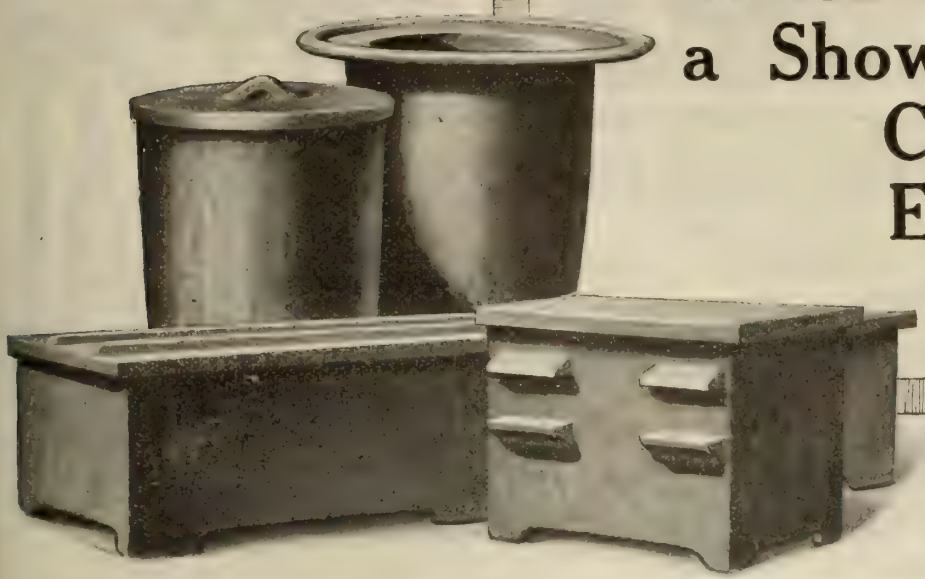
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YOU will, of course, recognize these two as inseparable, when it comes to real carbonizing economy—"More Heats per Dollar—More Uniform Results"?

And if you could make a thorough inspection of the hundreds of heat-treating plants in which Cast Nichrome Containers are used you would fully realize how inseparable are "More Heats per Dollar—More Uniform Results" and Cast Nichrome Containers.

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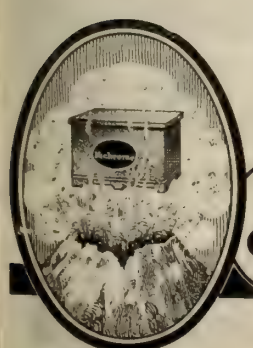
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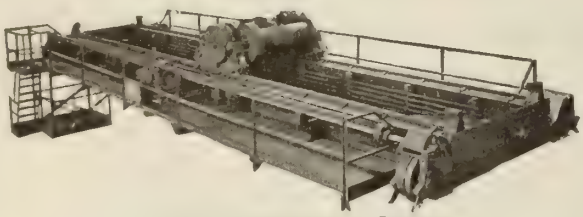
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1—21" x 10' London Lathe, S.B.G., C.R., P.C.F.
4—20" x 8' C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1—21" x 10' Butler Lathe, D.B.G., Q.C.G., C.R.
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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom Foundries & Steel, Hamilton, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

For list of Dealers see the last page of This Buyers' Directory

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd Montreal, Canada
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach. Vertical
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers

Building Materials
Robertson Co., H. H., Cleveland.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bort
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont

Flux, Galvanizing
British Smelting & Refining Co., Ltd. Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R I
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn
Johanson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Johansson Inc., C. E., Windsor, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton Ont
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R I
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R. Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I
Burke Machine Tool Co., Conneaut Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto,

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel. Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont.

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton,

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont

Surface Plates
Bilton Machine Co., Bridgeport, Conn

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, O
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, I
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

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Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

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MacGovern & Co., Montreal, Que.
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The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
A. R. Williams Machinery Co., Montreal, Que.

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The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

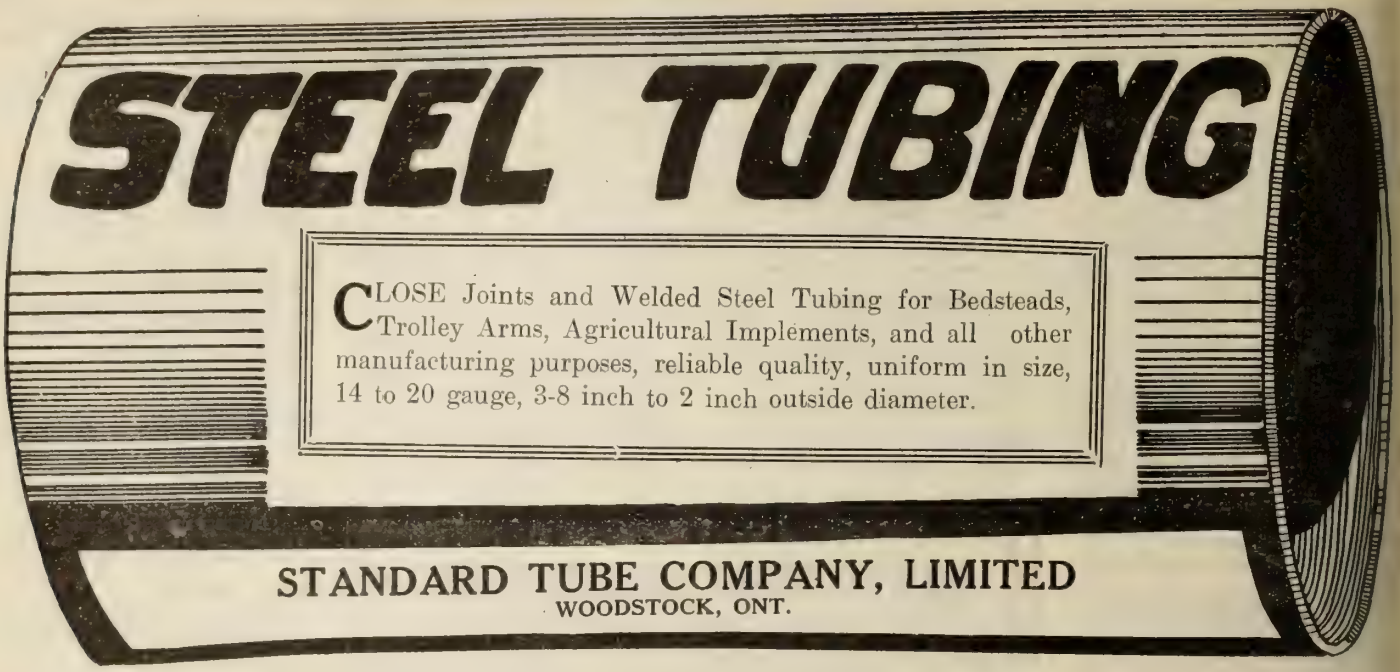
Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

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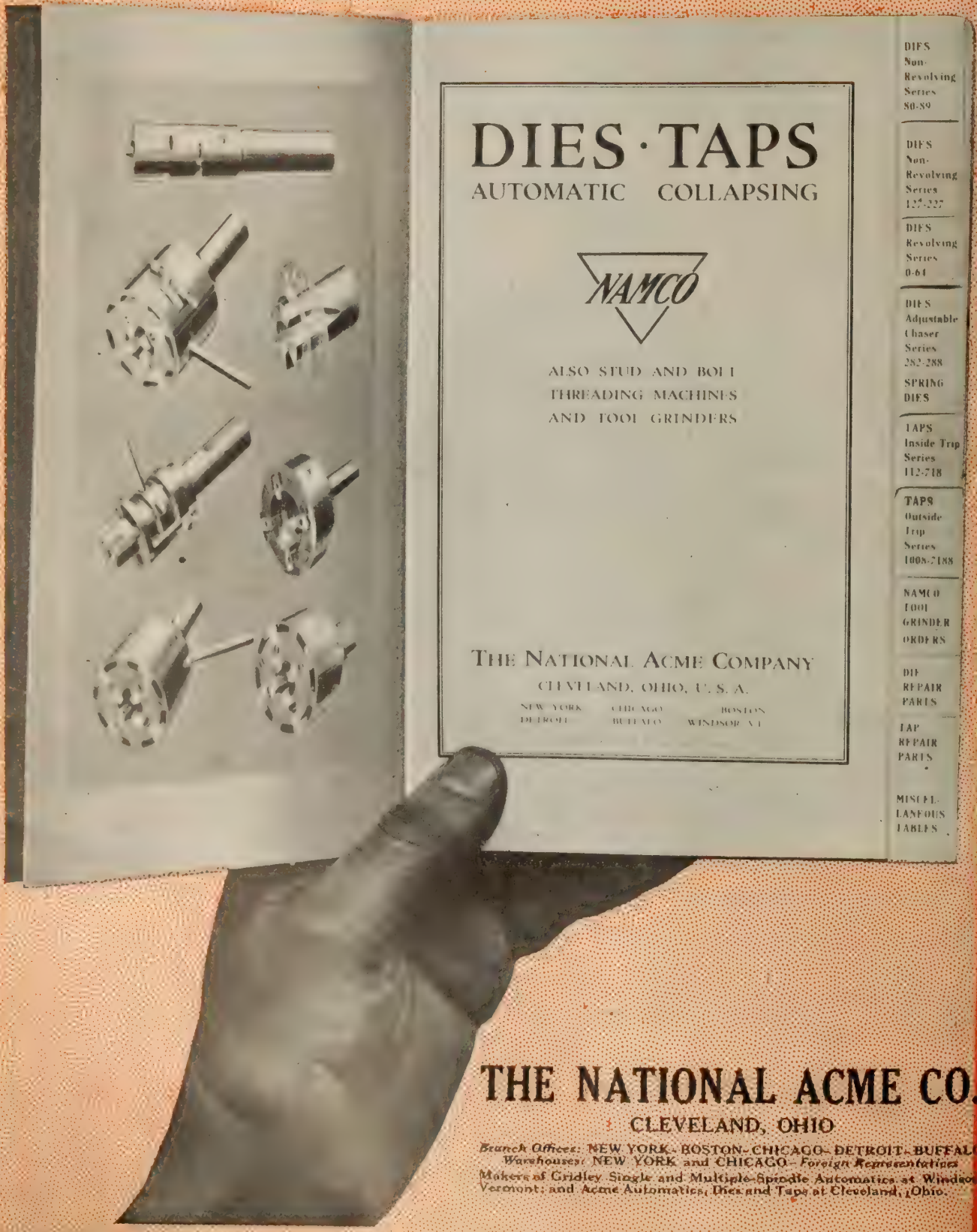
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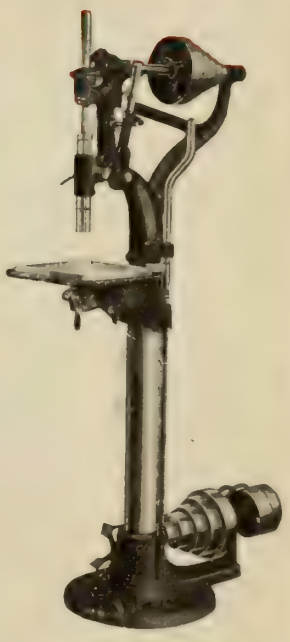


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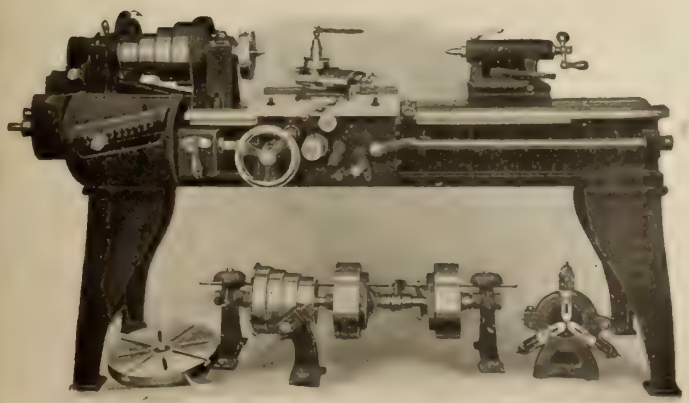
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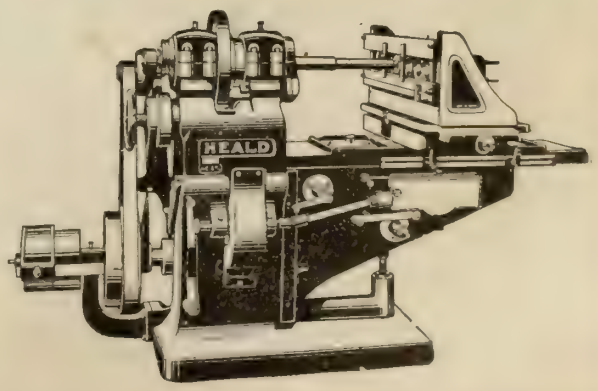


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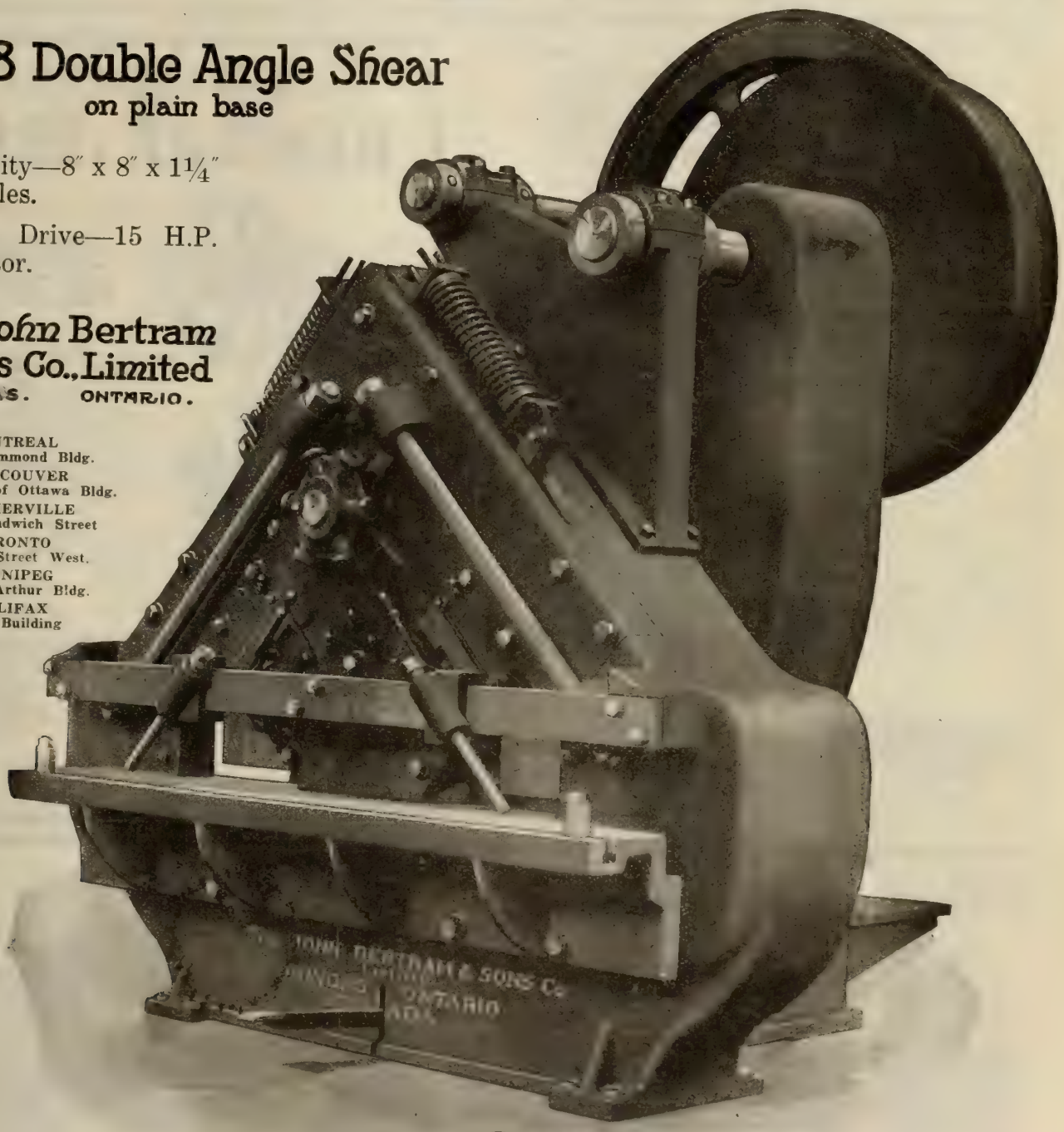
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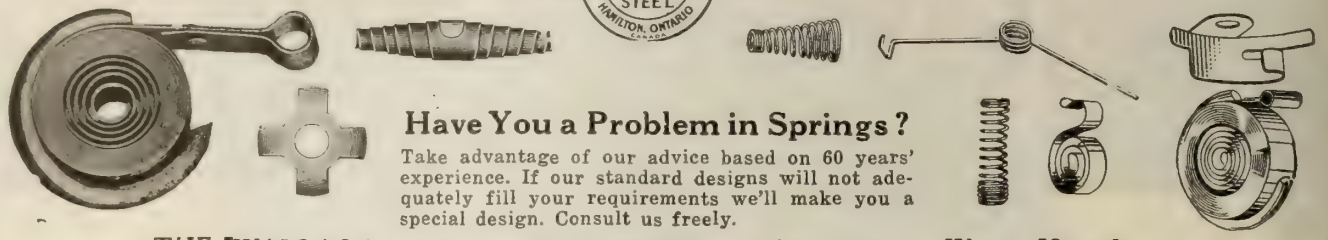
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In the final test of hard, severe service, Hepburn Power Presses forge away ahead of presses less strongly built. The cranks are made from solid forgings and give long strokes. There is first-class workmanship and a high finish to all our machines which distinguish them from cheap products. Let a Hepburn fill your needs. Get particulars on our Vertical Engines, Planers, Pumps, Cranes, Cut Gears and Castings.

JOHN T. HEPBURN Limited

Engineers and Iron Founders

18-60 VAN HORNE STREET, TORONTO, ONTARIO

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

M·A HANNA & CO

HANNA

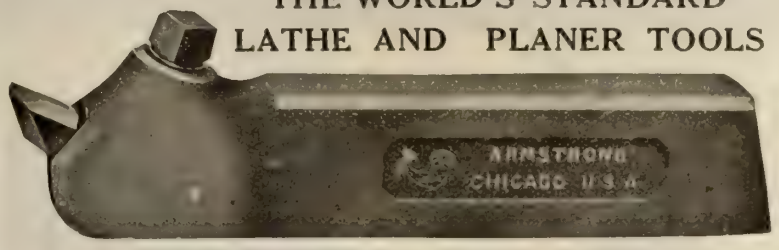
M.A. HANNA & CO.

Cleveland Toronto Cincinnati
Pittsburgh Buffalo Detroit

ARMSTRONG TOOL HOLDERS

Machine shops the world over, for more than a quarter of a century, have recognized Armstrong Lathe Tools to be by far the Best in lathe tool equipment.
Refuse to use imitations. Insist upon being supplied with "Armstrong."

THE WORLD'S STANDARD
LATHE AND PLANER TOOLS



By using Armstrong Tool Holders in your shop you will make one pound of High Speed Steel do the work of ten pounds in forged tools, save all forging and 70% of grinding.

Write for our catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.

ELK
BRAND
FIRE BRICKS
FOR
Quality and Service

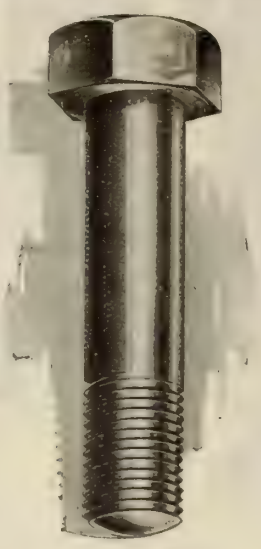
Remember—we make several qualities of Fire Bricks, all perfectly adaptable to the purpose for which they are intended. Now, here is where our Service stands you in good stead: we recommend the class of brick particularly suitable for your purpose. In other words, we do not sell you a costly high-class brick when another class of brick suits just as well.

Our Various Brands

"Elkco"	"Keystone"	"Elk Dust"
"Elkco" Special	"M. D. Elk"	"Keystone Dust"
"Elk Steel"	"Rotex"	"Rotex Dust"
	"St. Marys"	

When you select Elk Brand Fire Bricks you know you are getting the right quality. Our warehouse is well stocked to supply your immediate needs.

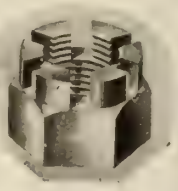
ELK FIRE BRICK CO. OF CANADA
LIMITED
Sun Life Building, HAMILTON, ONTARIO



ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited
GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.
Western Representative:
Mr. D. PHILIP
138 Portage Avenue, Winnipeg, Man.

Operators Prefer New Air-Tight Blast Gate

Detroit, Mich.
Air-Tight Blast Gates are giving very good satisfaction, and our operators prefer them to either valves or cocks for the air line.
LINCOLN MOTOR CO.

There are many reasons why—Low first cost and upkeep—Easily and quickly operated—Afford full area of the pipe.



NEW AIR-TIGHT BLAST GATE
Light, Strong, Compact, Inexpensive, Quick-Acting

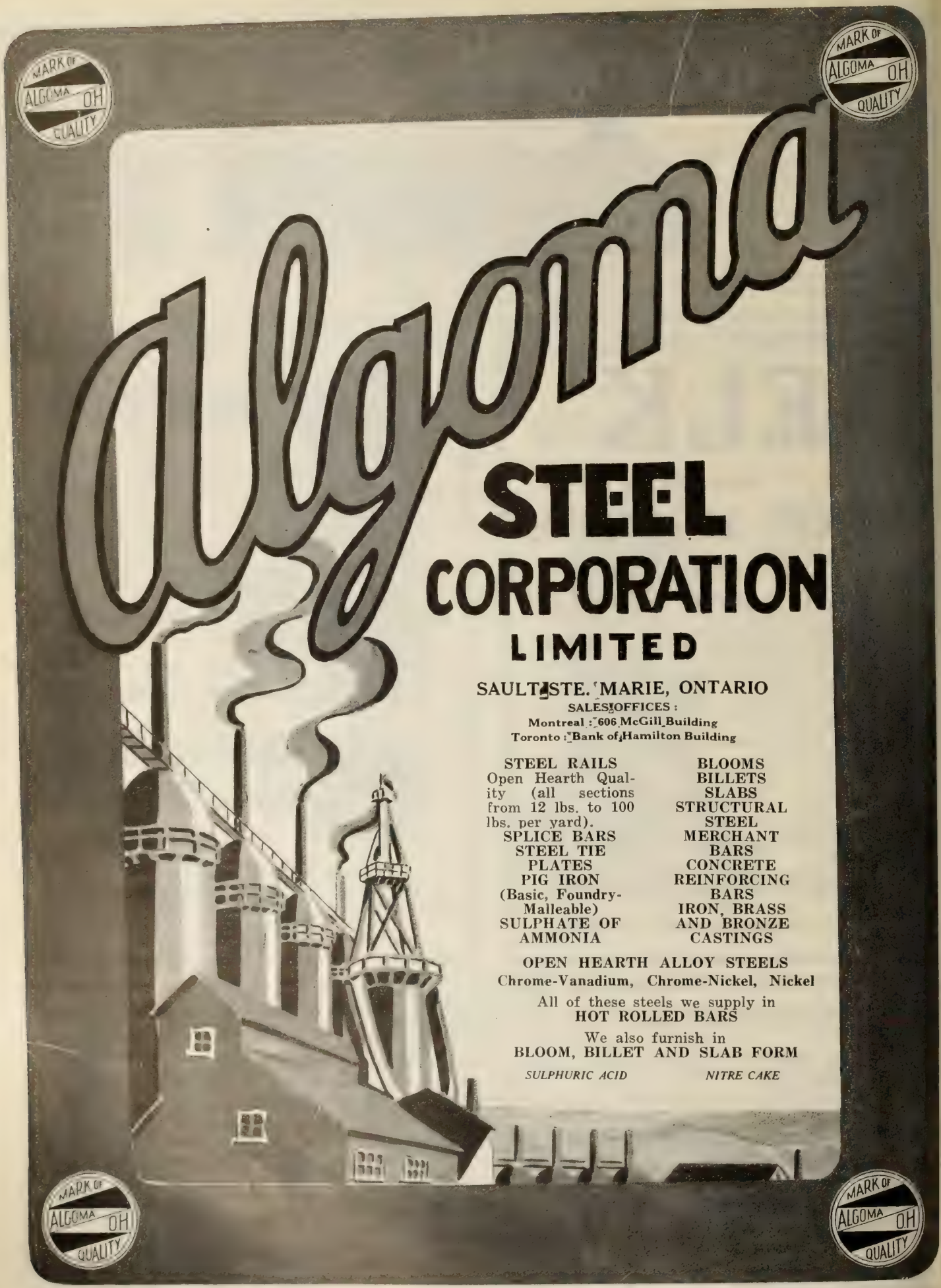
An ideal substitute for heavy, cumbersome, expensive and slow-acting gate valves and stop cocks.

This New Air-Tight Blast Gate is made in sizes from 2 to 16 inches, threaded and flanged. Descriptive circular 210—T gives detail dimensions of all sizes. Write for copy.

"Air is Free, but not Compressed Air."
W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St. (Hudson Terminal Building) New York
Canadian Distributors: Drummond, McCall & Co., Ltd., Montreal



GATE VALVE
Heavy, Cumbersome, Expensive, Slow-Acting


MARK OF ALGOMA OH QUALITY
MARK OF ALGOMA OH QUALITY
algoma
STEEL
CORPORATION
LIMITED
SAULT STE. MARIE, ONTARIO
SALES OFFICES:
Montreal: 606 McGill Building
Toronto: Bank of Hamilton Building
STEEL RAILS
Open Hearth Quality (all sections from 12 lbs. to 100 lbs. per yard).
SPLICE BARS
STEEL TIE PLATES
PIG IRON
(Basic, Foundry-Malleable)
SULPHATE OF AMMONIA
BLOOMS
BILLETS
SLABS
STRUCTURAL STEEL
MERCHANT BARS
CONCRETE REINFORCING BARS
IRON, BRASS AND BRONZE CASTINGS
OPEN HEARTH ALLOY STEELS
Chrome-Vanadium, Chrome-Nickel, Nickel
All of these steels we supply in
HOT ROLLED BARS
We also furnish in
BLOOM, BILLET AND SLAB FORM
SULPHURIC ACID
NITRE CAKE
MARK OF ALGOMA OH QUALITY
MARK OF ALGOMA OH QUALITY



Milled

PLAIN and CASTELLATED

Nuts

STANDARD

V. & U.S.S. Semi-Finished Nuts
V., U.S.S. & S.A.E. Cap Screws
V. & U.S.S. Set Screws
S. A. E. Plain & Castellated Nuts

SPECIAL

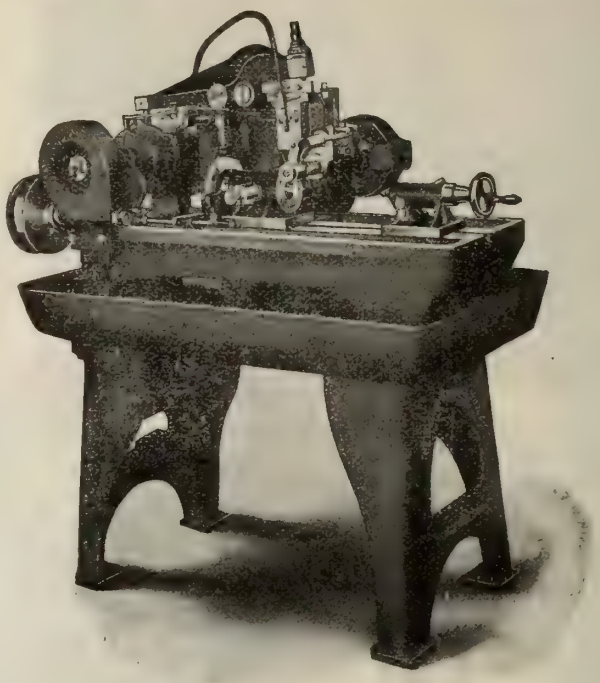
Screw Machine product up to 2¼" diam.—to specifications
Hardened and Ground screw product—to specifications.

THE NATIONAL ACME COMPANY

MONTREAL, P.Q.

Bilton

MACHINE TOOLS Bilton BRIDGEPORT



Gives You the "Newest" in GEAR MILLER Practice

The "newest" in Gear Miller Practice as interpreted by Bilton, is *more* work, *faster* work, and *better* work per minute.

The Bilton is a compact, up-to-the-minute machine, that easily and accurately produces plain and form milling, as well as serrating, notching, slotting, fluting, etc.
If you are interested in lower costs, get the facts about Bilton. Catalogue on request.

Bilton Machine Tool Company
Bridgeport, Conn., U. S. A.

FOREIGN AGENTS
Chas. Churchill & Co., Ltd. M. Mett Engineering Co.
Alfred Herbert Ltd.



Safe and Economical, Yet Cheaper Than the Old Way

Storage and handling of lubricating oils is an item which, if not given the proper attention, will add seriously to your costs of operation. Bowser Equipment will store and handle your oil safely and economically.

The Bowser Fig. 172 is designed especially for making small quantities of oil easily available. Equipped either with a 25 or 54 gallon tank, it takes a minimum of floor space. The Piston-Type Measuring Pump delivers quickly the exact amount required. The leak-proof tanks eliminate leakage.

A Bowser in *your* plant will show you worth-while savings.

Write for Illustrated Booklet C-13

Bowser Equipment is MADE IN CANADA by
S. F. BOWSER CO., Ltd., *1368 Fraser Ave.*, Toronto, Ont.

BOWSER ESTABLISHED 1885
PISTON-TYPE MEASURING PUMPS

BANFIELD

With a completely equipped factory covering over 100,000 square feet of manufacturing space and the machinery necessary, we are prepared to take care of your requirements in

Metal-Stamping, Drawing, Forming, Finishing, Assembling, Packing.

W. H. BANFIELD & SONS, LIMITED

370-386 PAPE AVE. - - - TORONTO

BOLTS

Machine Bolts Blank Bolts End Spring Bolts
Carriage Bolts Stud Bolts Cant Dog Bolts
Plow Bolts Bridge Bolts Coupling Bolts

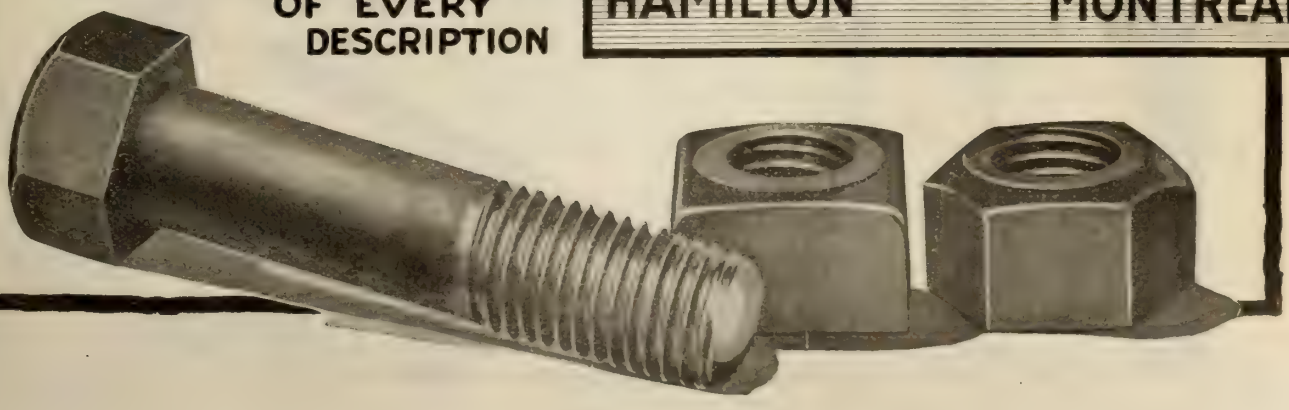
ALSO

NUTS, WASHERS AND RIVETS

OF EVERY DESCRIPTION

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL



THE JOHNSON FRICTION CLUTCH

Install a Johnson Lineshaft Drive

The practical experience of hundreds of our customers has established their belief in the Johnson Clutch Drive as the ultimate method of power transmission.

It replaces the countershaft, with its old fashioned tight and loose pulleys, and its troublesome overhead belting.

It avoids the expense of individual motors, and the waste of current they involve.

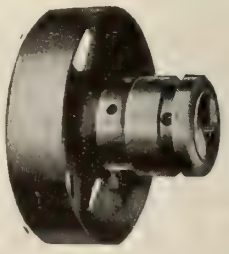
It substitutes reliable clutch control—economical in first cost, efficient in operation, durable under all kinds of service.

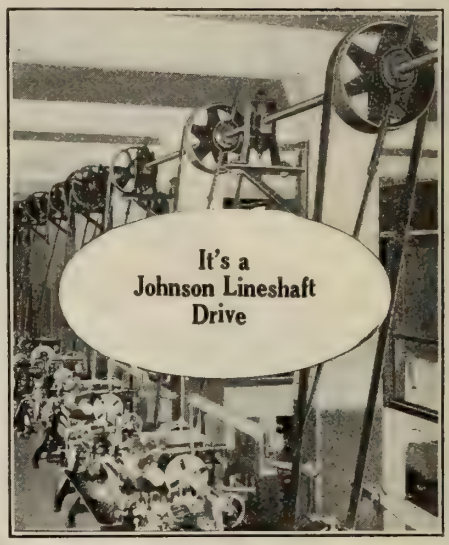
Friction Control Means Better Machinery

We specialize in friction clutches alone and can supply the right clutch for any drive. Hundreds of standard sizes in stock to fit all shaft and pulley dimensions.

"We are still using Johnson Clutches with very good success and have had them installed in our Nut Tapping Department for about ten years and at least half of that time they have been running night and day. We are also very greatly pleased with their operation in direct drives from lineshafts to lathes and other machines in our Machine Shop Department."

The National Screw and Tack Co., Cleveland, Ohio.





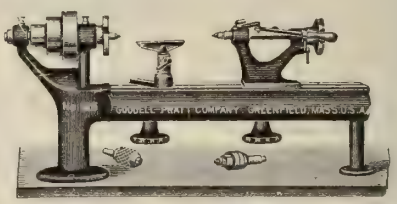
An installation made ten years ago on Lodge and Shipley Lathes. Still in perfect condition.

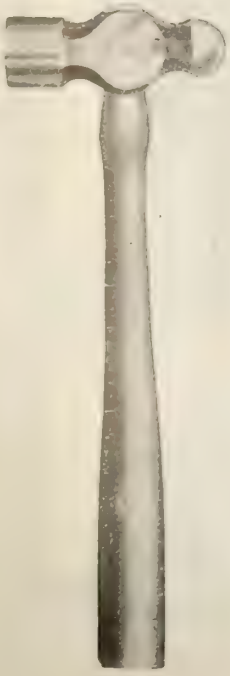
Write for our stock list and Yellow Catalog

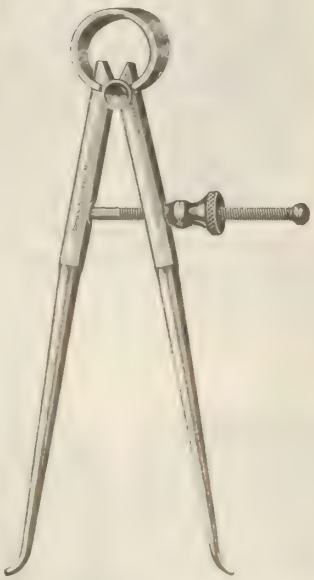
CANADIAN AGENTS: WILLIAMS & WILSON, LTD., 84 Inspector Street, Montreal
THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Machine Shop, Foundry, Factory and Construction Supplies

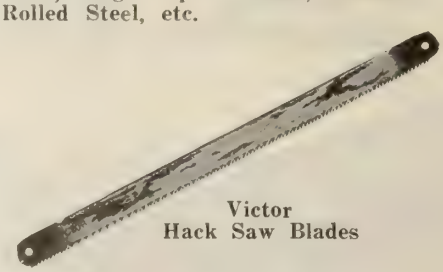






The Rice Lewis line includes Pipe Vises and Wrenches, Micrometers, Torches, Set Screws, Cap Screws, Machine Screws, High Speed and Carbon Drills, Files, etc., and Machinists' Tools of every description. We also have large stocks of Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.





Victor
Hack Saw Blades

RICE LEWIS & SON, LIMITED

19 VICTORIA ST., TORONTO, ONT.



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

Heavy Foundry and Machine Work for Machine Builders

Our Foundry Equipment enables us to handle work up to 75 tons per piece in Grey Iron or Semi-steel, mixtures to suit your requirements, clean castings of uniform quality and prompt deliveries.

Machining when required, Boring and turning capacity to 35 ft. diameter, 18 ft. high.

Your inquiries with blueprints and specifications will have prompt attention.

Dominion Engineering Works, Limited

Telephone Melrose 700.

MONTREAL, CANADA

Cable Address: "Domworks, Montreal."

R. F. MATHER, Western Representative, London Bldg., Vancouver, B.C.

(M-38)

LOWER COSTS
First Step to
BIGGER PROFITS

A CANADIAN Manufacturer was asked by a Lincoln Sales Engineer the other day if he was taking advantage of this slack period to check up on his factory costs. The manufacturer replied, "I suppose you want to talk to me about Electric Welding. We have done some welding in our plant, that is, Oxy Acetylene Welding, but most of the tanks and steel structures we build are riveted."

"Instead of talking Electric Welding to you, suppose I talk costs. You, no doubt, secure a certain number of repeat orders: in other words, you may get an order very soon to build a tank the same as you built once before. You know what your costs were in the previous case. Let us help you find out what your costs would be if this tank was electrically welded. You prepare the tank for welding with our co-operation. Send it to our shop in Toronto and either come to Toronto yourself or send one of your engineers to watch the work being done. You can check up on the time it takes, the material used, and the power required. With these three items you have the complete cost. You can then compare this with your previous method. We will give you a price on this welding if you want us to do it, or we will give you a price on a Lincoln Welder capable of handling this work and will supply you with an operator or train a man for you. This is as far as we can go. The rest remains with you. If your figures prove to you that you should buy an Electric Welding outfit now, or at some date in the future when business improves, you will do so without any persuasion on our part."



Compensation Case — A production job in our own factory using Electric Welding to reduce our costs.

The Manufacturer was impressed with this proposition but made the side remark that recently they had bid on a good deal of work which they had not secured, thus presenting another argument why he should lose no time in checking up his costs to see if he could not get them on a lower basis, allowing him to quote prices that will bring profitable business.

We maintain an Electric Welding shop in Toronto where we have handled during the past three years between two and three thousand jobs. We have just completed welding on the first two penstocks for the new Hydro Electric Power Plant at Queenston. Our shop practice and welding costs are freely available to any manufacturer in Canada, and we might say that during the past few months we have had frequent visits from shop superintendents, shop foremen, and engineers checking up on some particular piece of work with a view of reducing their factory costs or putting a new article on the market that will compete where they haven't been able to compete in the past. The Lincoln Electric Company of Canada, Limited, Head Office and Works: John Street, Toronto, Phone Adelaide 7200.

LINCOLN ELECTRIC WELDING



HENRY BERRY
& Company Limited.

LEEDS, England

Codes: A.I., A.B.C.(5th Edition), Engineering, Everybody's Pocket Code, Marconi International.

CANADIAN AGENTS:

Messrs. Fairbanks-Morse Company, Limited.

***Head Office*—Montreal**

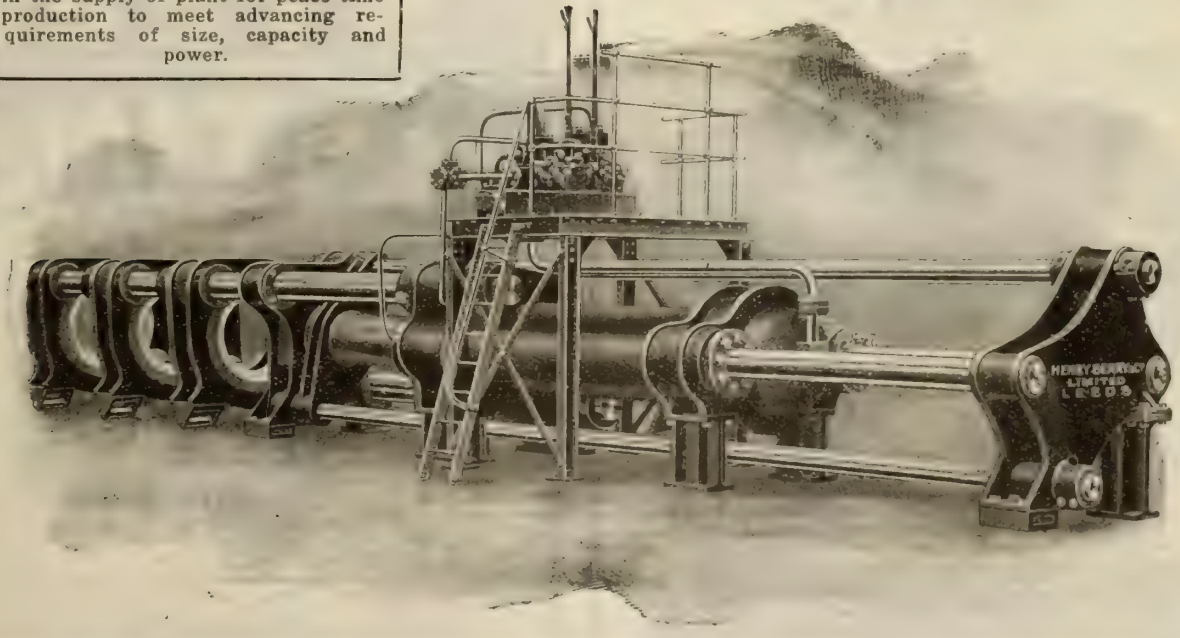
A Cradle Of Imperial Industry

Concerned for many years with the design and the manufacture of some of the largest types of machinery for the British Government, the Colonies and the Indian Empire, the firm of Henry Berry & Co. possesses some of the most extensive resources in the country for the production of the biggest, most powerful and most practical types of hydraulic machinery for Shipyards and Industrial Enterprises. These include all kinds of Shipyard Tools, Plate and Armour Bending Rolls, Rivetters, and Punching and Shearing Machines, Presses and Cranes.

Designs and estimates will be submitted to all requirements without charge. Prompt deliveries with full guarantee of Quality and Power.

750 TON PUNCHING & DRAWING PRESS

Pioneer manufacturers of hydraulic shell forging presses for the largest shells in use during the Great War, we are likewise always to the fore in the supply of plant for peace time production to meet advancing requirements of size, capacity and power.





STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL



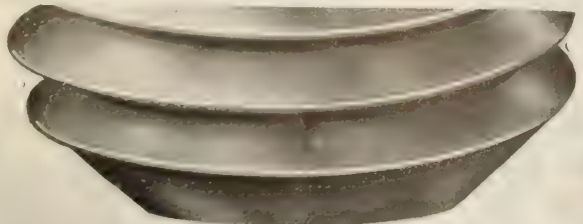
Steel Ingots
by the
HARMET
Liquid Process

TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE
PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.



Get copy of new Bulletin I-810
THE BRISTOL COMPANY
Waterbury, Conn., U. S. A.

STEEL CASTINGS

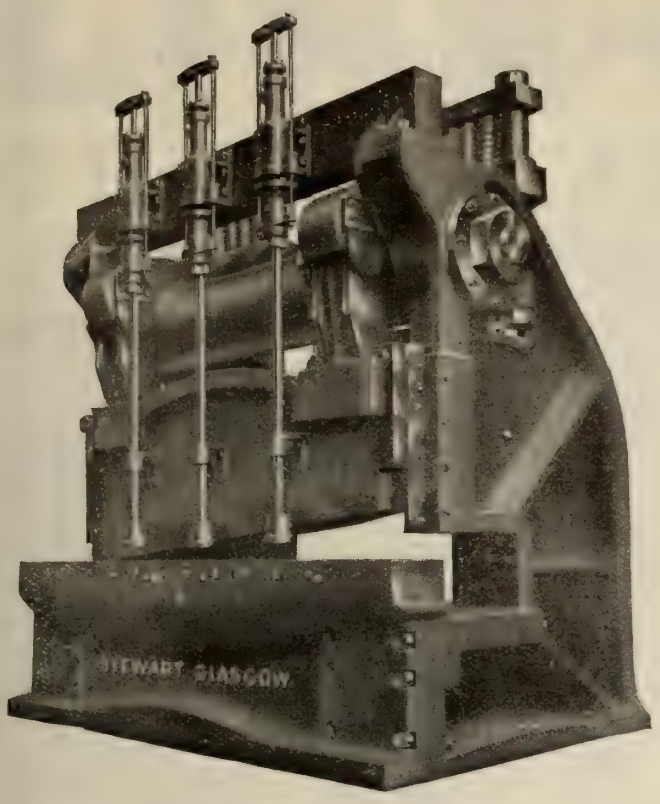
QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLIS HED 1860



1¾ in. x 8 ft. Steam Hydraulic Plate Shears

Steelworks Plant and Hydraulic Machinery

ROLLING MILLS
BLOOM, SLAB, BILLET AND PLATE SHEARS
FORGING PRESSES
TUBE DRAW BENCHES
TROUGHING PRESSES
HYDRAULIC PUMPS

Duncan Stewart & Co., Ltd.

LONDON ROAD IRON WORKS
GLASGOW
ESTABLISHED 1864

All who are intent upon obtaining

Increased Works Output

SHOULD SUBSCRIBE TO

Engineering Production

The British Journal of Works Practice and Administration

IT IS the recognized British journal for the dissemination of practical information and new ideas relating to modern works practice, administration and control, and is the official organ of the newly-formed Institution of Production Engineers.

Published weekly. Price 6d. Annual Subscription: 39/- post free

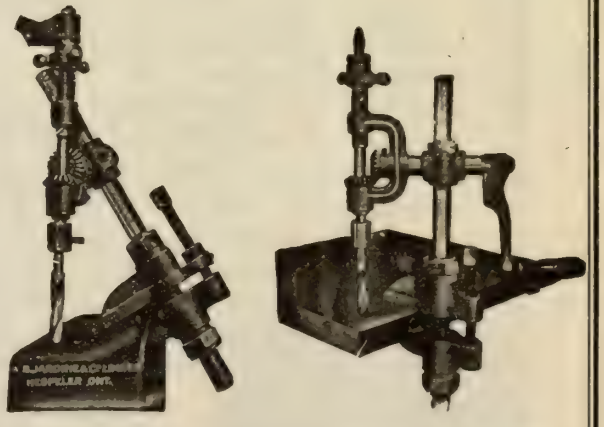
A specimen copy will be sent free of cost upon application to the publishers.

May we send YOU a copy?

ILIFFE & SONS, LIMITED
20 Tudor St., London E.C.4, Eng.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

Bright Spots In The Industrial Outlook

NO. 4

The accompanying cartoon aptly illustrates the lesson we have been endeavoring to inculcate by this series of advertisements, viz., that the present trouble with business is not so much that buyers refuse to buy as that sellers have discontinued their efforts or have made no special efforts to sell. We have given instance after instance of companies who have increased their business this year in spite of the general depression, yet in the very same lines in which these firms are engaged there are others who are bewailing the fact that business has gone to pieces.

Various reasons have been stated by the firms whose records we have given for the gratifying results reported, but one feature is always present, that is, increased sales effort. This is evidently the indispensable method which must accompany every other form of special endeavor.

Business can be secured by energetic salesmanship, judicious advertising to the merchant and to the general public is more essential and more important to-day than ever before. Our contention that where there is a will there is a way has been conclusively proved and it rests with each manufacturer or merchant himself to devise exceptional methods to keep business moving at its normal level or to increase it, instead of being content to sit still and await the coming of better times.

What's Wrong? What's Wrong?



Darling in Des-Moines Register

Moral: It isn't the public that has quit spending so much as it is business that has quit selling.

You can send your sales message throughout Canada from Coast to Coast by means of the following MacLean publications, all of which are members of the Audit Bureau of Circulations. Information regarding circulation, advertising rates and fields covered will be furnished on application.

The MacLean Publishing Co., Ltd. 143-153 University Ave. Toronto

Publishers of:-

The Financial Post
Canadian Grocer
Hardware and Metal
Dry Goods Review
Men's Wear Review
Bookseller and Stationer
Canadian Machinery
Canadian Foundryman
Druggists' Weekly
Power House
Canadian Motor and Implement Trade Journal
Marine Engineering
Printer and Publisher
Sanitary Engineer
MacLean's Magazine
Farmers' Magazine

LINK-BELT

CRANES AND HOISTS



THE Locomotive Crane is one of the most satisfactory machines for handling material, where conditions are right for its use. Today such a machine is low in initial cost—the upkeep is low, one man can operate it, and it can work for years, with ordinary care.

Practically the same thing can be said about the Link-Belt Electric Hoist—for lighter loads. Experienced plant operators found out years ago that it pays to handle material by machinery. Let us study your conditions, and make you recommendations. Catalogs and full particulars sent on request.

CANADIAN LINK-BELT CO.,
Limited
Toronto - Wellington and Peter Streets.
Montreal - 10 St. Michael's Lane

Upper view shows 40-ft. span, 3-ton, overhead, electric traveling crane handling ladle of metal in a foundry

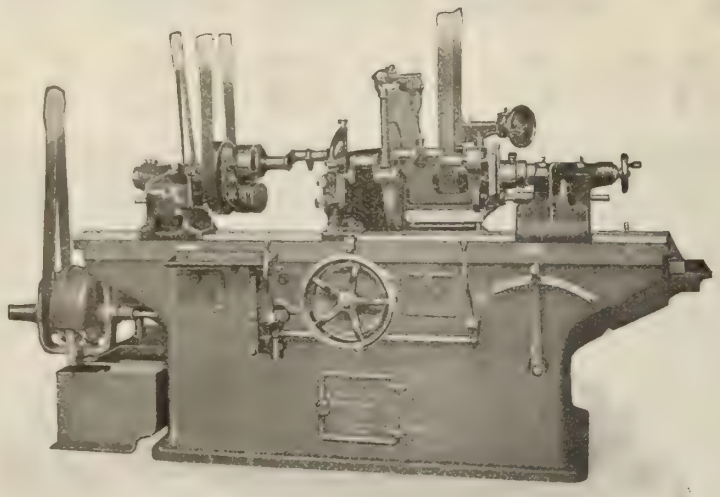
Circular insert shows Mono-rail cage-operated electric hoist, delivering raw materials to cupola charging floor at steel foundry

Lower view shows Steam-operated Revolving Locomotive Crane handling billets



LANDIS

No. 4A SPECIAL GRINDING MACHINE



The Landis Grinding Machine can perform all the operations necessary to put the gasoline motor in first-class condition and repaired as good as new. The installation of one machine in your shop is not limited to work of any special nature, it is designed to handle any grinding operation connected with the repairing of automobile, truck, tractor and other gasoline engine parts.

Let us show you what Landis Machines can do for you. Write to-day for literature.

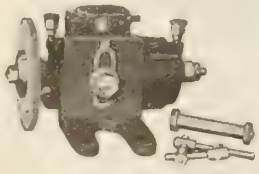
LANDIS TOOL COMPANY

Waynesboro, Pa. **New York Office: 51 Chambers Street**

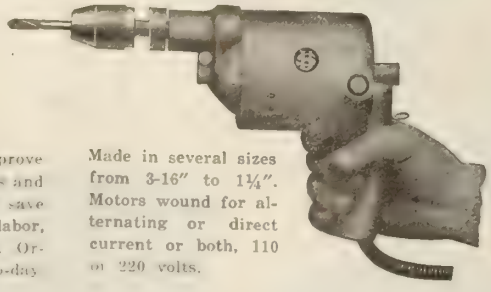
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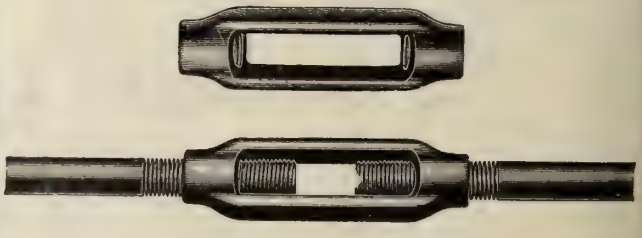
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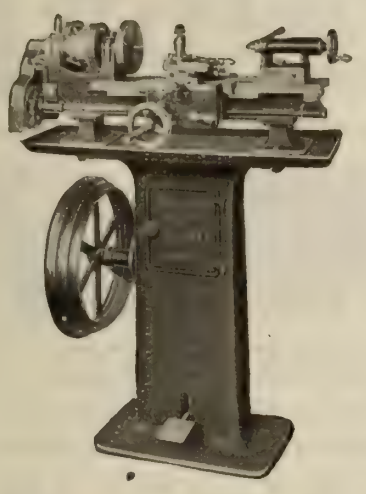
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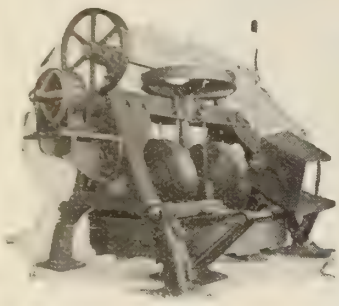
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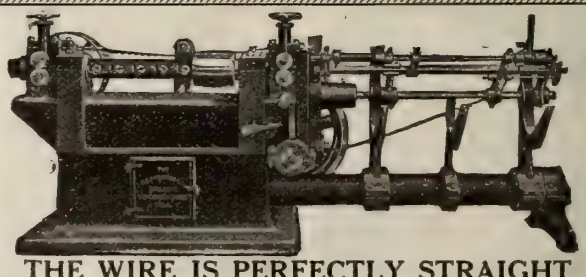
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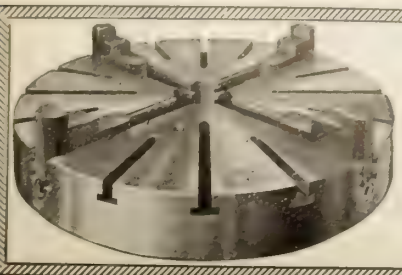
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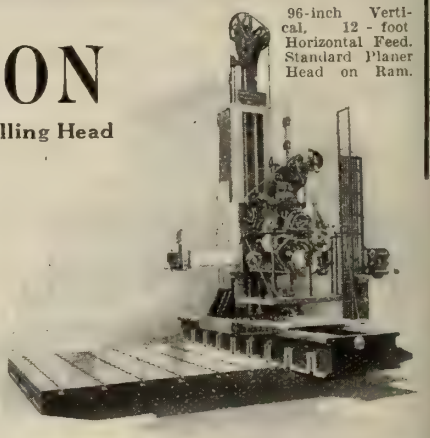
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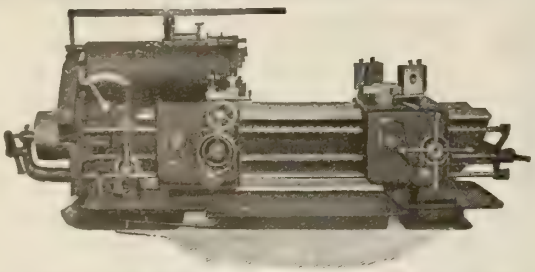
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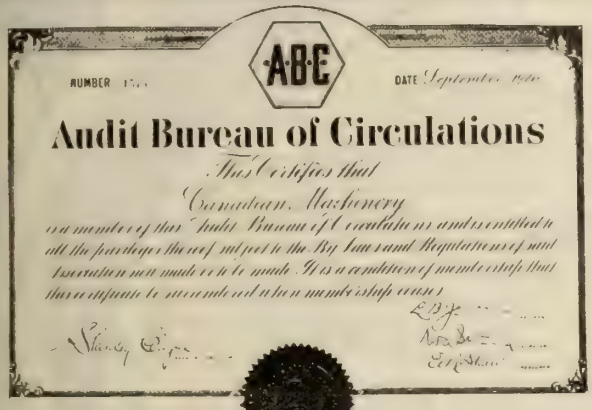
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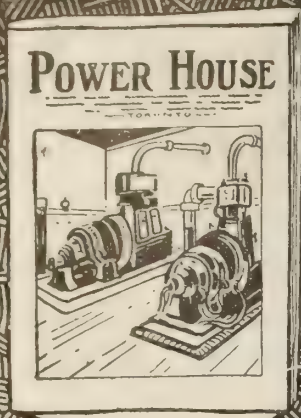
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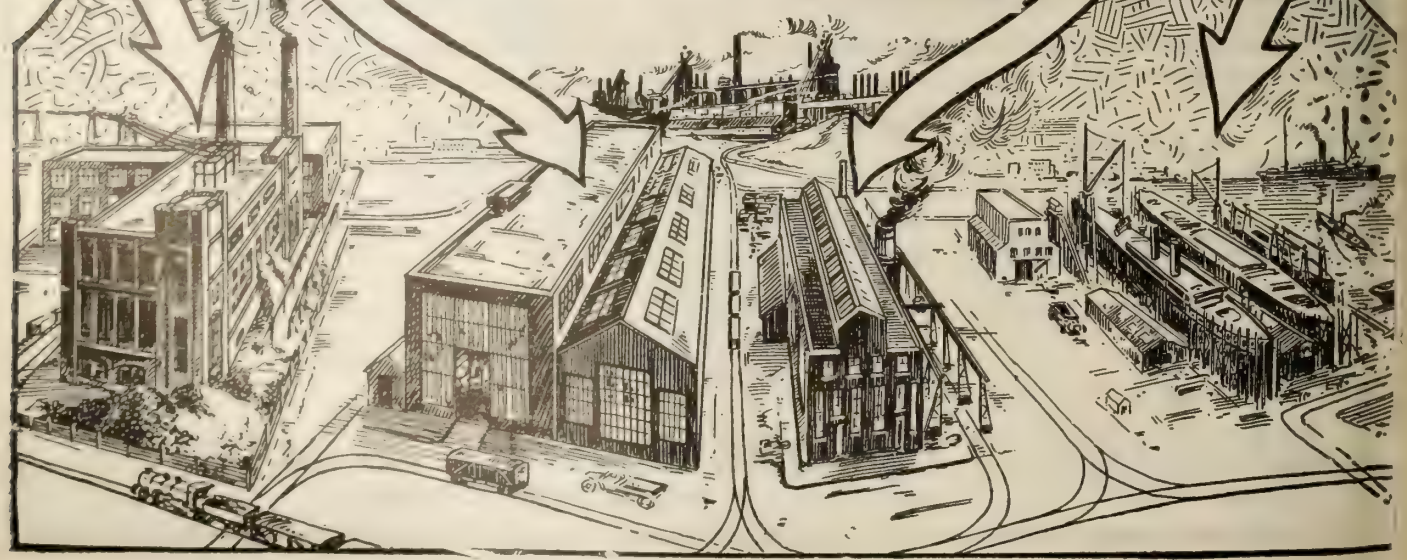
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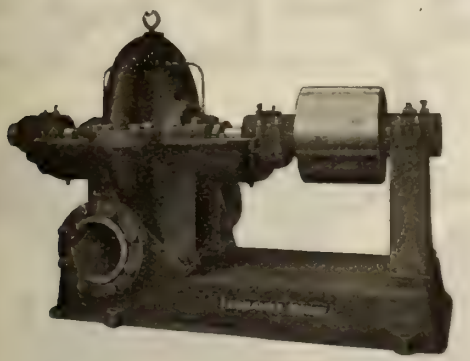
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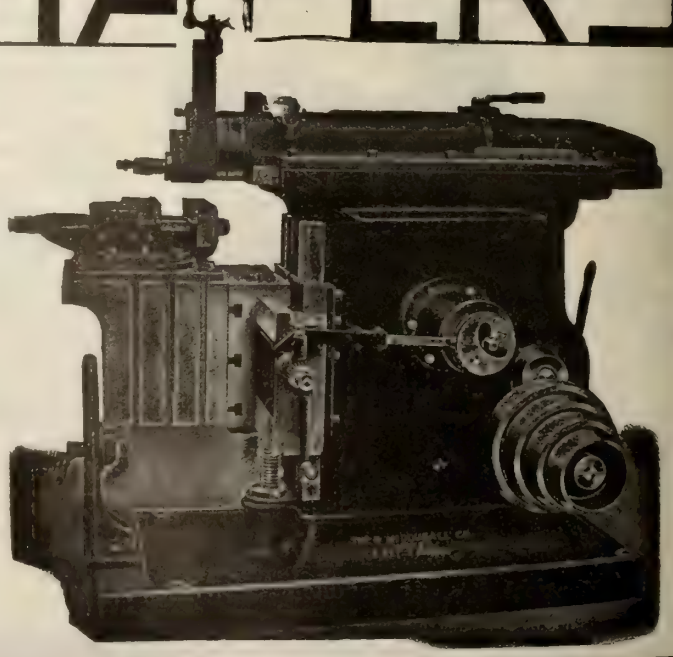
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VOL. XXVI No. 23 DECEMBER 8th, 1921

Problems Met With In Machine Shop Work

Machining an Adjustable Shaft Support—Fixtures Used on Different Operations—Widening Standards on a Planer—Rigidity Maintained—Overhanging Work Support for Open Side Planer

Machining Adjustable Shaft Support

By F. Scriber.

TO OBTAIN the desired degree of accuracy on many classes of work, it is advisable when machining the same to take into consideration the relation of the finished surfaces of more than one part, or in fact of several parts, before deciding on the method of tooling or machining any one part. After consideration of the portions A and B, Fig. 1, it was decided that the best method to be followed in machining was to handle them together as one unit throughout the various operations, followed by finally cutting them apart.

With this end in view the following sequence of operations was decided upon: First, drill hole C, spot face one side of this boss, and the same side of bosses D and E, also drill, ream and tap hole F, followed by spot facing of boss G. Second: mill three bosses at reverse side of piece. Third: mill both vee grooves and lug H, making three settings; fourth: saw apart at J, thereby completing the machine work. To accomplish this jigs or fixtures are provided which are illustrated in Figures 2, 3 and 4, a description of each, together with the method of using, is given below.

Referring to the drill jig, Fig. 2, the work A is located by the boss in a vee block B, it being necessary to rest the boss on a bushing C. At the extreme end of the boss having the tapped hole in it, another vee block D, is provided which locates that end; a clamp E, being used, which is cut away in the centre to provide two spots, which in addition to clamping the end, squares the work from the long vee boss against which it clamps. This clamp is pivoted at F, and a screw, G, is used for tightening purposes, while spring H, pushes the clamp away from the work when it is desired to remove the same. In addition, a screw, J, in combination with a screw, K, supports the other end at the boss. These various units securely hold and locate the work from the rough casting while the holes are drilled, reamed, tapped and the bosses at the open side of the jig are faced together with the boss at the tapped hole. Slip bushings are used for guiding the drills and reamers, the same being removed while spot facing and tapping.

The next operation, which consists of spot facing, the three bosses at the side opposite to that which was machined in the jig, is done by vertical milling, using the fixtures shown at Fig. 3 for holding the work. At this time advantage is taken of the bosses previously machined for locating purposes as the work rests

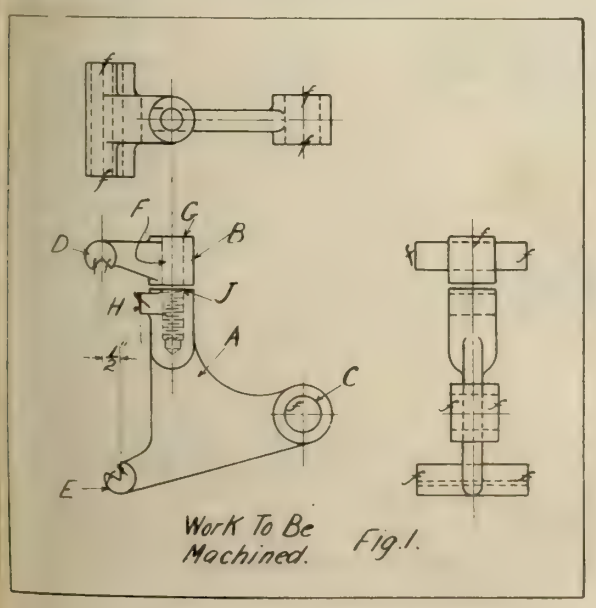


Fig. 1.—Showing the Shaft Support.

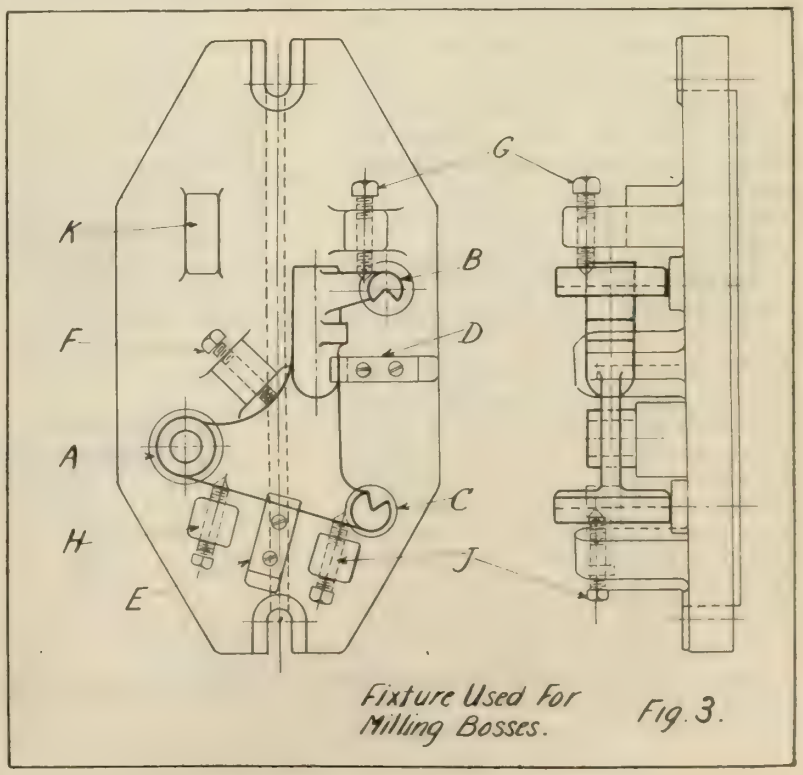


Fig. 3.—Fixture Used For Milling Bosses.

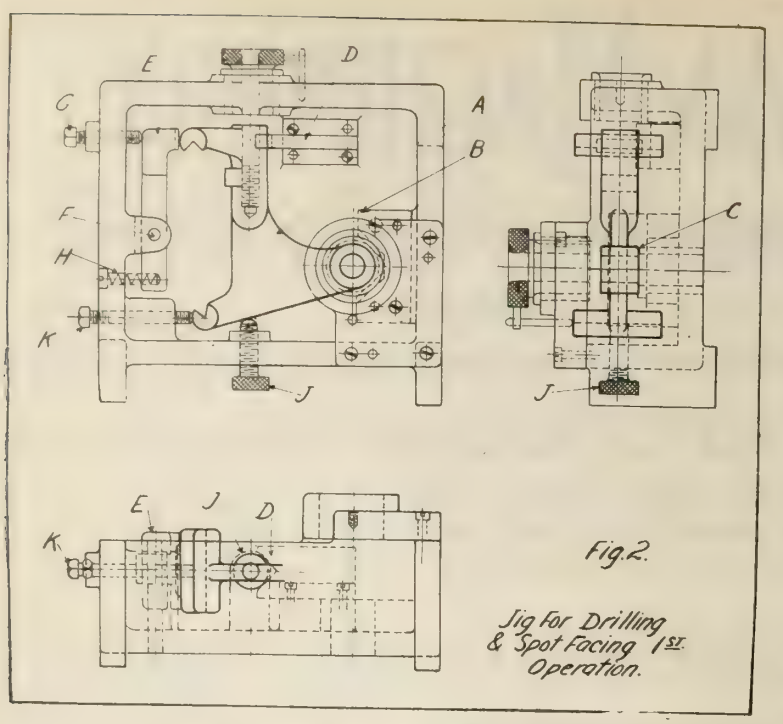


Fig. 2.—Drilling and Spot Facing Jig.

at A, B, and C, on finishing lugs on the fixture casting. In addition a block D, and a block E, are provided, against which the work is pushed by means of the set screw F. Following this the screw G, is tightened against the work to securely hold the boss at that end against the strains of the milling cutter. Screws H and J are then tightened to hold securely the respective bosses, and it is found in practice that this arrangement makes a very substantial holding method for performing the vertical milling operation. It will be noticed that on this fixture a finished surface K, is provided, the object of this being that blocks of suitable thickness may be interposed between this surface and the milling cutter for setting, so that the bosses will be milled the correct length measured in a vertical plane.

Perhaps the most interesting part of machining this piece is that done in the fixture, Fig. 4, three settings in the same fixture being necessary for milling the two vee slots and the finished pad. At this point it is advisable to locate from the hole A, by means of a plug over which the work is slipped. A pin B, is then pushed in the other hole to locate the work radially about the stud at A, and this is clamped by set screw C. A large strap D, having lugs at its three extreme corners is held in place by a set screw E, entering a hole at its center. This is used to clamp the work, it being of very substantial nature.

It is found to be sufficient to hold the same in place, as the fixture is fed so that the strain of cutting comes against the solid wall of the fixture. It will be noted that in clamping the work, it rests against a shoulder on the stud at X, and the finished surfaces Y and Z, of the fixture wall. It will be obvious that formed cutters held in a vertical plane are used to mill the vee grooves, while a plain surface mill is used for the lug. To complete the machining of this piece all that is necessary is to set the piece up on a milling machine using a vise to clamp the two vee bosses while it is sawed apart at J, Fig 1, thus the two pieces which are both marked with the same number are machined so they will work together with very little fitting when mounted in place on the slide of the machine to which they fit.

Two Planer Hints of Value

By H. A. WILSON

A rather unique method of increasing the capacity of a planer, in so far as width of work accommodated between standards is concerned, may be seen in the shop of the Dominion Engineering works at Rockfield, P.Q. The machine on which the extension was made is a 60 inch x 60 inch Pond planer. The standards were opened up about 21 inches. On the side of the planer, remote from the drive, a large block casting, suitably cored out, has been placed between the standard and the main frame of machine. The shorter studs that originally held the standard to the frame have been replaced by longer studs which are screwed in the frame and pass completely through the extension block, on through the standard, against which the nuts are tightened, clamping the whole structure together.

A similar method of extending the casting which bridges the standards at the top has been employed. In this case, however, the original casting permitted the use of bolts instead of studs. In both cases slots or shoulders have been planed in the extension blocks to accommodate the design of the original pieces, assisting in the locating and holding of the various parts when assembling, and lending rigidity to the machine under operating conditions. The bevel pinion shaft which operates the screws raising and lowering the cross rail has been extended by use of a long sleeve coupling, hooking up the two pieces of shaft. It was found that the old cross rail could be refitted to the standards after they had been widened out. Two heads are mounted on the cross rail.

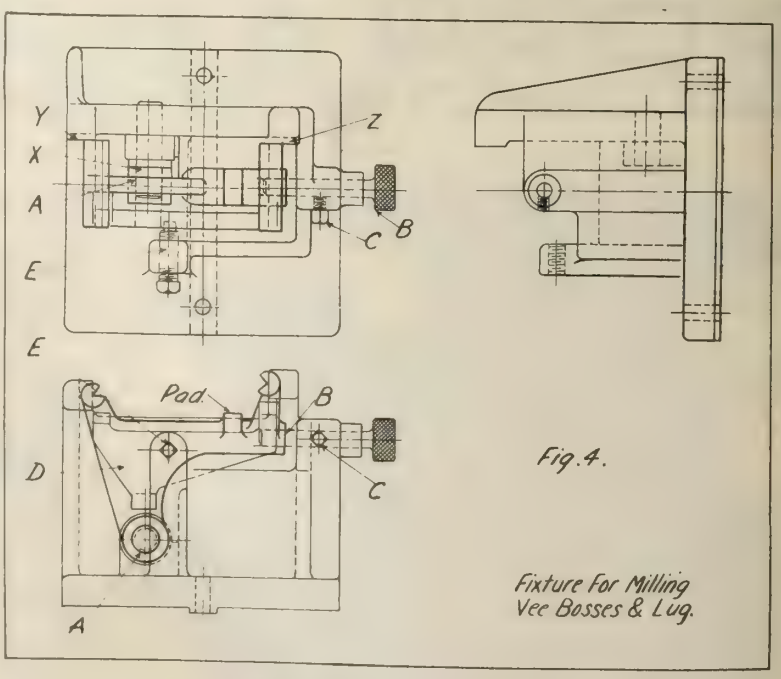
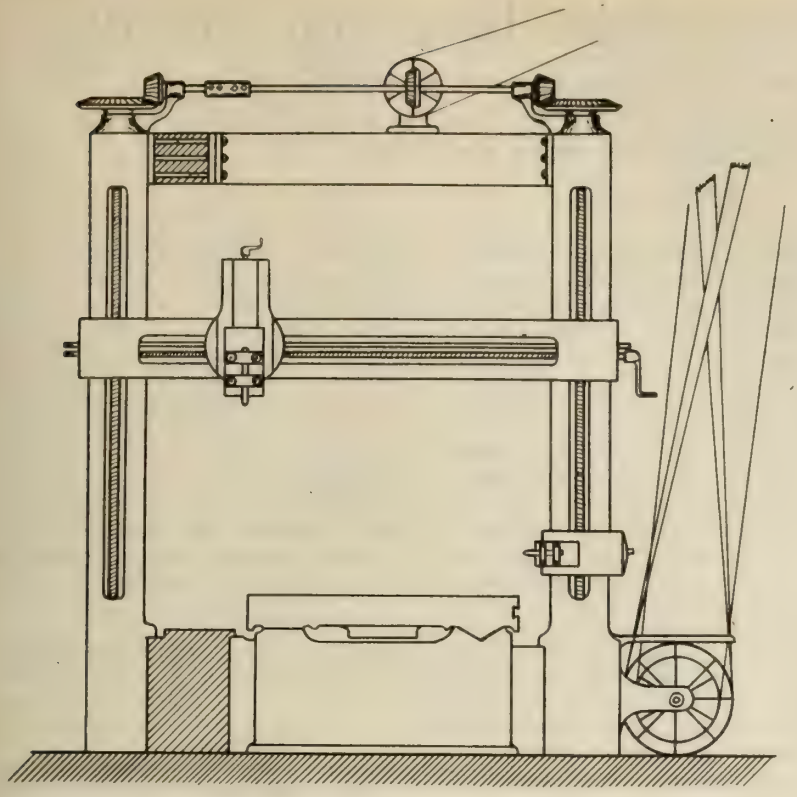


Fig. 4.—Fixture Used to Mill Vee Bosses and Lug.



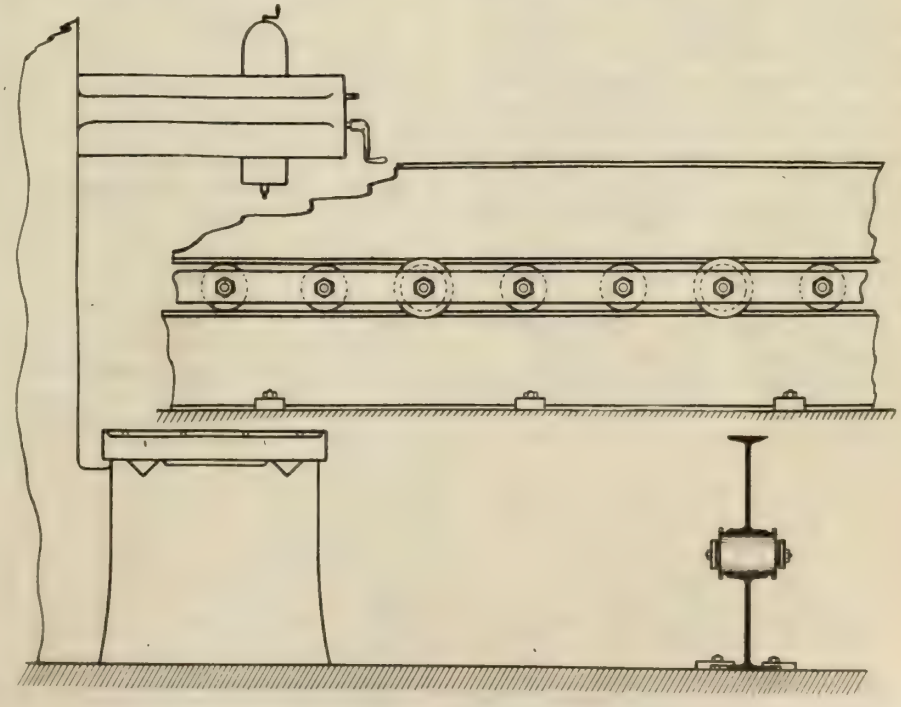
Sketch Showing How Planer Was Widened.

The significance of this bit of engineering is not realized at first glance. When one considers ordinary planer jobs, it is not once in a blue moon that the capacity of a planer, in height accommodated under the cross rail, is taxed, but it is a common trouble to get work in hand that won't pass between the standards. This sixty inch machine will take in a piece nearly seven feet wide, yet none of the rigidity of the machine has been sacrificed. The table has not been increased in width and therefore all the good points of the smaller machine have been retained with the added capacity thrown in. The outfit has been grouted in cement and is a permanent fixture. Another feature is that the cost of the whole job has been very moderate.

OVERHANGING WORK SUPPORT FOR OPEN SIDE PLANER

Frequently a job of planing some very wide casting is routed to an open side planer of moderate dimensions. Ordinarily great difficulty would be experienced in holding the work during the machining operation. The writer recently ran across a very simple, but yet ingenious little fixture which enables the Dominion Engineering Works to handle very bulky pieces on a small open side planer.

A 12-in. I beam is strapped to the floor, its length being only slightly less than the length of the V slides in the frame of the machine. The flanges of this beam are 5 1-2 inches wide. On the top of this I beam are placed a number of turned C. I. rollers 6 inches diameter and 7 inch face spread at 12 inch centres. Each roller is mounted on a steel pin 1 1-2 inch diam. and theee pins pass through two steel side bars 3 1-2 inch by 1-2 inch being held by nuts as shown in Fig. 2. Every third roller is flanged and has a face of 6 inches between flanges. On top of these is placed another 12-ich I. The top of this latter I beam is flush with the top of the planer table. Work wide enough can rest on this top I beam and be supported in this way. As the apparatus is placed about eight feet from the near side of the planer table often there are jobs that will not reach out to the rollers. Parallel bars, however, can be stretched across the gap and work bolted to the table using the bars as packing pieces. It is a simple little apparatus but an extremely useful one on many occasions.



Overhanging Work Support Which Is Found To Be Very Useful.

A DIRECTION INDICATOR

The look-out man on a ship is now able to directly indicate whatever information he desires. A British firm has brought out a special look-out telegraph which enables a man to transmit to an indicator, which may be fixed at any point of the ship, information regarding the exact bearing of any object he has sighted. The look-out man observes the object through a simple form of open sight which can be raised or lowered as well as turned around; and when he has sighted the object he touches a bell to give notice to the navigating officer that something has been sighted. At the same moment the pointer on the indicator shows how many degrees to port or starboard the object is. A reply circuit is provided so that the navigating officer can inform the look-out man that the information has been received. By mounting the indicator in a particular position the pointer can be regulated to point in the direction of the object sighted. The same firm has introduced another electrical appliance for mounting the revolutions of an engine or other machine. The principle involved is quite novel and very little energy is required to operate the appliance, which gives very accurate readings.

A Neglected--Yet Most Essential Study

Machinists Should Make It a Point to Learn Workshop Trigonometry—It Is Not as Difficult as Some Imagine and It Lends Itself to Many Machine Shop Problems

By J. DAVIES

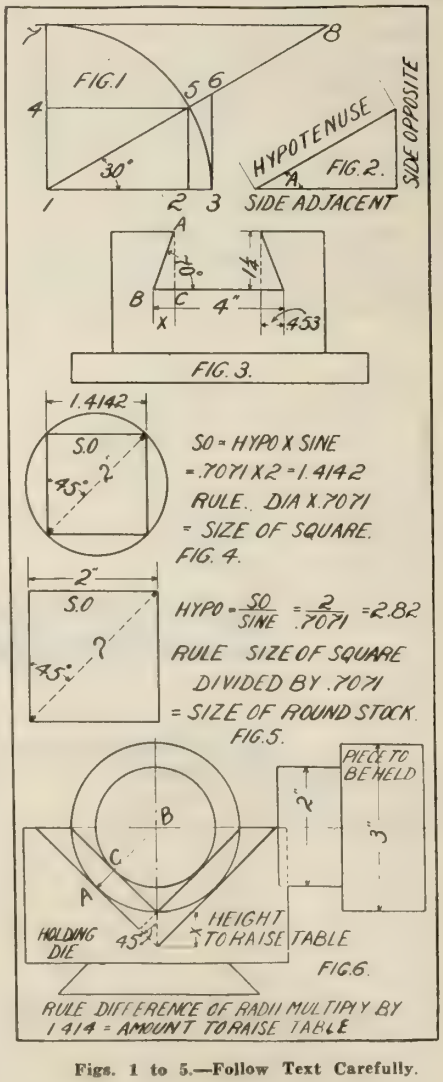
WORKSHOP trigonometry is the most useful form of mathematics for the machinist, yet, somehow or other it is the most neglected. Most shopmen, as soon as they run up against any formula that requires a knowledge of trig., conclude that it is too hard for them, whereas an elementary knowledge of such is as simple as any other form of arithmetic. It is really a system of constants based on the fact that there are always fixed proportions between the sides and angles of triangles and other figures.

A table of trigonometrical functions or tables is included in most machinist handbooks, or can be bought at any bookstore for a few cents. These tables give the exact proportions of various parts of a right angle triangle. The figures given are simply multipliers or constants for a Radius of 1", or for a right angled triangle whose hypotenuse is 1". For any other radius we multiply the number given in the table by the radius we are using. These tables form the most convenient and accurate method of solving many shop problems as will be shown.

The tables can represent anything such as inches, feet or meters, and the answer will be in the same unit, but we will confine our workshop calculations to inches only. Everything is based on the radius of a circle and the figures in the table are all based on a radius of one inch. Figure 1 is a circle whose radius is one inch lines 1 to 3, and lines 1 to 7 are the radii and form a right angle with each other. To show the different functions of the angle, we will construct an angle of 30 degrees. Line 1 to 5 represents the hypotenuse and is also the radius. A line dropped from 5, meeting the line 1 to 3, and being perpendicular to it is called the sine, and is shown by line 5 to 2. Line 1 to 2 is the cosine. A line tangent to the circle 3 to 6, and meeting the line 1 to 5 extended, is called the tangent. A line tangent from 7 meeting the line 1-5 extended to 8 is called the co-tangent. These are the principle functions, the others can be seen by reference to the figures.

Lines 1 to 3, and 1 to 7,=Radius.
1 to 2=Cosine
2 to 3=Versed sine
4 to 7=Co-versed sine
2 to 5=Sine
3 to 6=Tangent
7 to 8=Co-tangent
1 to 6=Secant
1 to 8=Cosecant.

It must be distinctly understood that the angle refers to one side of the center line only and not to the total or included angle. The reading of the tables is very much like reading a railway time table. On the left a table of angles 0° to 45° are found, and from this column and the columns marked at the top by the word sine, tangent, etc. The value of these ratios may be found for any given angle, at the right, and usually reading from the bottom up, these angles are continued from 45° to 90°. The ratios for these angles are indicated at the bottom of each column. Thus given an angle of 20, we find 20 marked in the column representing the angle, and corresponding to this in the column marked sine we have the figures .34202. Thus, sine of 20 is .34202. By referring to column marked tangent and cosine, we find tan of 20 is .36397 and Cosine of 20 is .93969. To find values for an angle greater than 45, say 65, look in the right hand column marked sine, etc. At the bottom reading upwards and we find the sine of 65 to be .90631. All the different ratios for any angle are read in the same manner. Every right angled triangle contains three sides and three angles. Perhaps they can best be remembered by reference to Fig. 2.



Figs. 1 to 5.—Follow Text Carefully.

Suppose A is the angle under consideration. The long side is always the hypotenuse. The side next to angle A is the adjacent, and the third side is the side opposite. By remembering this simple explanation the following formulas can easily be applied.

$$\text{Sine} = \frac{\text{Side opp.}}{\text{Hypot.}} \quad \text{therefore Side opp.} = \text{Hypot. x sine}$$

$$\text{Cosine} = \frac{\text{Side adj.}}{\text{Hypot.}} \quad \text{therefore Side. adj.} = \text{Hypot. x cosine or side opp.} = \text{side adjacent x tangent}$$

$$\text{Tangent} = \frac{\text{Side opp.}}{\text{side adj.}} \quad \text{therefore Side. adj.} = \text{Co tan x side opp.}$$

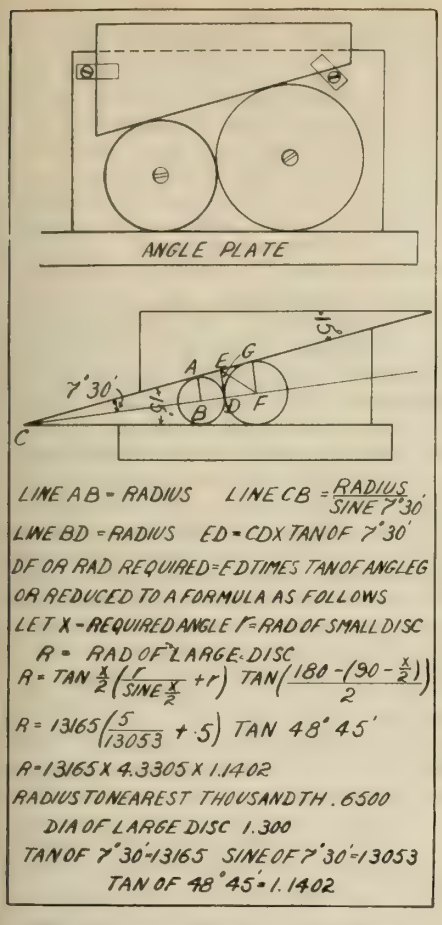
$$\text{Cotangent} = \frac{\text{Side adj.}}{\text{Side opp.}} \quad \text{therefore}$$

$$\text{Hypot} = \frac{\text{Side adj.}}{\text{Cosine}} \quad \text{or}$$

$$\text{Hypot} = \frac{\text{Side opp.}}{\text{Sine}}$$

A few practical examples taken from the workshop will show the application of these formulae. Fig. 3 shows a sketch of a casting as it came to the machine shop. The draughtsman was not as thoughtful as he might have been. You will notice that the dimension is given at the wide end of the dovetail and not at the top, with the result that the planer hand set his planer head over to the required angle and took a roughing cut off each side and then found he was too wide at the bottom and the work was spoiled. He had roughly measured the width at the bottom. But, it happened that the angle of the casting was not anywhere near the finished angle, and not knowing the width at the top, the result was a spoiled job. With an elementary knowledge of trigonometry he could have found out the width at the top for himself in a few minutes as follows.

Draw a verticle line, making a right angle triangle A. B. C. The angle at B is 70°. By applying one of the form



Refer to Text Matter for Explanation.

ulae given. Cotan x So.=Side adjacent Length X is found by multiplying cotan of angle 70° taken from table, and side opposite which is 1¼. Cotan x side opposite=side adjacent=.363 x 1.25=.453, or .453 on each side. .453 x 2=.906. therefore 4—.906=3.094. width at top.

Here are two simple shaper jobs.

Shaper Work

A round bar of iron 2″ dia. It is required to shape the largest possible square on it for use as a wrench. Form a right angle triangle inside the 2″ circle. It is evident that the Hypot will be two inches. The problem will then be to find the length of one of its sides. Formula: Hypot. x Sine=2 x .7071; 7071 being the sine of 45=14142. From this we get the general rule that the size of a square=Dia. x 7071. The next example is just the reverse, but still illustrates the same rule. We are to machine a piece 2″ square. What size must the round stock be? It is evident that the stock must be the size of the diagonal of the square or the Hypot.

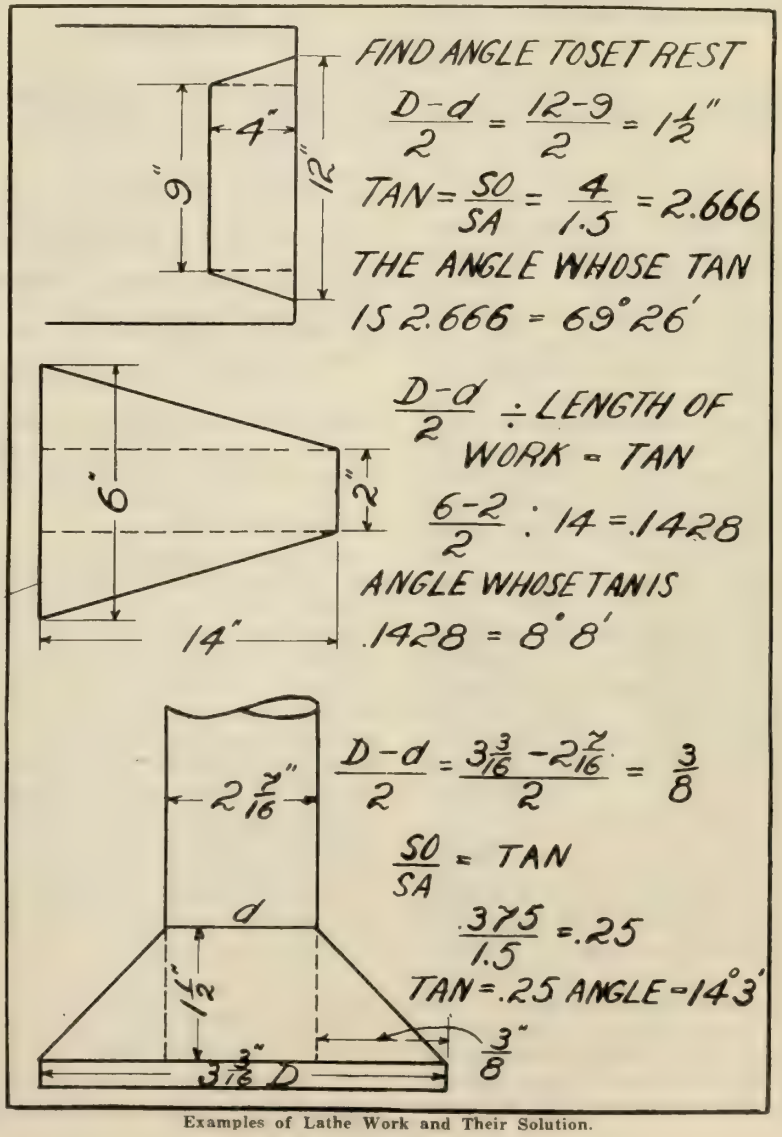
$$\frac{\text{Side opp}}{\text{Sine}} = \frac{2}{.7071} = 282$$

Rule size of square ÷ 7071 equal size of round stock.

Here is another very practical job but a little more difficult to follow. A pair of jaw chucks are to be milled to hold the piece shown in perfect alignment. As both jaws are alike, we will consider one only. The jaws were Vee shaped and cut with a 90 deg. cutter. The jaw for the small dia. was cut first and could be cut to any size with reasonable limits. The problem consists in calculating the exact distance to raise the table to cut the large Vee so that the piece would lie in perfect alignment. The sketch shows two concentric circles, one 3″ dia., and one 2″ dia. The lines of the two vees in the jaw will be tangent to these circles and parallel to each other, therefore the problem resolves itself into one of finding how far apart these lines will be when measured in a vertical direction. The line A. B. measured from the point of contact with the Vee will equal the radius of the large diameter. The line C B, radius of small dia., and A C equal difference of the two radii. The line A B is at right angle to the face of the jaw, therefore a vertical line taken through the center of the piece will be at an angle of 45 deg. with A. B.

The length of this vertical line from point to point of the two vees will be the amount to raise the table. By reference to sketch you will see that the forms a right angle triangle. The difference of the two radii, forms the two sides, and the vertical lines between the apex of the two vees form the hypotenuse. Therefore the formula is— $\frac{\text{Side opp.}}{\text{sine}}$ =Hypoteneuse. Side opp.=Difference of rad. Sine of 45=7071 1″ .5-1″=.5÷ 7071=height to raise table. Quite a number of these jaws were to be made of different sizes so the following rule was deduced. Multiply the difference in radius by 1.414.

When milling the teeth in an end mill, or the side teeth in a side mill, it is neessary to cut one end of the teeth deeper than the other, in order to make the top of teeth, or lands, of uniform width. This being the case it is necessary to work out the depth of cut at the deep end to get the angle to move the dividing head. The depth of cut can be found as follows: Suppose an end mill is to have 10 feet, and the milling cutter has a 70 deg. angle. The center angle, or angle between adjacent teeth=360, the number of degrees in a circle divided by the number of teeth. $\frac{360}{10}$=36. The width of the cut will equal adjacent x tan of 36°. The length of the adjacent=



Examples of Lathe Work and Their Solution.

radius. It may be here stated that the diameter of the work makes no difference to our calculations as we will base all our calculations on a radius of one inch. The tan of 36° is .7265, therefore the width of cut is .7265. The depth of cut depends upon the angle of the cutter, and equals cotangent of angle of cutter x width. Cotangent of 70°= .3639. Cotan of cutter .3639 x .7265= .2643. Hence the dividing head must be set to angle whose cosine is .2643= 74° 49 minutes.

Lathe Work

Some parts to dimensions shown, are about to be made. In many similar jobs, it will be found most convenient to swing round the compound rest and feed by hand. The angle to swing round the rest is taken from formula side opp

$$\frac{\text{side opp}}{\text{side adjacent}} = \text{tan.}$$

Another example somewhat similar in principle is a long taper. The most practical way is to set the taper attachments to angle required. Some taper attachments are graduated in degrees. We will suppose we are using an attachment graduated in degrees, applying the same formula as the last example. The side opposite will equal one half the difference of the diameter, and will equal $\frac{D-d}{2}$

$$\therefore \text{length of work} = \text{tan.} = \frac{6-2}{2} : 14 =$$

.1428

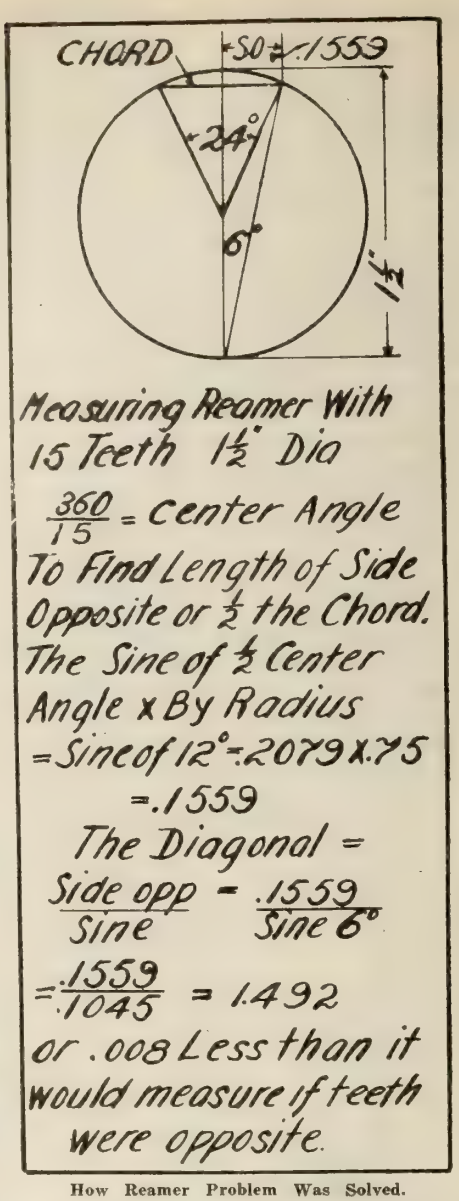
Angle whose tan is .1428=8 deg. 8 min.

This job came to the grinder before any trouble was experienced. It was an 1½" reamer with 15 teeth. It was all right for the lathe hand. He turned it 1½+.010 for grinder but when the grinder operator came to measure it, he found a space opposite a tooth. He had at least two ways to measure it. First wrap a feeler over the space and add the thickness of the feeler to measurement required, or calculate the distance across the two teeth nearest to the center as follows:—Make a circle equal to dia. required. Divide 360 by number of teeth, center angle. In order to form a right angle triangle we find half the chord. The sine of one half the center angle, multiplied by the radius. The inscribed angle is one half the center angle so that the angle that is formed by a line drawn through the center and the diagonal line drawn through the two teeth will=6 deg.

$$\text{Length of the diagonal} = \frac{\text{Side opposite}}{\text{Sine}}$$

=hypot. or diagonal.

This rule will work both ways, suppose the diagonal is known, or found by actual measurement to be 1.492. To find diameter of reamer center angle $= \frac{360}{15} = 24$ deg. angle formed by diagonal with center line=6 deg. The diagonal times the sine of6 deg.=Side opposite=.1559. Side opposite divided by the sine of half the center angle hypo, or radius $= \frac{1559}{2079} =$ .75 radius dia.=1½.



How Reamer Problem Was Solved.

One more practical example, perhaps the most useful of any. Suppose we wish to grind a flat gauge to any given angle. It might be an angle that it would be impossible to measure with an ordinary protractor. A very practical way is to use two discs and an angle plate as shown in sketch especially if it is a repitition job. Calculating the size of the discs so that they will touch each other makes them much easier to set up. As no measuring is necessary after the size of the discs are known, it is convenient to use the standard one inch reference disc used for testing micrometers, and gives the correct answer.

WHEN IT DOES NOT PAY TO RISE TOO FAR

It is irksome not to advance rapidly. It tries one's patience. It makes one sometimes feel discouraged. But the events of the last eighteen months have brought home to many that it is dangerous to rise too far, especially in abnormal times. What has happened in a great many concerns is this: During the boom period promotions were made pretty rapidly. Things moved so quickly and money was being made so easily that promotions and salary increases were not always scrutinized with care.

Then disaster came. Boards of directors ordered drastic retrenchment. In many instances outside experts were called in to recommend reorganization of forces. Their investigations revealed that certain men were drawing big salaries for doing comparatively little work and that these men often were not of calibre warranting the salaries received. When heads began to fall, the heads of such men were the first to drop. In a great many cases, their places were taken by assistants or others who had not basked in the favor of any higher-ups and who were doing a lot of work for relatively little money.

If a list could be compiled of the dismissals during the last year of men drawing salaries of from $10,000 to $50,000 a year, it would create a tremendous sensation.

During this same period not a few able, industrious, conscientious fellows have moved upwards to fill the places of those who rose too rapidly and too far. The law of compensation may often seem to us to operate heartbreakingly slowly, but it does operate. It is safer to be paid less than one is worth than more than one is worth. That's a thought worth keeping in mind.—Forbes Magazine.

AN ELECTRIC SOOT RECORDER

Information was published recently regarding an interesting instrument for recording the amount of smoke suspended in the air from hour to hour. In this machine a fixed quantity of air was drawn through a piece of wet filter paper which was stained to a greater or lesser degree by the impurities in the air. Another instrument has been devised in Brtain for a similar purpose, and it operates on an electrical principle. It consists of a covered dish containing a small quantity of electrified water over which the air to be tested is passed. By proper adjustment of the rate of flow of the air all the acids in the air are dissolved in the water and the solid particles fall into it. The proportion of acid can be readily estimated by chemical means and the solid impurities make themselves known by changes in the electrical resistance of the water. The advantage of this appliance is that it indicates the amount of acid in the air as well as the amount of smoke. This is an important point as the proportion of acid has a great deal to do with the harmful effect of air upon stone and other structures.

Typical Applications of Ball and Roller Bearing

Continuation of Article Which Appeared in November 10th Issue —Polishing Spindle Application—Worm Gearing Arrangement —Lathe Application—Also Automobile Gear Box Method of Mounting

*By O. H. WILLISON

IN THE Nov. 10th issue of Canadian Machinery, the first portion of the present article was published. Since that time we have received a criticism to the article, and in order that readers get a chance to hear both sides of the question, we are publishing the criticism on another page of this issue.

Mr. Willison's article was complete in itself, but owing to its extreme length we broke it up into two parts. This being so, we now publish the remainder of his material.

In Figure 9, this cut being shown in the last portion, we showed a ball bearing pulley design where the pulley is mounted on the end of a shaft. It differs from Figure 8, the previous application only in that one bearing is clamped against the shoulder of a parallel sleeve, which in turn is clamped against a shoulder machined on the shaft. The other bearing is made a push fit on the shaft, and must be free sideways so that it can align itself opposite its outer race. Most of us, at one time or another, have had occasion to enter factories where polishing or buffing machines are in use, and almost always have we noticed the excessive vibration which exists where the machines have been in operation for any length of time. This is usually due to the sleeve type bearing having become worn and the shaft chattering in consequence.

*Bearings Engineer with Lyman Tube and Supply Co., Montreal.

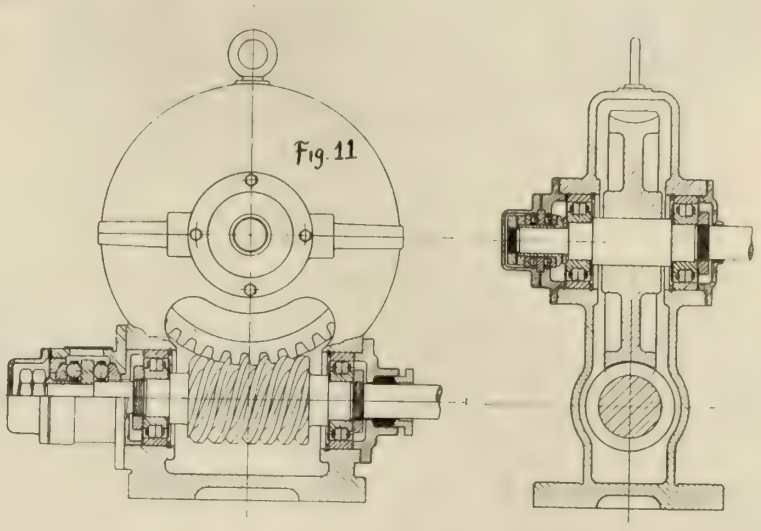
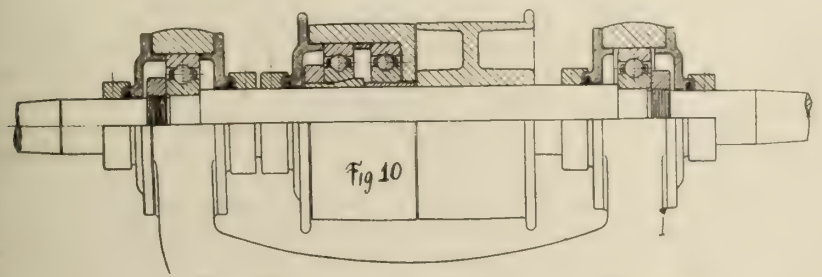


Fig. 11.—A worm gear application

Figure 10 illustrates a ball bearing application to a polishing spindle. It will be noticed also that, in addition to the spindle bearings, the loose pulley is mounted on ball bearings. Like all other applications, one bearing is locked endways to locate the spindle and to take any end thrust that may be put upon it. The outer races of both bearings should be a nice push fit in the housing. They must not be slack, but must have sufficient freedom to permit of the outer race of the free bearing aligning itself opposite its inner member. The success of a machine of this type depends largely upon keeping dust out of the housings. It is very necessary, therefore, that ample means are provided for this. Flanges are attached to the shaft close up to the housing, and, in addition to the shallow grease grooves, a felt washer should be used. If these precautions are taken, all trouble can be eliminated and a thoroughly satisfactory and vibrationless spindle produced. The loose pulley is exactly as shown in Figure 8.



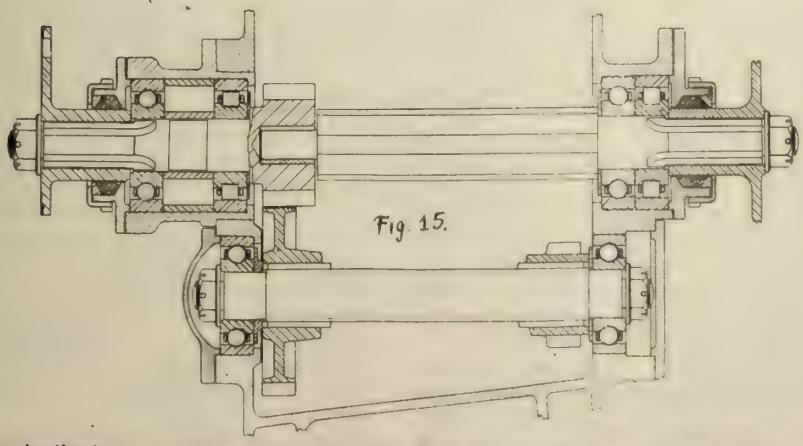


Fig. 10—Application to polishing spindle. Fig. 15—Method adopted for heavier type of touring car.

Figure 11 illustrates the application of anti-friction bearings to worm gearing. Where the loads are exceptionally heavy, the worm shaft is carried on two roller bearings, and the end thrust taken by a double thrust bearing unit, this being complete with housing ready to bolt to the frame. The worm wheel is similarly supported on roller journal bearings, but, as in this case the thrust is usually much lighter than on the worm shaft, it is common practice to locate the worm wheel by means of an ordinary double thrust washer. By the use of roller journal bearings on this work the diameter of the housings can be kept reasonably small without endangering the efficiency of the unit as a whole. Gearing mounted in this way reaches its maximum efficiency, and since there is

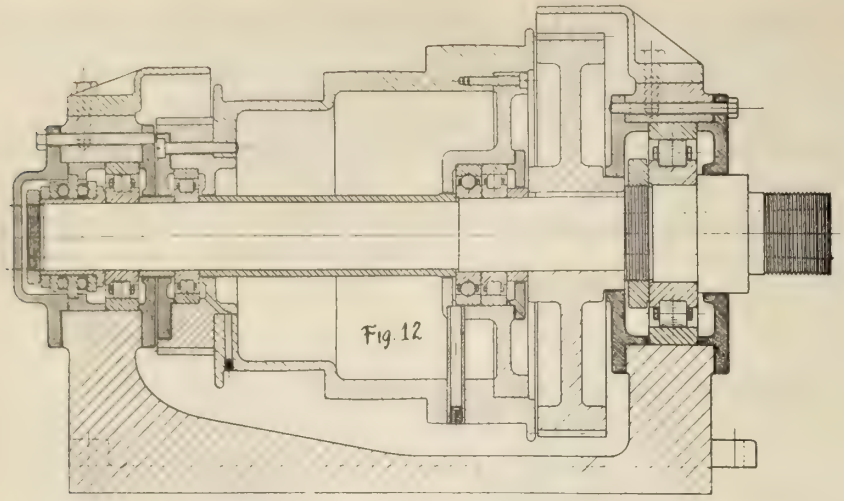


Fig. 12.—Showing a lathe application.

no wear in ball and roller bearings under proper conditions, this condition is maintained indefinitely. The absence of wear in the bearings reduces to a considerable extent the tendency for wear in the gearing itself.

In so far as the mounting of the bearing is concerned, it will be noted that the inner races of the journal bearings are a tight press fit on the shaft and held in position against shoulders on the shaft by means of lock nuts, care being taken that the nut does not bear against the race to a greater diameter than the bottom of the roller tracks. Between the shoulders on the shaft and inner race of the bearing a thin steel washer is shown. The outside diameter of this washer should be slightly smaller than the bore of the outer race of the bearing. This will keep the bearings free from any fine particles of metal which may find their way into the grease from the worm or worm wheel teeth.

The outer races of the roller journal bearings should be a tight fit in the housings, and are held endways by means of spigots on the end covers and split rings, rectangular in section and let into a suitable groove in the housing. The housing of the double thrust bearing on the worm shaft must be held both square and concentric with the bore of the housing provided for the journal bearings. Neither this nor the accurate machining of the shoulder securing the centre race of the double thrust bearing presents any difficulty, however. The end cap on the double thrust bearing completely encloses the end of the worm. A packing gland is usually provided on the other end of this worm shaft, thus preventing the leakage of any oil or grease from the worm casing.

The sleeves of the thrust bearing on the worm wheel should be a nice push fit on the shaft and clamped firmly against the shoulder by means of a lock nut. The same care must be taken to ensure the centre race being held perfectly square with the shaft. The thrust bearing end may be capped off and the other end cover provided with very fine running clearance, about .01 in. A series of small grooves should be turned in the bore, but it is unnecessary to provide a packing gland in this case.

It is important to remember that when the halves of the worm wheel case are bolted together they must provide a perfectly cylindrical recess for the outer races of the roller bearings. Any inaccuracy is liable to distort the outer race of the bearing and cause local overload. It is usual to rely upon the oil contained in the gear case for lubricating the whole of the bearings, and, if the shields described above are fitted so as to protect the bearing from chips and dust, this is a very effective method of lubrication, and one that will give satisfactory service.

Lathe Application

Of particular interest will be found the application shown in Fig. 12. This illustrates a lathe spindle equipped with ball and roller bearings. Apart from the saving in power and freedom from lubrication trouble, the bearings offer considerable advantages on a lathe headstock. Where plain bearings are used, they commence to deteriorate from the day the machine is set to work, gradually showing more and more wear until work turned out by the machine is so unsatisfactory that it is essential to overhaul it and refit the bearings. Where roller journals are employed, however, there is no measurable wear over very long periods, and the machine after it has been running for many years is turning out as accurate work as on the day it was first started up. In view of the efficiency demanded from the modern machine tool, this advantage of accuracy maintained over indefinite periods cannot fail to result in an ever-increasing demand for the use of roller journal bearings on machine tool spindles.

While the cost of the bearings and their mounting is admittedly higher than the sleeve type, the saving effected in power, lubrication, overhauling, and the fact that accurate work can be done more quickly, should more than compensate for this. It is significant in this regard to mention that one of the largest manufacturers of turret lathes has recently placed a machine on the market having its spindle mounted on anti-friction bearings of this type. It will be seen from the drawing that the spindle is mounted on two roller journal bearings, a double thrust washer being provided to take the end thrust. The cone pulley is also mounted on roller journal bearings, but, as in this case the thrust is comparatively small, a ball location bearing is ample to take care of the load. The outer race of this location bearing is ground smaller on its outside diameter than the adjacent roller bearing. This prevents any radial load being placed upon it, enabling it to take the thrust load only.

The production of perfectly cylindrical work with highly polished surfaces, and the production of perfectly flat surfaces having a mirror finish, has been one of the greatest problems in the grinding machine industry. The selection of suitable grinding wheels and the operation of the machine at proper speeds, feeds, etc., is obviously of greatest importance. Equally so is it important that the spindle be mounted in such a way that vibration is entirely eliminated. The design illustrated in Fig. 13 shows an application of anti-friction bearings to this type of machine. The spindle runs in two roller journal bearings; the weight is supported and the end thrust taken on a double thrust washer. The same method of mounting the bearings must be adhered to as in all previous designs, and special precaution taken to prevent the intrusion into the housings of particles of dust or emery.

The driving pulley is carried on one roller and one ball journal bearing. These bearings are mounted on a sleeve which forms part of the frame of the machine, and there is accordingly no belt pull on the actual grinding spindle. Inasmuch as the outer races of the pulley bearings are the revolving members, they must be a tight fit in the housing, and both are held endways by means of a shoulder in the housing and a spigot in the end cover. The inner races are in this case a nice push fit on the sleeve, separated only by a distance piece, and clamped against a shoulder by means of a lock nut. This design makes for a very neat machine and one that has proven eminently satisfactory in use.

Ball bearings have been adopted as a matter of course in the gear boxes of automobiles, and their use is so general that further comment is unnecessary. An illustration, however, showing the standard practice as adopted by car manufacturers in England will surely be interesting on account of the wonderful records for reliability and long service established by these cars. Such names as Rolls Royce, Sunbeam, Vauxhall, Wolseley, and many others are by-words wherever automobiles are discussed, and it is significant to point out that ball

bearings and the short roller type of bearings described above are standard equipment with by far the greater majority of car builders in that country.

It will be noted by reference to Fig. 14, which is a design suitable for a light car, that the engine shaft is carried on one ball and one roller journal bearing. The propeller shaft is supported at its large end by a substantial ball bearing The small spigot bearing is of bronze, but in cases where the gear wheel at the end of the engine shaft is large enough, a roller journal bearing can be used. The lay shaft is carried in two ball journal bearings. It is recommended that as small chips from the gears are liable to damage the bearings, thin metal shields be fitted between the inner race and the shoulders against which they are clamped. The shields should be of a diameter that will enable them to just clear the bore of the outer race of the bearing.

Fig. 15 shows the method adopted in the heavier type of touring cars. It will be noticed here that in addition to the ball and roller bearings used on the engine shaft, they are installed on the outer end of the first motion shaft. The former, however, is a "location" bearing exactly similar to the others described in this article. The method of mounting the bearings is the same as in all the previous applications. The application of antifriction bearings to high speed woodworking machinery has attracted the attention of most high grade manufacturers, and they have achieved some startling results. One of the most notable achievements is in vertical shears, and these are now being run satisfactorily at speeds hitherto thought impossible; in same cases, 10,000 to 12,000 r.p.m. being the standard practice. A suitable application will be found in Fig. 16. Two roller journal bearings are mounted in the housing next the cutter and one in the lower housing. The weight of the spindle and any thrust there may be is taken on a ball location bearing placed at the bottom of the lower housing.

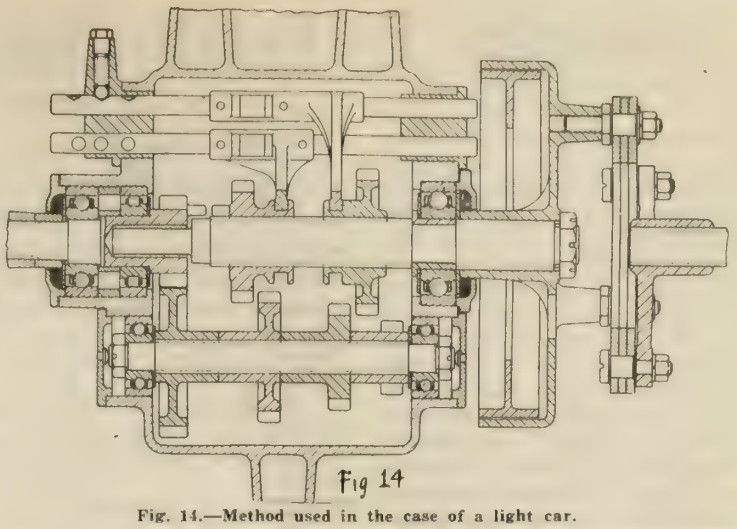


Fig. 14.—Method used in the case of a light car.

As is well known, the slightest vibration in the bearings of a moulding spindle results in unsatisfactory work. The complete absence of wear in the roller journal bearings is accordingly a very great advantage, ensuring the quality of work turned out over long periods without any attention whatever to the bearings. In order to ensure perfect alignment, it is assumed that the housings carrying the bearings will be cast solid with the slide and bored out at one setting. Rigid type bearings are strongly recommended.

It is hoped that the designs given above will prove helpful to those who are responsible for designing any class of machinery. Naturally, no attempt has been made to give shaft or bearing dimensions, as these must vary with each individual application. Nevertheless they outline what is necessary for successful operation, and, if followed in a general way, attention being paid to the remarks concerning the nature of the loads, etc., mentioned in the article, the results will be entirely satisfactory.

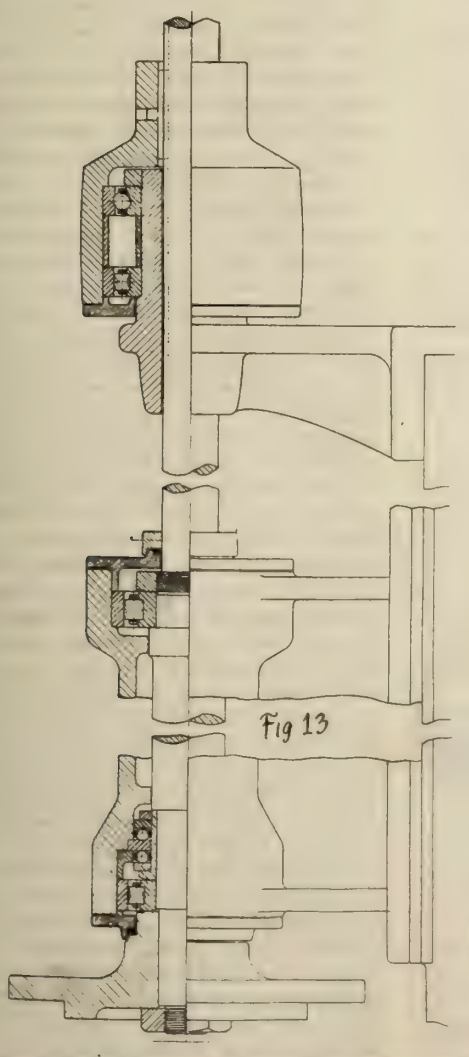


Fig. 13.—Method of applying to vertical grinder spindle.

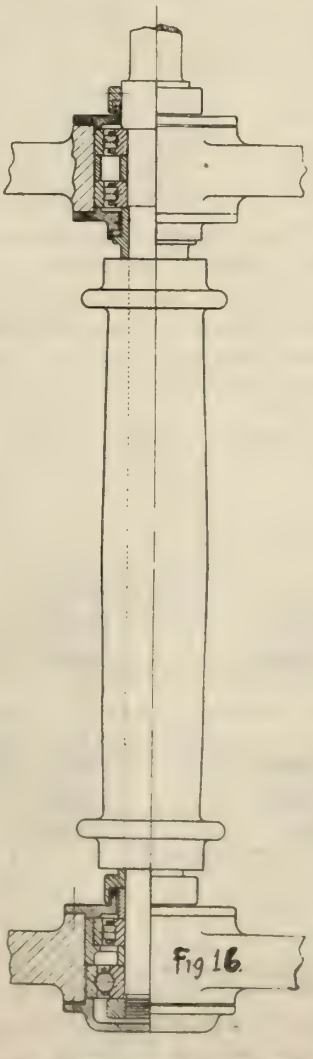


Fig. 16.—A vertical shaper application.

The Westinghouse Electric & Mfg. Co., has issued leaflet 1732, which describes and illustrates enclosed float switches. These float switches are used on motor operation pumps, to automatically maintain a water level in open tank, reservoir or pump system, and to prevent the water from rising above a pre-determined level. Electric motor drive for power pumps is the title of leaflet 1950, which is being distributed by the same company. This leaflet gives a discussion of the advantages of the use of electricity for this work, and it specifically points out the type of motor which should be used.

Criticism To Recent Ball Bearing Article

*By G. C. HEWSON

AFTER reading an article published in the Nov. 10th issue of "Canadian Machinery" under the caption "Typical Applications of Ball and Roller Bearings," the writer feels it his duty to call to the attention of the readers of this journal, statements therein, which are not in accordance with accepted theory or practice. This is done, not in any spirit of intolerance; but purely for the purpose of disseminating accurate technical information in this important branch of modern engineering development; because very little reliable information of value on ball bearings is to be found in the engineering or text books; and those interested must depend on the bearing manufacturers for exact data.

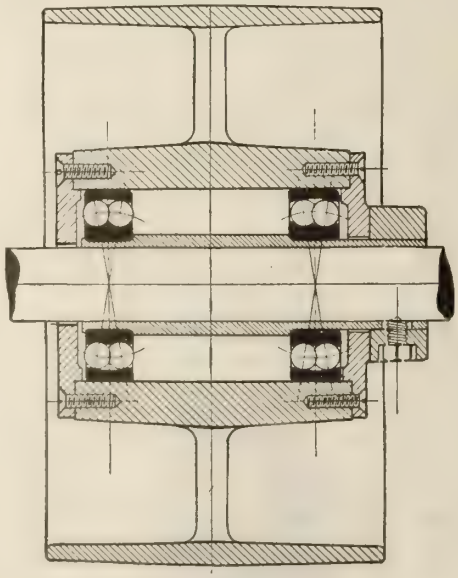
In the article just mentioned in the first paragraph on page 27, the following statement is made: "Unfortunately, however, this design limits the number of balls to those that can be put in by placing the races eccentrically. More balls can be inserted by use of a transverse filling slot, but this weakens the race and the balls are liable to be damaged if great care is not taken when they are inserted. The greater number of balls that can be used by this method, if carefully carried off, should, however, more than compensate for the somewhat weaker race."

The fallacy of this contention is readily seen, however, when a logical analysis of the problem is made. The weakest part of an annular ball bearing is the inner ring, for the following reason. The diameter of the inner raceway is smaller than that of the outer raceway by twice the diameter of the balls. This results in a sharper curve of the raceway of the inner ring — that is a greater convexity—in a plane perpendicular to the axis of the shaft. Therefore, when the ball flattens out under load, its area of contact on the inner raceway will be less than on the outer raceway, and since the load on both areas is the same, the pressure per unit of area will be greater on the inner race. Now if this race is weakened by the introduction of a filling slot, it is not difficult to realize that its carrying capacity may be exceeded by that of the balls and that therefore any additional balls inserted cannot increase the capacity of the bearing as a whole, since a chain is only as strong as its weakest link. Incidentally, also, all troubles due to interference between balls and filling opening are done away with in a bearing of the uninterrupted groove or no-gap type. The few tests given below of unbroken groove bearings and others with a greater number of balls will confirm the statements just made.

Two Col Table

Bearing	No. and size of balls
H. B.	8-9-16 in.
Time	Remarks
186¾ hrs.	Unbroken groove
H. B.	8-9-16 in.
176¾ hrs.	Unbroken groove
"A"	13-9-16 in.
57½ hrs.	With filling opening
"A"	13-9-16 in.
79 hrs.	With filling opening
"B"	8-9-16 in.
55¼ hrs.	With filling opening
"B"	8-9-16 in.
59¾ hrs.	With filling opening
"C"	11-9-16 in.
32 hrs.	With filling opening
"C"	11-9-16 in.
46¼ hrs.	With filling opening
"E"	13-9-16 in.
47½ hrs.	Very thin races with filling opening
"E"	13-9-16 in.
47 hrs.	Very thin races with filling opening
"F"	12-0.610 hrs.
63¾ hrs.	With filling opening

The rated steady load of the first bearing is given as 890 pounds at 1445 R.P.M. In these tests a load of 2,500 pounds at 1445 R.P.M. was employed in order to bring about quick results, since the number of hours run before failure occurs is all that is needed for comparative purposes, and gives a true indication of the relative endurance of the bearings.



Showing the patented method of mounting a loose pulley on ball bearings.

Metal'urgy and Heat Treatment.

The next paragraph in the same column of the article in question deals with the steel used and its proper treatment. The statement is made that —"a suitable mild steel properly carburized is the most suitable for the races and that the difficulty with a chrome-carbon steel is in obtaining a uniformly hard race." The writer is prevented by lack of space from going into the metallurgy and heat treatment of ball bearing steel in detail, but a general outline of the situation may be given.

Steel obtains its hardness, partly through a high carbon content, and partly through hardening. It is impossible, however, to harden pure carbon steel uniformly throughout, except in pieces of small size. Since alloy steel of suitable composition permits of uniform hardness throughout, good ball bearings are made of hardened alloy steel, generally containing chromium and with a high carbon content. This steel is glass hard after hardening and is, therefore, subjected to a moderate drawing process, which removes the stresses set up during quenching and increases the toughness without materially decreasing the hardness of the material. This toughness is required to prevent fracture under shock loads. The great secret lies in obtaining in the beginning a steel as free as possible from impurities. The carburizing or case-hardening method mentioned in the article in question is a cheaper and commoner method, but, in practice, is inferior to a high carbon alloy steel, which is hardened throughout.

Capacity Affected by the Kind of Load

In the middle paragraph of the second column on page 27 the statement is made that "when pearings are mounted in a substantial housing on a rigid base plate bolted to a solid cement foundation the effect on the bearing is more severe than when the load is imposed by gearing or some spring method." The fact is, that bearings subjected to loads imposed by gears, especially straight spur gears, are operating under one of the worst conditions and a factor of 5 or 6 is generally used in calculating the size of bearing required. This means that the shock imposed on the bearings by the action of the gears brings the equivalent loading up to about 5 or 6 times the value of the normal steady load due to the

*Author is bearings engineer for the S.K.F. Co. at Toronto.

power being transmitted. In chain transmission the factors used vary from 1 or 1.5 with silent type chains up to 3 or 4 with anchor type chains.

The example given by the writer of the article under review is, in my opinion, even further wrong than his statement of operating conditions. He says that in selecting a bearing to take the thrust of an aeroplane propellor, one was satisfactorily used that was much smaller than was apparently justified by the rated load. This is quite true, but not so the reason he gives, which is, that "in an aeroplane the shocks and stresses are dissipated through the various parts of the machine." The real reason for the satisfactory service of the smaller bearings is that the life of the aeroplane power plant is distinctly limited, in fact, is only a few hundred hours—and that therefore a bearing which is capable of standing up to the conditions of service for the same number of hours is all that is necessary. This is equivalent to overloading the bearing deliberately for the time mentioned and the shorter the life required of the bearing the more it can be overloaded. That is, the overloading and the life vary in an inverse ratio. This idea is carried out in motor car and motor truck design where in some cases bearings are overloaded 100 per cent. because even then, the bearing, with proper care and attention, will outlast the life of the car itself.

Applications

Among the so-called practical applications are shown in figs. 8 and 9, page 28, two methods of mounting ball bearings in loose pulleys, both of which are anything but practical. In fig. 8 a special sleeve and an adapter sleeve are required, the special sleeve being accurately machined to fit the shaft and the bore of the bearing. This special sleeve must also be of exactly the right length to occupy the space between the adapter sleeve and the end of the hub of the tight pulley. This makes every loose pulley a special job, to fit the tight pulley it is to work with, and means that it cannot be interchanged with another pulley without altering the length of the sleeve. Also to install or remove this pulley it is necessary to take off the end cap before reaching the locking nut. When the hub of the pulley is thus left open during installation there is great danger of the intrusion of grit and other foreign matter which would quickly bring about the destruction of the bearings. If it be found necessary to remove this pulley after it has been in operation for a time, the end cap would have first to be taken off and the grease removed—a dirty operation at best.

The pulley application shown in fig. 9, is even more impractical than that shown in fig. 8, since it requires considerable machine work being done on the shaft. The shaft must, first, be accurately turned to the bearing bore, a shoulder must then be turned, and, finally, the end of the shaft threaded. A special sleeve is also required machined to fit the shaft and bearing. The whole assembly is locked together by means of a nut on the threaded shaft. Besides the considerable machine work necessary, this application is open to the same objections as the application in fig. 8, namely, the necessity for removing the end cap in order to reach the nut when mounting or taking off this pulley. The bearing which is mounted directly on the shaft is not locked to it in any way and if a perfect fit be not secured, (and possibly even if it be secured) the bearing will commence to creep, peen down the shaft, and eventually destroy itself. The only practical way of mounting ball bearings in a loose pulley is the patented application shown in the cut, fig. "A." In this way the pulley is secured by the purchaser as a unit and he can install it in five minutes by simply slipping it on the shaft and tightening up the set screw in the end collar. It is interchangeable and can be used on any piece of cold rolled shafting of the same nominal diameter. Moreover the objectionable feature of having to remove the end cap is entirely eliminated as these can be closed by the manufacturer without the necessity of ever re-opening them.

The application shown in fig. 7 is quite correct mechanically, but far more expensive than necessary. The fairly large cost of the double thrust bearing can be eliminated by using a roller bearing that will carry an axial thrust load in addition to its radial load. The writer has not, by any means, dealt with every point that could have been criticized but feels that enough has been said to call readers' attention, to what he considers incorrect ideas with regard to the use of ball bearings.

TIDAL RESEARCH WORK IN EASTERN CANADA

Have you ever had occasion to refer to tide table? Did it ever occur to you how this advance information is compiled?

The general public are unacquainted with the method of obtaining information concerning tides. The system of reducing the tidal observations is complicated and technical. The usefulness of the survey can, therefore, best be judged from the published results as shown in the annual tide tables issued by the Naval Department. These tide tables give the time of the rise and fall of the tide or the turn of currents along the Canadian coasts for periods of one year in advance; that is, the time of the tides for 1922 may be obtained from the tide tables issued in the fall of 1921. The tide tables also give for various regions the height of the tide and the depth over certain areas at high and low water. The information is valuable to shipping interests as they are enabled to know the depth of water over bars and shoals at the entrances of our harbors at any stated period. The information compiled by this survey is also useful with regard to mean sea level which is determined by them and which is used by land surveys as the basis of their levelling operations.

The record of tides is obtained by use of an ingenious instrument actuated by clockwork. This instrument gives a continuous curve which shows the height of the tide at every moment throughout the day and night, and thus records more accurate information than could be obtained by three men set to observe the tide in eight-hour shifts during the 24 hours of each day. These instruments, to give correct results, must be carefully installed and must also be kept accurately set.

The tidal records complied by the Canadian Government have now reached a high standard of perfection and Canada is well in the lead in recognizing the importance of tidal information not only for navigation purpose but also as a basis for carrying out levelling operations and survey work on land.

Extensive tidal research work has been carried on by the tidal survey branch of the Naval Department during the past summer. This work was performed in order to obtain additional tidal data over that compiled in previous years for our harbors and various other areas for which tidal information is required.

During the past year observations of the tide were made at Campbellton and Dalhousie at the head of Chaleurs Bay and other habors in eastern New Brunswick, where the tide is of special importance because of bars at their entrances. At these harbors, considerable dredging has been done, or is in prospect. Tidal data are essential in relation to low-water levels and the amount of rise of tide where the depth of water available for navigation is limited. The tidal data will facilitate the determination of what amount of dredging is necessary.

Three new tidal stations were put in operation at the entrance to the St. Lawrence, i.e., at Gaspe, Fox River and Seven Islands. Tidal data were also obtained for the east coast of Hudson Bay and for James Bay. In addition to the special work undertaken, the six permanent tide stations on the east coast have been continued and from the reduction of the records obtained will be compiled tide tables for future years.

The Universal Knitting Co., Vancouver, B. C., has in the past twelve months doubled its floor space and doubled its capacity, and according to the manager, is employing more operators than ever before. Full time has been worked all the year. The volume of garments manufactured and sold has been 50% greater than last year.

What To Do, And Avoid, During Business Cycles

The Ideal or Normal State Never Did Exist—Business Always Moves in a Ceaseless Ebb and Flow—Business Should Be Handled as If We Were Piloting a Ship

By Chas. L. Cameron

"WHAT should machine tool builders do, and what should they avoid during the various stages of business cycles?" This was the interesting subject which Charles L. Cameron of the Gould & Eberhardt Co., Newark, N. J. discoursed on during the annual convention of the National Machine Tool Builders' Association at New York, but let Mr. Cameron speak for himself.

"We frequently discuss normal business in the sense that at some time everything runs along smoothly—nothing to disturb us and orders plentiful. When orders fall off, we hear complaints that the situation is abnormal. If material prices are high," said Mr. Cameron, "or selling prices low, it is abnormal; if money is tight with high interest rates, we consider it abnormal. If wages are high and labor productively low, the manufacturer thinks it is abnormal. If wages are low, and the boss is insisting on getting a full day's output, then the workman fee's that he is 'out of luck.'

"A student of economics finds that the ideal or normal state never did exist. Going into it more deeply, he finds business always moving in a ceaseless ebb and flow, now at high tide and now at low—never the same—and he concludes that like the ocean, the only normal thing about business is its continual change, its tides rising and lowering, while its waves, storms and calms play on the surface. Business cycles, that is, depression alternating with prosperity, are the only normal—a state of rest would be abnormal. Therefore we must learn to study and handle our business as if we were piloting a ship, with the knowledge of an efficient seaman who knows the dangerous tides, and who constantly studies his barometer to know whether it is going to be fair weather or foul, and who eventually brings his vessel safely to port.

The Four Cycles

"Briefly, there are four cycles in business — prosperity, liquidation, readjustment and improvement. Reliable understanding of what should be done and what should be avoided during these periods is the foundation on which business can be successfully conducted. There has been a preponderance of statistics gathered and published in the last months in an endeavor to explain and analyze the causes of the depression through which we are passing. Statistics or barometer charts of any kind are like a feather. They blow this way and that, and really only show the direction of the wind. Do we ever stop to reason why the wind blows, or why it does not blow? Similarly in business—we know it is good, or we know it is poor, and we try to fathom the cause. It seems to me, however, that we do not go deeply enough into the underlying fundamental causes. It is a very deep subject, and while many students draw comparisons with experiences after great disturbances such as long wars, or catastrophes such as earthquakes, we never find exact parallels. There are, however, a great many indications and experiences during these four cycles, which if we would only be impressed with them as they are occurring, would help us greatly.

"It is very plain that the cycles cannot be understood unless one appreciates that the business man starts a business, not to produce or sell goods as such, but to make a profitable income through the production or sale of the goods. In making this profit credit is used more and more, with the result that the cycles are really financial or credit cycles rather than production or sales cycles. In the present state of depression, most industries have passed through the period of liquidation. Probably the iron, steel and machine tool industries are behind many others in this respect, as it is quite apparent that there is still further liquidation to be anticipated. But the general feeling and statistics show that business as a whole has passed through the period of readjustment, and is now starting in the cycle of improvement. I will briefly refer to the cycles, commencing with improvement, followed in turn by prosperity, liquidation, and readjustment.

"I feel it is unnecessary to dwell at length on any of the cycles with the exception of prosperity, as it is there that our danger lies. At the beginning of a period or cycles of improvement the level of prices is low, drastic reductions have been made in costs. Profits are at a very narrow margin, there are liberal bank reserves, and there is a conservation in the valuation of business enterprises, and a conservation in the policy of granting credits.

"A great deal of cash buying is experienced. Business under these conditions will begin to revive slowly at first, but as one industry becomes more active, it in turn affects many others, and so on until there is a general turn from idleness into activity. These changes, as a rule, come about slowly unless some important event such as unusual harvests, active purchases by the Government or marked increase in export demand causes a more rapid expansion.

Cycle of Prosperity

"We now approach the cycle of prosperity, and the very processes which have been working one on the other to enhance prosperity are slowly creating an accumulation of strains that ultimately undermine the foundation on which prosperity rests. Let us see what happens in the period of prosperity; our plants have all the business they can handle with standard equipment. Contracts for material ordered during the period of improvement have expired; renewals must be made at higher prices. Salaries are increased. Prime costs are rising at a rapid rate. Inadequate equipment is brought into operation. Everybody is bidding for labor. As this goes on, the general efficiency of labor declines. Undesirable help gets into our plants, and we find it more difficult to obtain efficient executives. Prices of raw material rise faster than the selling prices of products, and right here we have a serious problem. Our selling organizations are crowding us with orders. We soon accumulate a tremendous volume of unfilled orders representing frequently several months' output. Due to the difficulty of obtaining deliveries of materials, we must anticipate and schedule our requirements frequently seven to eight months in advance. We are conservative in increasing the prices of our finished product, with the result that when the product has been on order for months, and is finally completed and shipped our costs have risen so greatly that what slight increases may have been made were not adequate with the rapid rise that has taken place.

"It would seem to me when our deliveries are so far off, that if some plan could be worked out whereby we could sell our product on the basis of cost at the time of completion, we would be in a much more equitable position. This was tried for a short period during the war, but there were not many of us taking orders under these conditions. As prosperity continues, the demand for bank loans grows rapidly, not only with the larger volume of trade, but also with the rise of prices, and the desire of business men to use their own funds for their own business. Additional loads are added to our banking system. The rates of interest then become very high, and check the expansion of the volume of trade out of which this period of prosperity has developed. Many ventures are postponed. The permanency of various business enterprises is analyzed very carefully by the banks. As costs and prices become so high, new enterprises defer execution of many plans for a more advantageous time. We find that orders for future delivery are falling off. Again we face a difficult situation, for the reason that we still have on our books many months of unfilled

orders, and we are now approaching the most dangerous period in any of the business cycles. It is at this time that we should set our storm signals. We have been going along optimistically, and it is hard for us to realize that at a time like this we should begin to 'watch our step.' It is at this time we should be unusually careful.

"Not long ago I heard of a very wealthy man who made a practice of investing his money in industrial plants, but he stated that he made it a rule never to invest in a one-man concern; yet he would never put his money in a concern that did not have a 'one man.' It is this 'one man' in our organization who must have a clear vision. We attend functions where frequently prominent people tell us in most optimistic phrases of continued prosperity and similar encouragements, but we must not allow ourselves to be misled. We must realize that the limit has been reached in the period of prosperity—in fact there should be a feeling in our bones that we have reached this limit.

"Our first thoughts should be to curtail our contracts for high-priced material. It may be difficult to do this, but it would be far more profitable to buy almost from hand to mouth at the higher prices to take care of the unfilled orders that we have, than to contract for a large quantity of high-priced material, and have it on our shelves for months after our prosperity has left us, and which we must work up and sell at a loss. There are a number of indications that are apparent at this time which we must learn to recognize as they occur.

"Prosperity thus ultimately brings on conditions which start the liquidation of large stocks which have piled up; this liquidation merges into a crisis. Again we may say to the 'one man' — know thyself! It is by his direction that unnecessary expenses of all kinds are curtailed. We have now reached the period of liquidation, and passing through this we come to the period of readjustment. As these periods are so fresh in our minds it is unnecessary for me to say what the machine tool builders should have done or should have avoided. If we had known as much a year ago, as we know today, no one would now have to tell us what we should have done."

LAUNCH OF S.S. KUTSANG

On the 19th October there was launched from the Wallsend Shipyard of Messrs. Swan, Hunter & Wigham Richardson, Ltd., the Katsang, a single screw ship to carrry passengers and general cargo and to run in the service of the Indo-China Steam Navigation Co. of Hong Kong and London. Messrs. Swan, Hunter & Wigham Richardson have already built a number of ships for these owners. "Increase in Luck" is the meaning of Kutsang, which name was bestowed upon the ship by Mrs. Keswick, the wife of Major Henry Keswick of Cowhill Tower, Dumfries, as the vessel left the ways in the presence of a large company of visitors.

The Kutsang has an overall length of 434 feet, a moulded breadth of 54 feet, a depth of 31 feet, and will carry 7,000 tons deadweight on a draft of 25 1-2 feet. She has been built to Lloyd's highest class, and has a poop, a long bridge amidships, and a full topgallant fore-castle. On the boat deck there are comfortable quarters for the captain, a smoke room, and a ladies' room. On the bridge deck, on either side of the engine casing are cabins for the officers and engineers, and forward of the funnel are staterooms for first class passengers and the dining saloons. In the poop is accommodation for the second class passengers and above the steering-gear house is an hospital and dispensary. The sailors and firemen have their quarters in the f recastle, the petty officers and apprentice boys being housed on the upper deck on either side of the mail and baggage compartments beneath the first class dining saloon. Refrigerating machinery will be installed to keep meat and other perishable provisions in good condition.

In most of the cellular double bottom of the ship, oil fuel can be carried as well as water ballast. The machinery and boilers of the Kutsang have been built by the Wallsend Slipway & Engineering Co. The main engines are of the four-cylinder quadruple expansion type, balanced on the famous Yarrow, Schlick and Tweedy system. There are four single-ended, cylindrical boilers with a working pressure of 220 lbs per square inch under forced draft.

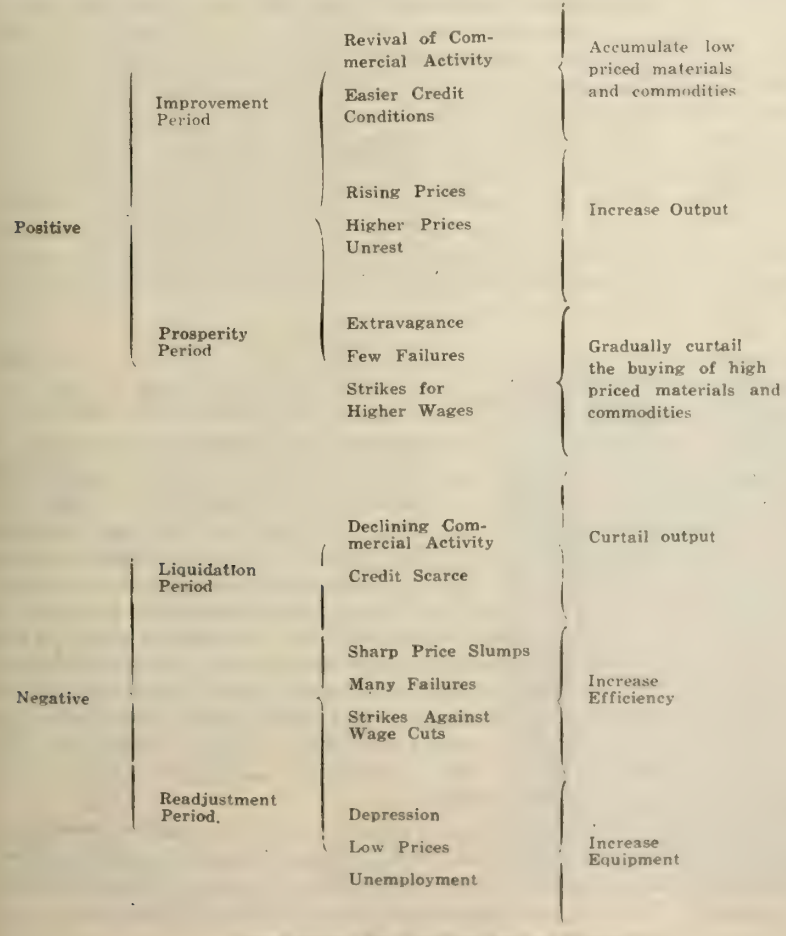


Chart Shows the Author's Idea of Grouping.

S.S. SERVICE TO BRITISH WEST INDIES

The Canadian Government is inviting tenders for a mail, passenger, and freight service between Canada, the British West Indies, and British Guiana. These tenders will be received at the office of the Deputy Minister of Trade, Ottawa, up to January 31st, 1922.

Tenders should be for weekly or fortnightly sailings from St. John, N. B., or Halifax, N.S., to the Bermudas, Barbadoes, Trinidad, and British Guiana, with calls at Grenada, St. Vincent, St. Lucia, and other places. Tenders also have the option of tendering for a weekly service with sailings alternately from St. John and Halifax. The length of time that the contract is expected to cover is from five to ten years. The steamers are to be from 5,000 tons to 6,000 tons gross, and must be able to maintain a speed of twelve knots an hour, provide accommodation for 100 first class, 30 second class, and 100 steerage passengers. In tendering it is requested that the amount of the subsidy required be stated. Other regulations state that there must be no unfair differentiation of rates of freight against the smaller as compared with the larger colonies, an that all freight and passenger rates are to be subject to the approval of the Minister of Trade.



Automobile Bodies of Zinc

ZINC sheets are now being used for many automobile parts, according to information received. In the No. 18 gauge and the heavier ones employed the metal possesses all the strength required, while the cost is decidedly less than that of aluminum. It also has the further recommendation that it does not rust and cause the enamel to chip off. In supplying large quantities of zinc for making hub caps and other parts of automobiles, a certain American zinc company realized the need of a joint different from the soldered type, which would possess as much, or more, strength than the metal and which could be polished smooth without losing any of its strength. After due consideration they made several successful experiments in zinc welding.

The edges of two sheets of zinc were cleaned bright and butt-welded, with a strip of the same material to fill in and give strength to the surface. Bending and tensile strength tests of the joint after it had been polished smooth showed that the two sheets were completely united, and that when thus joined together they were fully as strong at the point as at any other place. The work was done with the oxy-hydrogen flame of a lead-burner's outfit by two men, who, it is stated, were not especially expert either in soldering or in lead-burning.

Increasing Their Earning Power

A STEEL mill in Georgia was not getting along very well. Although their methods were up-to-date, the profits were too small to allow the existing rate of wages to continue. The owner of this plant, which was run on the open shop plan, decided a ten per cent. reduction in wages was necessary, so, not wishing to have trouble with the men, he asked that a delegation be sent to confer with him.

George F. Swetnam, who tells the story in a recent issue of Industrial Management, says that when this owner laid his case before the men and told them of his proposed action, they announced, after some deliberation, that they appreciated his courtesy and sympathized with him, but that in justice to their families and themselves they could not accept a reduction of more than five per cent. The owner then suggested a revision of wages on a piece-work schedule, and to this the men agreed.

Each man was furnished with a chart on which to put down the amount of work done each day. At the end of the day the charts were handed in to the gate-keeper, to be compared with his report of work done, and filed. In the six months since that time only one man has ever tried to cheat. He was caught, but given another chance, and has been straight ever since.

Records for the past six months show the following facts: Hours have been shortened; the average amount of work per man has increased twenty-five per cent.; wages have increased on an average of fifteen per cent, and the labor turnover has been strikingly small.

A Sliding Bumper

ANY device which makes for safety is always welcome. Geo. F. Paul describes in Scientific American a new bumper that has been perfected and which is said to eliminate many of the dangers met with in the use of a rigid bumper for railroad cars. The one main advantage with the new bumper is that, when moving cars into track, the instant the first car strikes the shoes the whole crew knows it and they all realize that they are coming to the end of the track, and it is the engineer's duty to stop, whereas, in the case of a rigid bumper, the first notification the crew has that the cars are at the end of the track is a sudden jolt, and with the coming of this jolt the damage has been done. With the use of most types of rigid posts there is always a possibility of injuring the post or displacing the track.

This bumper is designed to be used on the blind end of a track. The sliding shoe catches the car wheel and is forced along the rail, creating a very high friction which effectively retards the momentum of the car wheel within a rail length.

Is It Quality or Application

AT a recent meeting of the American Chemical Society, in the division of dye chemistry, Dr. J. Merritt Matthews stated that, in his opinion, the fast colors of antiquity were not so much due to the better dyes employed, but that in the application of these dyes a great deal more care was exercised and a great deal more time taken. In the discussion which followed it was pointed out that advances in economy in the application of dyes can easily be accompanied by a deterioration in quality. This emphasizes the point often made that American-made dyes themselves are not so much open to criticism as methods used in their application. It has been pointed out also that methods are not apt to improve under present conditions when the price of fuel is such as to tend to shorten every process where heat is employed, such as, for example, the proper steaming of printed goods following the application of dye.

Making Up For A Poor Memory

ONE of the best executives I have ever known started out in a very small way and in a very small business, and seemed to have all the ends of the business in hand. This man, continues B. R. Duncan in System, lacked but one qualification to make a perfect executive—namely, a good memory. He made up for this by being a great believer in the memorandum system, and in placing everything where he would see it before it should be attended to. This man is now in a very large establishment and he seems to have mastered the details of every portion of the business. Added to his qualifications for an executive was the fact that he had a wonderful mind for thinking out things far ahead of anyone around him. The result was that in a cumulative way he did splendid work and is doing it to-day.

He has a thorough knowledge of practically everything in the business. This, to my mind, makes a good executive—not a knowledge of just certain sections of one's business. To be a good executive one must be broad, and ahead of the procession—not in back of it.



WHAT OUR READERS THINK AND DO



ANSWER TO CRITICISM

By Cecil H. Smith

In the Nov. 24th issue of Canadian Machinery, Mr. Davis gave his viewpoint on a former article on threading written by the author. I have read his article with interest, but frankly I cannot understand his viewpoint. In the following matter I am going to give solutions to his problems as best I can.

To my mind, when a pitch of thread is given as a decimal, it would be quite proper to also designate the lead screw pitch in decimals. For example:—

$$\frac{.654 \text{ screw to be cut.}}{.333 \text{ lead screw}}$$

By cancellation we get zero as follows:

$$\frac{.654}{.333} = \frac{218}{111} = \frac{109}{111} \times \left(\frac{2}{1} \times \frac{20}{20}\right) = \frac{109}{111} \times \frac{40}{20}$$

This makes a slight error in lead.

Mr. Davis' method would be:—

$$\frac{654}{1000} \times \frac{3}{1} = \frac{1962}{1000} \div \frac{2}{1} = \frac{981 \text{ driven}}{500 \text{ driven}}$$

Now the question is—"where do we go from here?"

I have had over nineteen years' experience in the machine shop, but I never, as yet, heard of a lathe with a lead screw three threads per inch. Nor have I seen or heard of a drawing which gave the pitch of a thread as 3 2-3 in 1 3-4 in. Further I cannot see why a thread should be cut to a pitch of .654 in. Mr. Davis mentions that my method may be all right for the common threads usually found in a machine shop. As this is what I use it for, I am perfectly satisfied. A word about metric pitches.

On Page 875, fourth edition Machinery handbook is the following rule, and which is on the principle of the one I gave: "Suppose a thread of 3 millimeters lead is to be cut in a lathe having an English lead screw, and a screw constant of 6. As there are 25.4 m.m. per in., the number of threads per inch will equal

$$\frac{25.4}{3}$$

Place the screw constant as the numerator and the number of threads to be cut as the denominator, and we have:—

$$\frac{6}{\frac{25.4}{3}} = 6 \div \frac{25.4}{3} = \frac{6 \times 3}{25.4}$$

The numerator and denominator of this fractional expression of the change gear ratio is next multiplied by some trial number to determine the size of the gears. The first whole number by which 25 can be multiplied so as to get a whole number as the result is 5. Thus 25.4 x 5 = 127. Hence, one gear having 127 teeth is always used when cutting metric threads with an English lead screw. The other gear required in this case has 90 teeth. Thus:—

$$\frac{6 \times 3 \times 5}{25.4 \times 5} = \frac{90}{127}$$

Rule: Take number of threads per inch in lead screw by the lead of required thread in millimeters x 5 as the numerator of the fraction, and 127 as the denominator. The product of the numbers in the numerator equals the number of teeth for the spindle stud gear, and 127 is the number of teeth for the lead screw gear.

INCREASING UTILITY OF MILLING MACHINES

(By J. H. Rodgers)

The slotting of locomotive connecting rod ends in a Montreal railway shop, which formerly required three to four hours to accomplish—the work being performed on a slotting machine—is now done in about one-sixth the time on a universal miller.

When the job was first turned over to the miller it was necessary to drill two large holes through the inner end of the rod jaw, as the distance between the arm and the cutter spindle would not permit of a saw sufficiently larger in diameter to make the complete cut. It was subsequently decided to alter the shape of the arm so that larger saws could be used to cut out the piece by drilling the one clearance hole only at the inner end of the fork.

The design of the modified arm can be clearly seen by the accompanying illustration. The arm was made with an offset that provided ample clearance for the two large Huther saws, which were secured to the milling machine spindle in the usual manner. The time required for sawing is approximately 40 minutes. The jig is so designed that minimum time is required in setting up the work.

A POWER SAW ON A WHEELBARROW

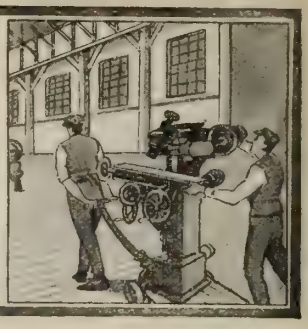
A portable power-driven cross-cut saw exhibited by a British firm at a recent Agricultural show in England has many points of interest. It will do any kind of cross-cutting or cutting in the field or in the timber yard. A gasoline engine of four horse power is mounted on the shafts, which have handles at one end and a wheel at the other, wheelbarrow fashion. The light flywheel of the engine carries a small sprocket which drives a chain operating a large sprocket to which is attached the stroke arm of the connecting rod to the saw. Although this machine carries a 5 feet saw and can cut through a trunk 4 feet 6 inches in diameter, it can be wheeled about by one man. The whole outfit is self-contained, with tanks for water and fuel. Another feature is that the engine carries a small pulley from which farm or other machinery may be driven.



How the Locomotive Connecting Rods Were Slotted.



DEVELOPMENTS IN SHOP EQUIPMENT



MULTIPLE SPINDLE DRILLING MACHINE

The Henry and Wright Mfg. Co. of Hartford, Conn. have developed a bench, multiple spindle drilling machine. It is known as their No. 0. The machine is equipped with ball bearings and has a two step pulley in each spindle and on the rear driving shaft. These pulleys give four speeds, with a maximum of 12,000 r. p. m. The machine will drive a 13/64 inch drill to capacity. The tension of the belt driving each spindle is spring adjusted according to size drill being used. The lower arm has a vertical adjustment of 6¾ inches, which with a feed range of 2½ inches, gives a maximum height of 7⅞″ from table to the nose of the chuck. Spindles are all equipped with a special spring return. This spring prevents the breaking of drills when drilling of a piece is completed. The machine is equipped with a tight and loose pulley and a belt shifter.

Special attention in design has been given to rigidity as all parts must be perfectly in line to take care of the high speeds. Each spindle is ⅜″ diameter and is provided with a chuck that will take in a 13/64″ drill. The centre distance between spindles is 7 inches. The distance from the centre of each spindle to the edge of its corresponding column is 5¼ inches. The machine occupies a floor space of 26¼ inches x 33 inches, and is 22¾ inches high. The weight is about 345 lbs.

VARIETY BELT SANDER

The Oliver Machinery Co., Grand Rapids, Mich. have placed on the market their No. 127 Variety Belt Sander. It is designed for rapid sanding and polishing of all kinds of irregular shapes, edge work, and flat surfaces. and also for polishing metal surfaces. A main driving pulley is mounted on a counter shaft, located on a substantial base, with a frame swinging about the center line of the countershaft and carrying a support arm. On this support arm are carried two clamp brackets, one of which supports the main idler pulley and the tension idler. The other supports the table and the backing plate or any forms of flexible pads desired. The machine will take belts up to 10 in. wide and 14 ft. long. The edging table is made of cast iron size 10 by 12 in. and tilts any degree up or down to 30 degrees. It can be adjusted in or out and has drilled holes for attaching wood tops or forms. The breaking plate is 10 in. wide, of cast iron, and can be adjusted in or out to suitable tension on the belt. It has drilled holes for attaching flexible pads.

The main idler runs in ball bearings and is adjustable up or down the whole length of the idler arm to accommodate various lengths of belts. This pulley is faced with leather. The tension idler, is of the ball bearing type and fulcrums in the centre line of the main idler, is leather faced and is balanced by weights to give the proper tension to the belt. The fork idler attachment is mounted on the machine in place of the regular table. It is used for doing oval sanding. The fork idler is rigid in construction and carries two aluminum idlers, which run on ball bearings and are adjustable to the work, the counter shaft is 1½ in. diameter, runs in roller bearings and the driving pulley is 14 in. diameter by 10 in. leather faced. Tight and loose pulleys 10 in. diameter by 5 in. face are supplied. The electric driven machine calls for a 2 h. p. motor running about 900 r. p. m. direct connected.

RING WHEEL GRINDER

The Graham Manufacturing Co., Province. R. I. have issued a circular describing their new Ring Wheel, Knee Type Grinder which has recently been placed on the market. The grinder is intended for wet grinding and can be arranged to drive by countershaft and belt, by belt from a motor mounted on a bracket attached to the column, or direct connected to a motor of from 1500 to 1800 r. p. m. No one motor is considered standard as the application of the machine is so wide that various powers may be required. The countershaft and regular spindle pulley are sufficiently rugged to take care of all requirements when the machine is being operated at full capacity. It is claimed by the manufacturers that the machine is easy of access to both cutting agent and work table; great rigidity exists between cutting agent and work table; that it will stand up under continuous work at full capacity; any available power can be applied; useful on production or tool room work; can be greatly modified in capacity, operation and scope; and is of simple design. In all cases the work is held directly on the table in special fixtures, vises, magnetic chucks, etc. Milling fixtures can be used on the machine although generally speaking grinding on this type of machine does not require work to be clamped as securely as when milling.

The design throughout is obtained from well tried and proven practices, such as the box shapes in the column and knee. The table is similar to that of a milling machine and is similarly controlled. The spindle is of low grade tool steel, hardened and ground, running in two Timken taper roller bearings. A collar is shrunk on for the abrasive ring holder. The dust collars are packed with felt and protected glass indicators show the height of the lubricant. To avoid end play a heavy adjustable coil spring presses the spindle back so that it is always in contact with the front end thrust races. The table slides are of liberal proportions with special lubricating facilities. A special Brown & Sharpe cutting lubricant pump is supplied. The travel is 16 in. longitudinally and 3 in. transversely. It lowers from about centre line of grinding arbor to 7 in. below it. The machine will grind 6 in. high, 12 in. along the table, and any length across the table. The power required to operate the machine varies from 5 h. p. to 15 h. p., according to the class of work being done. The height to the centre of the spindle is 42 inches. When belt driven a 6 inch belt is used. The floor space required is 6 ft. 0 in. x 6 ft. 0 in. The abrasive ring is 12 inches in diameter, with 8 in. hole, and the ring is 2 in. deep.

TURRET ROTARY SHEAR

Three news sizes of the "Gray" type of turret rotary shears have been developed and placed on the market by the Southwark-Gray Foundry and Machine Co., Philadelphia, Pa. These machines are adapted for cutting any shape of opening in sheet metal, without cutting in from the edge and without turning the sheet. This method of cutting sheets and plates is made possible by mounting the rotary cutter on a turret which can be moved to any angle through a full circle while the cutting action is in progress. The machine is now manufactured in four sizes the smallest being the No. O. on which only the lower cutter is driven. This machine is designed primarily as a hand-driven machine, but power can be applied. On all other sizes both cutters

are power driven. The special feature on the largest shear. No. 3., is the mounting of both the upper and lower cutters on adjustable turrets.

This machine has a capacity for cutting any thickness of plate up to ⅜ inch. Both the upper and lower cutters are set at an angle, and they keep the same relative positions at any degree of the circle to which they may be turned. Handwheels for revolving the turrets are provided on both sides of the machine. The cutting speed of this machine is 10 feet per minute and the throat depth is 36 inches. Three horse power is required for driving. The No. 2, machine has a capacity for cutting sheets up to No. 8 gage, a cutting speed of 10 feet per minute, and a throat depth of 30 inches. The No. 1. machine has a capacity for cutting sheets up to No. 14 gauge, with a throat depth of 3 inches. The No. O. machine will cut up to No. 16 gauge and has a throat depth of 18 inches. Special machines to cut plates up to 1 inch thickness can be made up to special order.

The smaller machines are used to produce various lines of products, including automobile aprons, pans, tanks, mud guards, flanges, fenders, radiators, etc. In general sheet metal work they are employed to cut elbows, tees, hoods. oil pans, ventilator spstem parts, etc. The heavier machines are employed to shear plates in building ships, locomotives and also to shear structural steel parts.

SPOTTING AND ROUTING ATTACHMENT

Frank N. Krag, Chicago, Ill. is manufacturing a spotting and routing attachment to be mounted on milling machines for use in the accurate lay-out and drilling of holes up to, and includ- 3/16 inch diameter, in dies, jigs, templates, and master plates, etc. The attachment is marketed under the trade name of "K-N" by E. L. Krag & Co., Chicago, Ill. The locating of holes by means of buttons is entirely unnecessary when the attachment is used. It is permanently placed in alignment by means of a locating screw in the base, which is locked in place after being adjusted. The driving arbor for the attachment is inserted in the spindle of the milling machine, and is provided with a spring dog that engages automatically when the machine is started.

The spindle of the attachment is driven by means of a round belt that is always kept at a uniform tension through the provision of a compensating spring idler, mounted in such a manner that the belt is always in alignment. The speeds of the attachment spindle and the machine spindle are in the ratio of 7 to 1. The spindle housing and the bracket which holds the guide bushings are cast in one piece to assure alignment at all times. The spindle sleeve can be locked firmly in any desired position, when using the attachment for routing, by means of a friction plug. Five guide bushings 1/16, 3/32, ⅛, 5/32, and 3/16 inch in diameter are supplied, and these are made of a high grade tool steel. The attachment is graduated to 360 degrees, and may be quickly adjusted to any desired angle. It is supplied for all standard makes of milling machines

PORTABLE ELECTRIC WELDING OUTFIT

The Bartman Machine Shop of Hanna, Alta.; has recently constructed a rather unusual electric welding outfit of the portable variety. In addition to being of the portable variety it is also independent of an outside source for its electricity. Therefore its field of usefulness will be limited only by conditions which will prohibit the transporting of the outfit.

An old Chevrolet 490 chassis was used as a foundation on which to place the equipment. A platform was built on the chassis. The engine was removed and placed transversely across the platform, at one end. Two Chevrolet fly wheels were bolted to the crank shaft flange, and were then machined so as to serve as a pulley from which power could be taken. In the other end of the platform a 200 ampere 4 k. w. belt driven welding generator was mounted. A 6 in. endless belt was used to transmit the power from the engine to the generator. The engine was operated at a speed of 950 r. p. m. Constant speed, under varying load conditions, was obtained in an ingenious manner. The cam shaft was extended in order to bring it through the timing gear cover, and a Pickering governor was geared to the shaft extension. This governor was connected to the butterfly valve in the intake of the carburetor. The principle is very similar to that of a throttle governing steam engine. A radiator is used to cool the water for the engine.

The welding panel is mounted near the generator, and the machine is not self propelled but is arranged with a self steering tow bar.

VERTICAL SPINDLE MILLING MACHINES

The Jackson Machine Tool Co., Jackson, Mich. have brought out an improved type of vertical milling machine for manufacturing and die sinking purposes. The machine, known as their No. 6A, has power feeds and their machine No. 5A has hand feeds. The hand feed machine is similar in most respects to the power feed machine except the table surface is smaller and some of the traverses are less. To facilitate operation the spindle has a vertical movement, manipulated by hand, through a mechanism permitting of both hand feed and rapid traverse. Near the lower end of the spindle is a vertical sliding housing, which carries both the lower main spindle bearing and the thrust bearing. The spindle and housing are counterbalanced by a weight inside the column, which is slightly greater than the weight of the spindle and attached parts, in order that all lost motion between the cutter and hand wheel may be taken up. A micrometer stop is provided for determining the depth of the cut and the vertical postion of the spindle. The spindle may be clamped in position when the proper depth is obtained. and then longitudinal or transverse cuts may be made.

In addition to these machines the firm has also brought out two other new vertical milling machines known as their No. 10-A and No. 10-B. The No. 10-A machine has a table and cross rail feed ranging from .001 inches to .015 inches per revolution of the spindle, and the No. 10-B machine has a range of feeds from 5/16 in. to 16 in. per minute regardless of the spindle speed. The machines are similar to the No. 10 die sinker put out by this firm except that they are fitted with a heavier vertical milling head and have no cherrying mechanism. Inside the milling machine head is a back gear arrangement whereby thirteen changes of spindle speeds are obtained. These speeds range from 8½ to 310 r. p. m. A simple pull pin lever throws the back gear in and out. All spindle speeds are obtained from quick-change-gear box. The spindle, on its lowered end, has an integral flange 6½ in. in diameter. Across the face of this flange is a ¾ in. keyway and into it two holes are drilled. which can be used for securing and driving large cutter heads. A 13/16 in. hole runs through the entire length of the spindle. This hole has a No. 13 B. & S. taper at the bottom.

This feature is useful for a draw-in bolt. All feed changes are made through the feed change box. A novel feature is a round table 36 in. in diameter which can be provided for circular and continuous milling. This table may be used as an attachment on the regular milling machine table. so that it may be removed when not in use, or it may have its bearing on a specially designed cross rail. Standard sizes of cutters are made for these machines, the cutters being 4, 6, 8. 10, 12 and 14 inches in diameter. All cutters are made from standard stock and may be used with any cutter head, the larger heads having backing rings for more securely holding the cutters

NEW CALCULATING MACHINE

The Monroe Calculating Machine Co., New York. have placed on the market a new line of calculating machines, built in 20-place, 16-place, and 12-place sizes. The outstanding feature of the machines is, the minimum of effort required to operate them, combined with great speed possibilities. Dial clearouts, and interlocking devices to prevent errors, all tend to make the machine of very practical usefulness in any place where numbers are added and calculations made.

CANADIAN MACHINERY
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The Business Paper Gets at the Facts

A STRIKING illustration of the service the technical or trade paper renders its readers and of the difference in the reliability of the information it supplies and that furnished by the average daily newspaper is afforded by an article in a recent issue of the "Railway Age Gazette" with reference to Henry Ford of automobile fame and railway management.

Mr. Ford as many of our readers will have learned from the newspapers, recently purchased the Detroit, Toledo and Ironton Railway, a small road which was practically in a state of bankruptcy. In the same papers they will also have read how Mr. Ford put in his management in March, and in April the net operating income had risen from $78,000 to $276,000. For several months past the various newspapers, magazines and labor publications of the States have been jumping at conclusions and drawing deductions from this one month's figures, enlarging upon the fact that, in spite of higher wages, Mr. Ford had succeeded in making his railway a paying proposition, and in many cases it was hinted that here was the man who could straighten out the railway systems of the country and place them upon a stable and profitable basis.

The "Railway Age Gazette," however, was not content to accept these hastily drawn conclusions as decisive and started an investigation on its own account, with the result that when the figures for several months of Mr. Ford's regime were examined a very different tale was unfolded. The income of $276,000 in April had dropped to $187,000 in July and in August to $70,000, lower than it was when Mr. Ford took the road over. Expenses, moreover had increased from 52.7 per cent. to 59.7 per cent. in July and 71.8 per cent. in August—this in spite of the fact that gross earnings which were $713,000 in June had increased to $744,000 in July and still further to $763,000 in August. Moreover, while the operating had thus increased 46 per cent., those of the ordinary railways of the country had increased only one per cent.

The point in this incident which immediately concerns our readers and ourselves is not so much the success or failure of a railroad as that to a business paper is due the fact of the truth being made known. During the last few years occurrences of this nature have been frequent in connection with the series of trade and technical publications of which this paper is one. Inaccurate and misleading information giving rise to serious complaints has been published on one subject or another by the daily papers. The public have been worked up to a pitch of indignation by some statement which upon investigation has been found to have no foundation, and it has been left to the business paper to show that the complaint was therefore groundless. It is the reliability and accuracy of all information published that differentiates the business paper from the ordinary newspaper and makes it of such high value to its readers.

Application of Ball Bearings

THE proper application of ball bearings is a specialized study. Unfortunately we have not arrived at the point where everyone is in complete accord. Each has his own viewpoint, and it is a difficult matter to move him from that position. This truth has been brought home to us very forcibly during the past few weeks. On November 10th we published the first part of ball bearing article appearing on another page of the present issue.

After publication, we received a criticism on the same, this matter also appearing in the current issue. We have taken up the matter with both authors, and each maintains his viewpoint is correct. The question is a debatable one, and those interested in ball bearings will no doubt bring their own knowledge and experience to bear on the points raised. As shop superintendents, designers and general managers will be the readers chiefly interested, we feel they are well able to judge for themselves the merits and demerits of the case.

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MARKET DEVELOPMENTS



Business Is Very Quiet On All Markets

Production of Steel Ingots Has Decreased Somewhat—Prices on Various Lines Holding Up Fairly Well—Machine Tools Are Dull —Also Small Tools—Scrap Metal Market Stronger

THE past week has brought no important developments in the steel trade, conditions being much the same. Production has dropped a trifle, an average rate of 40 to 45 per cent. existing. This compares with a rate of 50 per cent. early in November, although the production in October was only 44 per cent. As things have been rather dull on the steel market since the middle of October, the present rate of production is none too bad. In fact it proves that a considerable volume of business must have been placed some time ago for execution during the remainder of the year, otherwise the rate could not have held up as it has done.

The regular prices on sheets remain steady. Tin plate prices are also holding their own, although a little amount of shading is being done. This however is not taken seriously by the larger mills. Tubular goods show no change, but in line pipe the cutting is quite deep, in some cases going below the cost of production.

The price on bars, shapes and plates remains about the same; although the tendency exists for lower prices. Should buyers reach the position where they could place large orders, a drop in price would be more than likely.

There is some talk of a consolidation of steel interests in this week's Pittsburgh letter. It should be read with interest, for if it goes through it may make quite a difference, for several economies could be effected in due course of time.

Outside of the work on the ice breaker at Vickers Yards, and the repair work on freight cars at the Canadian Car and Foundry Co., there is not much moving in the Montreal market. Machine tools are very weak, and while the small tool market is moving it is nothing near normal. The scrap metal market is also very poor.

In Toronto we have a very quiet market. Machine tools are barely moving, small tools have weakened somewhat, and the steel trade shows seasonal depression. The only branch showing signs of life is the scrap metal market, but even here the course is erratic. Although the various markets are rather dull, this was expected some time ago, so that one cannot truthfully say the market is in poor shape. A better way to describe it would be to say that everyone is walking carefully, buying only what they actually require. What the new year will issue in is another question.

PRODUCTION OF STEEL HAS DECREASED CONSOLIDATION PROPOSITION ON TAP

PITTSBURGH, December 8th. — The past week has brought no important developments in the steel trade, market conditions being much the same as for several weeks past. Production has receded a trifle. Prices on the whole show a less distinct sagging tendency.

Current estimates are that the rate of steel ingot production lies between 40 and 45 per cent. of capacity, this comparing with a rate of about 50 per cent. early in November, and an average of 44 per cent. in October, which had shown the highest rate since last February. As the steel market, taking it as a whole, has been relatively dull since the middle of October the rate of production is really very good under the circumstances, and points to a considerable volume of business having been placed some time ago, for execution during the remainder of the year. In a number of cases mills made drives for business, representing to their customers that they would cover them to the end of the year at close prices and that they intended to advance prices after they had made the rounds of customers. In most cases the predicted advances did not occur, and where they did occur prices are back to the old level. An instance of this is hoops, bands, and hot rolled strips, which were nominally advanced to $2.25 a few weeks ago after business had been booked at $2.00 and thereabouts, the open market price having lately gone back to $2.00.

While steel production is being supported in part by recent contracts, it is not to be supposed that there will be any decrease in production January 1 on account of contracts running out, for buyers are taking only such steel as they absolutely must have, desiring to keep inventory down, and there should be heavier production in January than in December, rather than lighter production.

The Question of Prices

The regular prices on sheets have been holding pretty well up to date. On November 25, as reported a week ago, the American Sheet and Tin Plate company opened its order books for the first quarter of the new year, at the prices it had previously been quoting for this year, $2.25 for blue annealed, $3.00 for black sheets and $4.00 for galvanized. Independents had previously withdrawn cut prices. Bookings are running rather light. The American Sheet and Tin Plate company still has an advantage over the independents by reason of its old contracts, many being more than a year old, but still not completely specified. While the independents have to make sales as they go along, the leading interest gets a considerable part of its business by entering specifications against the old contracts, simply adjusting the price as occasion requires. Contract prices themselves are not revised, merely prices to apply on shipments as specified.

The $4.75 tin plate price, announced November 3rd, by the leading interest to apply on prompt orders and contracts with jobbers for first quarter and manufactuing consumers for first half, is holding quite well. There is a little shading by one or two mills which do not have a reguar clientele, but this is not taken seriously by the larger mills.

Tubular goods show no particular change in the matter of prices. The National Tube Co., (Steel Corporation) is adhering to its regular prices while as

for many weeks past independents are shading slightly. In line pipe the cutting is quite deep, to levels which are said to be below the cost of production.

Bars, shapes and plates are quotable generally at $1.50 to $1.60, depending on size of order, specifications, etc. Prices are hardly any weaker on these lines than a fortnight ago, but they certainly are not stiffening, and the probability is that eventually buyers will be able to develop slightly lower prices when they are in position to offer larger orders and for more extended delivery. The mills would probably welcome an oppotunity to drop prices a trifle, to book a good volume of business and then make an advance.

Talk of Consolidation

At intervals for about ten years past, there has been talk of there being a consolidation among a number of the independent steel companies. None of these projects got very far along, but there is a project now that seems much more serious, there being perhaps a 50-50 chance of its going through. There is a project within a project, that is, four companies have gotten pretty close together, as one propositon, and then there is another that would take in three other companies plus these four. The seven are: Midvale Steel and Ordnance Co.; Lackawanna Steel Co.; Republic Iron and Steel Co.; Youngstown Sheet and Tube Co.; Brier Hill Steel Co.; Inland Steel Co. and Steel and Tube Co. of America. One important point about the consolidation, as a means of improving the condition of the producers, is that with the two Chicago district concerns included the practice of basing steel prices on Chicago could be eliminated, by a return to the Pittsburgh basing which obtained until competition became so keen this year. The seven concerns have a rated steel ingot capacity of 9,800,000 tons a year, or approximately one-third of the total independent capacity which is about 30,000,000 tons, while the Steel Corporation has a capacity of about 22,500,000 tons, making about 52,500,000 tons for the industry as a whole. In time the consolidation could effect some economies of importance by combining sales offices and in other ways, just as the Steel Corporation has done in its 20 years of development.

Pig Iron and Coke

The pig iron markets seem to grow weaker steadily, though prices do not decline to any extent, perhaps because there is so little inquiry and therefore real competition. The prolongation of the very light demand in the market is remarkable, and the conclusion can hardly be avoided that consumption by the foundries has been decreasing in the past few weeks. As the steel makers who buy their pig iron, are not running as well as the integrated companies, they thus are poor buyers of merchant iron. There is no prospect of any additional merchant furnaces getting into blast in the near future, but rather a possibility that some furnaces will go out, as not all the merchant iron being made at present is being shipped. The valley market remains quotable $20 for Bessemer, $19 for basic and $20.50 for foundary, f.o.b. valley furnaces, but it is recognized that on the appearance of any important inquiry these prices would probably be shaded.

Connellsville coke has weakened farther, and for spot furnace coke $3.00 is the top rather than the bottom. Spot foundry coke is still quotable at $4 for ordinary brands but the price is likely to be shaded. A few particularly favorite brands are held at $4.50, but meet with little sale.

POINTS IN WEEK'S MARKETING NOTES

Production in the steel trade has receded a trifle. Prices, however, show a less distinct sagging tendency. The production of steel ingots at present is approximately around 40 to 45 per cent.

This rate is not likely to drop further on January 1st, on account of contracts running out, for buyers are purchasing only what they actually require. Some think production will increase slightly in January, but of course not much.

The $4.75 price on tin plate issued on Nov. 3rd, is holding quite well. Tubular goods show no change, although a small amount of shading is being done. The prices on bars, shapes and plates have not weakened any during the last two weeks, but they are certainly not stiffening. When buyers are in a position to offer larger orders, lower prices may result, although the mills may in turn book a good volume of business, then make an advance in price.

A consolidation of interests is discussed in the Pittsburgh letter this week. Should this movement go through, it would mean combining sales offices, also effecting economies in other ways.

Outside of some activity in the Vicker Yards, and repair work to freight cars at the Canadian Car and Foundry Co., Montreal reports nothing of importance. The market is weak, and machine tools are merely moving. The small tool business is about the strongest member of the Montreal market, but even this statement does not infer the latter mentioned branch is anything near normal.

The only bright spot on the Toronto market is the scrap metal situation. Even at that it's not so very bright, but as this market is showing signs of life for the first time in many moons, there is reason to be thankful, even for small mercies. Machine tools are very quiet, and the small tool market has eased off considerably. The steel market is showing signs of depression, and little improvement is looked for this year.

LOCAL ACTIVITIES ARE VERY LIGHT

TORONTO, December 8th.—If there is any change on the local market this week, then it is a change for the worse. Every dealer you meet is carrying a grouch these days. There may be some exceptions, but they certainly are few and far between. At that you can't blame them very much for these have been very trying times. In many cases dealers have not paid expenses for some time back, and from the look of the market at present, they are not likely to do so for some time yet.

Take for example the steel market. They have now entered into what can be termed their slack season, although the business closed for some time back has been none of the best. From now on until the end of January they can only hope to pick up a few odds and ends, but their overhead goes on just the same. Usually they depend on their good season to carry them over the dull season, but as there has really been no good period they will have to be content to carry on as best they can. From the foregoing it is hardly necessary to state that the steel market is suffering from a state of seasonal depression. Dealers do not look for any improvement in the near future, in fact do not expect to land any business worth while for the balance of this year. As far as prices are concerned, there is no change, nor is there likely to be any this side of the New Year. To predict any further than this is rather risky, for no one knows very well what is going to happen at any time. One thing sure, dealers are not over optimistic as to the balance of this year. The only ray of sunshine, if one can call it so, is that the existing condition is only what they expected.

The Small Tool Market

Even the steady member of the local market, the small tool business has gone back on us. Up to a month ago this branch could always be depended upon for a favorable report, but now dealers tell us that they are disgusted at the amount of business closed. Manufacturers are buying only what they actually require, and cannot be convinced that they should stock up at present prices. The Christmas season is also blamed for the present lull, and some think that—the start of the New Year will see a change for the better. Prices remain the same, and it is unlikely that there will be any changes in the near future.

The Scrap Market

Luckily we have one bright spot on the local market this week, and that is from a very unexpected source, viz, the scrap metal market. Conditions have improved on this market, although the change has not been sensational by any

means. However, as the scrap metal market has been the black sheep of the family for some time it is pleasing to see it reforming. The present change for the better has been largely due to the improvement on the New York market. We are now getting the benefit of the move, and red metals and coppers are the active lines. White metals do not show much improvement, but the strength shown by the other metals make up for the whites. European countries have started buying again, and several orders have been closed for export. The only difficulty seems to be the price. This is rather unsteady. For example: up to Thursday of last week, prices remained fairly firm, but after that date they sagged somewhat. However it is expected that they will stiffen up again to their former level.

Machine Tool Market

This market remains very quiet. Enquiries come in all right but they seldom get beyond that stage. What business is being done is not for any large amounts. Interest continues in the new proposed Machinery Hall, although, as mentioned last week, some think the ten year guarantee is prohibitive, especially for dealers who are in Canada doing business for firms making machines outside of Canada. One dealer speaking on the subject says that if the directors of the Exhibition feel there is a demand for an Engineering Building, which point seems to be proven, would it not be better for them to erect the building and offer space on a yearly basis with an opportunity for securing long term leases?

This dealer goes on to say that he represents a recognized production line, various manufacturers being included. The total capital investment of this group would be exceedingly large, he continues, yet not one of them has failed to express an absolute unwillingness to enter into any contract binding them for a number of years. On the other hand they express an appreciation of the opportunities afforded by this annual exhibition and would be very willing to exhibit their tools.

We would plan to use a large space with a collective exhibit of our various lines, concludes this dealer, but we can only interest our principal on the basis of a one year lease. This brings up an interesting point, and one which the exhibition authorities should think over carefully.

Taking the local market collectively this week, we should say that although very little business is moving, the market is in a quiet, but healthy condition.

MILLS ARE ANXIOUS FOR BUSINESS; MACHINE TOOLS MOVING VERY SLOWLY

MONTREAL, December 8th: — The past week has not developed any large business deals but the volume of trade closed has been about the same as the past few weeks. The heat of the election contest, which is now on the home stretch, has had a great deal to do with the tendency to let business become of secondary importance. The larger firms view, with no little anxiety, the possibilities which could result from the polling. Around the Vickers Yard more or less activity is present owing to the fact that work on the new ice-breaker is under way. The Canadian Car and Foundry Co., are making good progress on the repairing of the freight cars for the Canadian National Railways. Owing to the warmer weather that followed the cold snap of a week ago building operations are being rushed on all the larger structures also on many smaller buildings.

The steel situation has not changed a great deal. About the same tonnage seems to be required from week to week. Quotations are the same as have been used for the last two weeks. Other lines of the iron and steel business are moving in the same nominal way as has been reported for several weeks past.

Mills Are After Business

There is every evidence that the mills are very anxious to secure a greater volume of business. The present prices are as low as can be expected, and really leave little or no margin for producer or jobber. In fact many of the latter, who have carried a small or fair sized stock for some time, are complaining they are losing money at prevailing prices. In fact the margin is so small that every small saving counts. Those who have modern warehouses and can handle material in an efficient manner are able to make the little savings that go to total up a profit. Many firms, other than jobbers, are actively hunting up business in small lots. Thus the country is being scoured for all possible business. Conditions are very much the same across the border where there is little business offering and prices are cut to the minimum. The demand for structural steel has fallen to a low point as was expected. Merchant bars are still very sluggish. Sheets and thin plates are in fair demand.

Pig Iron Market

No changes in the price of pig iron have been announced during the last week, and there is every reason to believe that the present price will hold till the first of the year. The volume of business passing during the last few weeks has not altered greatly and it is not expected that the reduction in freight rates will have any effect on the quotations. There is a great deal of confusion existing about the amount of the reduction, for many understood it was a straight ten per cent. reduction.

As it is, the change will not enter into the price asked for pig iron. Some claim that the present quotations barely cover production expenses.

The volume of sales in machine tools during the past week has not been any more encouraging than the reports we have been able to make for some time past. In reviewing the situation however, the future does not look too dark. We have been, as a country, supporting a large number of contract and jobbing shops, where manufacturing in a small way was carried on. Gradually, as our markets became greater, we adopted modern manufacturing methods and have come into the market for special and automatic machinery as well as many labor saving devices, tools and fixtures. Our modern manufacturing establishments are meeting competition, and the smaller shops realize that the very latest in machine tools and equipment must be made use of to successfully meet the competition of the coming war for commercial supremacy.

Perhaps our experience in manufacturing war material has served to educate us, for many of our shops at present have their purchasing agents and superintendents closely studying the developments in the machine tool field. We must admit there is a big surplus of engine lathes, planers, drill presses, and the commoner types of general purpose machines. These will rapidly disappear as soon as business improves, as in many cases they have seen heavy service or are not suited to production work. One need only glance at a machine tool catalogue, or read circulars describing modern tools and it is realized that the type of machines now being manufactured are improvements over those offered for sale two or three years ago.

This is the factor that will swing machine tool sales into the limelight, and will make big business as soon as conditions improve. In fact this business will begin to move many new lines as soon as machine shop men are educated to the value of the modern lines now being placed on the market. Price reduction will not build up any permanent business, because if a need for a machine does not exist, a manufacturer will not buy. When he requires a machine he desires a machine from a reputable manufacturer and price is seldom the first consideration.

Small Tools and Supplies

Continued good business is the report from this section of the trade. Prices in the various lines are maintaining about the same level, with a slight tendency to become lower as production increases and the cost of labor and material comes down. In this field also there have been many new and labor saving devices that have been offered for sale, these having been met with fair reception. The number of portable tools that are being placed on the market is of interest. The various uses of such tools interest a new line of customers, namely automobile garages. This new field has stimulated the amount of business done in these lines. Prospects are that the regular channels will produce more business in the

(Continued on page 54)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shaues, Pitssburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 50
Castings, copper	17 00	18 00
Tin	36 00	37 00
Spelter	7 25	7 50
Lead	6 25	7 50
Antimony	6 75	8 25
Aluminum	27 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT
Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 88	14 71	17 77
½ in.	6 50	8 03	7 95	9 48
.....	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4 in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 25
Cut nails, base	4 85
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¾
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	1 03
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	55	68
Class B	23	33
Class C	15	23

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	.....	.....
Queen's Head, 28 B. W. G.	7 75	.....
Flerur-de-Lis, 28 B.W.G.	7 25	.....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	12½	Popular	.10
Standard	.11	Keen	9
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White 20 Dark colored .13
Mixed colored .14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

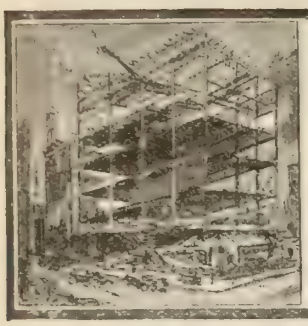
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

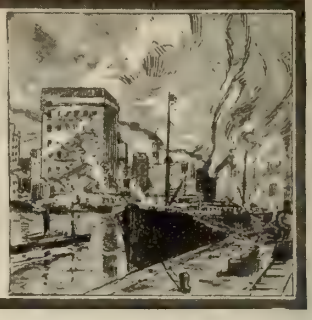
Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.08

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

Alexander Gibb, manufacturing agent of Montreal, has secured the agency for Eastern Canada, for the Canadian Tools Ltd., of Bridgeburg, Ont.

Three new buildings have been authorized in connection with the new Albert College, Belleville, Ontario. The total cost will be about $500,000.

The Malleable Castings Co., Smiths Falls, Ontario, reopened a part of their plant on November 30th. Fifty men were taken on as a start.

Georgetown, Ontario, has awarded the contract for the instalation of a waterworks pumping plant to Goldie and McCulloch, Galt, the cost to be $9,383.

The Strathroy Furniture Co. and the Middlesex Furniture Co., both of Strathroy, Ontario, report that business is taking on a brighter outlook. Both factories are running full time and recently have made additions to their staff.

The Canadian Vatu and Air Drying Manufacturing Co., with plant at Island Lake, near Sault Ste. Marie, has received an order for 25,000 dozen baseball bats from the Bregent Sports and Cycle Co., Montreal, and new machinery is being installed to handle the increased business.

We are in receipt of an inquiry as to who manufactures "Killametal." This is evidently a compound for the purpose of nullifying the chemical reaction of metals. Any information as regards the name of the manufacturer, or where this product can be secured, will be welcomed by the Editor.

The Colonial Motors Ltd., have now purchased the Canadian plant of the Detroit Lubricator Co. on Walker road, Walkerville. The transfer includes land, buildings and machinery.

Official announcement is made that work on the new hotel at the corner of Richmond and Fullerton streets, London, Ontario, is to begin at once. The hotel will have three hundred rooms and is to cost about $1,500,000.

Plants in the shoe-working industry have been running practically at capacity during the month of October, 1921. The Province of Nova Scotia reports that there production was 100 per cent. London, Ontario, also reports 100 per cent. Kitchener, Ontario, 90 per cent; Quebec reports 75 per cent, and Montreal 95 per cent.

Operations recommenced at the Brantford plant of the Massey-Harris on Monday of last week, about one-third of the normal working force going on a three day a week shift. The plant employs about 1,000 men normally. Binders will be produced at the Brantford branch for both home and export trade.

The plant of Scottish Fertilizers Ltd., one of Welland's new industries, is rapidly nearing completion, and will probably be ready to commence production early in the new year. The plant was designed by British Chemical Engineers and embodies some of the best ideas of British and American practice.

Cameron and Ralston, Windsor, have been appointed architects for the proposed Essex County Sanitarium, by the advisory committee of the Essex Health Association. Gordon M. McGregor, vice-president of the Ford Motor Company of Canada, is chairman of the committee. The building will be erected in Sandwich at an approximate cost of $150,000.

We learn that the Rand Water Board, Johannesburg, South Africa, has awarded the contract for about 8,500 tons of lapwelded steel water pipes of 18 to 24 inches diameter, to the Mannesmannroehren-Werke of Dusseldorf, Germany. The Rand Water Board has used Mannesmann tubes before to a very great extent, and we understand that the contract was secured against keen competition.

The Weeks Engineering Corporation, an American organization, has decided to establish a plant at Welland, Ontario. The principal product of the new works will be boiler plates. The company is taking over the Welland Machine and Foundry Company and will install machinery almost immediately. Additional buildings will be erected next spring and the entire site consisting of four acres, provides room for expansion. It is estimated that between seventy-five and one hundred men will be employed in the boiler tube plant.

A fair amount of business is on hand at the Port Arthur Shipbuilding Company Yards, that ensures active operation during the winter months. Extensive repairs will be made to the steamer Huronic, an American vessel that was bought by the Matthews Steamship Co., of Toronto, and which is to be converted into a Canadian vessel. Two large boilers are to be built for the western market. The company plans to construct twenty low-pressure heater boilers of various sizes during the winter. Hopes are entertained that a contract for the construction of a large bulk freighter for lake service will be placed in the near future.

The City of Guelph are preparing to purchase some equipment for the Civic Water Works plant in connection with the decision to supplement the present steam equipment with that of electrically driven centrifugal pumps. It has been definitely decided to purchase one three million gallon electrically driven centrifugal pump, and one three million gallon electrically driven booster pump, as an auxiliary, two three million gallon gasoline or Diesel driven units will be purchased. It has not yet been decided whether these will be served by gasoline or Diesel engines but it is expected that a decision will be reached shortly.

The King Suspender Co., Toronto, sold out their stock at sharply reduced prices last May. They then manufactured quickly, and well with low-cost material. A strong advertising campaign was cast and nearly the whole staff were sent on the road. The sales-staff was increased as it was realized that, with dealers buying from hand to mouth, more calls were necessary. The plant is working full time, and two auxiliary plants in Toronto, and two in Montreal, are adding to the output. The company is two months oversold in neckwear and have not taken orders for three weeks. Business in dollars and cents during the past three months has been more than last year; while, owing to lower prices, the quantity of goods sold is twice as great.

P. W. Cook, junior commissioner of the Department of Trade and Labor, was in Windsor lately with the page proofs of a bulletin entitled "Canada as a Field for British Branch Factories." The Border Chamber of Commerce, particularly the Manufacturers' section, has been assisting with material for the bulletin. In an interview, Mr. Cook, explaining the object of the publication, said: "What we are trying to do is to cut down the importation of manufactured articles. Last year we spent $100 in the United States for every man, woman and child of our population. Fifty-five of these $100 went for coal and iron and steel, but forty-five of each $100 was for manufactured goods, which might

just as well have been made in Canada. We have an abundance of man-power, water-power and natural resources that England has no idea of. Less than 90 per cent. of our factories use coal to generate power. The American firms have been quick to appreciate the industrial opportunities in Canada and at present there are ten American plants to each one established by British interests. The British manufacturers need educating and that is the object of the builetin.

The Vulcan Co., London. Ont., has been incorporated to manufacture iron, steel, brass, copper, metal products, etc., with $250,000 capital stock.

It is believed that the Forbes Vibration Co., St. Louis, Mo., intend establishing a plant in Canada for the manufacture of toys, etc. The location has not yet been decided.

If Guelph can raise $320,000 they will erect a new high and technical school. Day and evening classes will be held in such a school, but so far the matter is only in a proposed state.

The William Hamilton Co., Peterboro, Ont., are building certain machines for the Canadian Electric Co., which is establishing a plant in St. Catharines.

A fire amounting to a total loss of $200,000 occurred at the Woolworth store and Royal Bank Building at Calgary, Alberta recently. Both buildings are absolutely destroyed and it is expected they will be built up again in the near future.

Denmark has established a Consul General as a result of increased commerce between Denmark and the Dominion. Canada recently sent a trade commission to Denmark. Both moves are efforts to mutually increase the volume of trade and exchange products.

The production of steel ingots in October was at the rate of 23,000,000 gross tons a year or about 44% of production capacity. This rate is about 1-3 greater than the rate in September, or more than double the rate in July.

Figures secured from the report of the report of the Provincial Minister of Lands in the Province of British Columbia show that exports for the eight months ending August 31st, 1921, of lumber were 101,604,256 feet.

The Bell Piano and Organ Co., of Guelph, Ont., have been considering the installation of two new boilers to replace the three at present in use. According to the engineer in charge an order for these should be forthcoming in the course of a few months.

The Rae Machine Tools Company, plant, Hamilton, Ont., has been reopened for the manufacture of vises and other metal working tools. The plant was closed down two months ago; at that time a general line of machine tool was manufactured.

The Canadian Carbide Co., Montreal, have joined with the British Cellulose Corporation and others in an application to have carbide declared a key industry under the new Protection for Industries Act. If the application succeeds, Canadian Carbide will have the advantage of preferential entry of the 33 1-3 per cent. duty which will be imposed on the foreign products.

Mr. Hyndman, general manager of the Canadian Metal Products, Ltd., Guelph, says he is satisfied with the amount of business closed so far this year. He claims it is about 70 per cent normal. He is very optimistic about the future and feels the coming year will see things moving in a big way.

The erection of a central heating plant for the general hospital is being considered by the city of Guelph. Work will be proceeded with as soon as they can raise the sum of $30,000, this being the cost of the equipment they have in mind. Some action will have to be adopted shortly for the present equipment is said to be both insufficient and inefficient.

The Lloyd factory, a branch of a large United States concern, which was opened at Orillia, Ontario, last year, is adding new machinery and getting ready for a general advance of business. They are manufacturers of baby carriages, and furniture, and are not only buying new machinery, but are also occupying greater floor space and expect further additions will soon be necessary in order to supply the Canadian demand.

The Gibson Mfg. Co., report another successful year. Although last year's business was exceptionally good for them, this year is only 15 per cent lower, even in spite of the present depression. Mr. Cooke, the purchasing agent stated to Canadian Machinery, that his firm took an early lead in reducing costs. This in turn made better sales. This firm have decided to purchase two new boilers, also some sheet metal machinery.

The Ontario Agricultural College, Guelph, Ont., is to have two new buildings erected to be ready for occupancy in a year and a half. Building operations have already commenced. They will consist of a Dairy and a Veterinary Building together with a power plant, the whole to cost in the neighborhood of $150,000. Up to date, motor driven machinery will be installed in the dairy building which will, when competed be one of the finest equipped institutions of its kind in the country. The power plant will consist in the main of two 75 h.p., h.r.t. boilers.

Bowmanville is coming back to its own as an industrial centre and influential men have obtained a charter under the heading of Bowmanville Securities, to promote industrial conditions for the town generally. They are underwriting the Thomason Knitting Co., who have now established their factory in the premises formerly occupied by Messrs. Rhieder & Son. A short time ago the shareholders and friends, including the mayor and other prominent men, gathered together to inspect the plant, and in the near future we intend to give a descriptive review of these works, which are using machinery or representing improvements of a special character likely to be of interest to the trade.

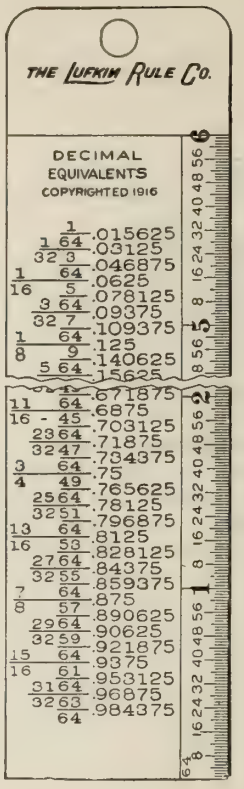
According to reports Krupps of Germany have asked for details regarding the Delaware bridge, which is soon to be building in the United States. The belief has been expressed that Krupps intend bidding for the contract. Letters of inquiry have also been received from English, Belgian and other foreign firms, one inquiry coming from China.

Some figures obtained from the November bulletin of the department of development in connection with the Canadian Pacific Railway show that Canada has risen to second place among the wheat growing countries of the world. The expected yield of wheat for the year 1921 from the Dominion is $288,493,000. Reverting back to the year 1870 we find that the total value of all field crops was $111,116,606 and that of the wheat $16,993,265. In 1920 these values were respectively $1,455,244,050, and $427,-357,300. In 1920 the Dominion obtained for the first time in her history a billion dollar crop, more than trebling the value of the crop grown a decade previously.

J. R. Baxter & Co., 102 St. Antoine street, Montreal, will in the very near future let the contract for the construction of a 200-foot by 60-foot factory in Brockville, Ontario, for the manufacture of abrasive wheels. The foundations will be laid before Christmas and the plant in operation by the spring. Two kilns will be used to begin with and a third and a fourth added as conditions justify. A new company will be formed for which incorporation papers will be taken out later and which will be operated as a separate concern from the J. R. Baxter & Co. Mr. J. R. Baxter, who will be the president of this company, formerly occupied the same position in the Dominion Abrasive Co. of Mimico, Ontario, and as such has had considerable experience in the field. The idea behind the new organization is to go out for British Empire trade. With this object in view Mr. Baxter recently spent some months in England studying conditions with a view to building the plant there, but it was found that costs, particularly in connection with taxes and labor, were so high that production would be cheaper in Canada so that it was decided to retain the organization in this country although an English branch has been organized for the export trade which it is hoped to develop. The organization of the company has been held back for eighteen months until a competent expert for the manufacture of abrasive wheels has been secured. This has been accomplished in the engagement of Mr. Edric Sawyer, formerly with the Dominion Abrasive Co., and also with the Safety Emery Wheel of Springfield, Ohio. Mr. Sawyer will be the manager of the factory.

A New Contest—Open To All Readers

The editors want to make Canadian Machinery as newsy as possible. Every week three or four pages of interesting and valuable news appear in our Industrial News Section, but we know there is a great deal more information to be obtained, the difficulty being to bring it to light. This is where we feel our readers can help us. Read the conditions stated below, then decide to help us **NOW.**



A word about the prizes. These scales are 6 in. long. They are made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is stamped on the one side, while a table of tap drill sizes is placed on the reverse side. Each scale is enclosed in a suitable case and every reader should strive to obtain one. Send in your item **NOW.**

What You Have To Do

As stated above, we are anxious to make our Industrial News Section still more valuable. Our readers can help us wonderfully in this respect, sending in each week, short items relating to industrial activities in Canada. These items **must** be real news and **must** not be clipped from other papers. A study of our present Industrial News Section will help readers to distinguish what constitutes a real news item and for their guidance we offer the following suggestions:

Let us have items dealing with the formation of new companies; reorganization of old companies; new factories to be erected; plant or factory extensions; changes in personnel of firms; appointments or promotions; contracts about to be placed; equipment or machinery required, or new equipment or machinery about to be marketed.

In every case the editor is to be the judge as to the value of any item received and he is at liberty to use or reject any material. A prize will be given to the readers sending in the best item, or items, each week and to make it interesting we will give two scales as prizes every issue. Make up your mind to secure one of these scales. They are well worth having. Obey the impulse, send in your item **NOW.**

— Important Note —

Readers should arrange to send their items so that they will reach the Toronto office early Monday morning of each week at the very latest. Of course, they should be forwarded before this if possible, but our forms close early Tuesday morning each week, and no matter can be used after that time. Should an item arrive too late for publication in one issue, if considered worth while it will be held over for another week, still being eligible for a prize.

INDUSTRIAL NEWS

The Brantford branch of the Massey-Harris Co., have taken on 200 of their old employees owing to the re-opening of the plant. The Cockshutt Plow Co., of the same city have also started 150 men. Both firms expect to increase the stock as soon as the various departments can be opened up.

In all probability the sum of $100,000 voted by the legislature at the last session for providing additional parliament building office accommodation will be utilized in the construction of the new building on the site of 17 Queens Park, Toronto. Honorable F. C. Biggs, Minister of Public Works, is having tentative plans drawn up for a new departmental block on the east side of the crescent.

The report of the Toronto City Architects Department for the past month shows an aggregate of building, for which permits were issued, mainly stores and dwellings, exceeding a sum of $2,000,000. November permits for 1920 totalled only $1,800,000. The Board of Education has been given a permit for the new Rose Avenue school, the construction of which will cost $175,000.

The Lang Manufacturing Co., of Guelph, Ont., report a successful year to date. Sales sheets already show double the volume of business transacted last year, and Mr. Skidmore, the general manager says that he has every confidence in redoubling his business during the coming year. Ornamental and architectural iron work is the main line of manufacture and Mr. Skidmore attributes the rapid growth of business in this line to increased building activities. A new building will be erected next spring by this company which will be used as an automobile repair department.

Another Monthly Statement has been issued by the Canadian National Railways. The President, Mr. D. B. Hanna, has stated that the net earniings for the month of October, 1921, are $1,036,130. Comparing these figures with the September net earnings, which were $500,000, it shows an increase of 105 per cent over last month's total. Figures supplied by the Dominion Bureau of Statistics, at Ottawa, show that the operating ratio published by the Canadian Railways for August was 86.41 per cent., which was a decided improvement over August last year. In August, 1920, the ratio was 98.82 per cent. The improvement was effected by reduction in operating expenses, the greater portion of which was brought about by a $5,118,010 reduction in pay rolls.

The Algoma Steel Co. has just given a two months' trial in ore unloading to a new bucket designed by one of its own engineers, Mr. Carl Stenbol. It is said that this bucket has been responsible for an increased capacity of 50 per cent. on the bridge, on which it was installed. It is of the grab type, with a large spread, although comparatively lighter than the older style in general use. It is planned to use it for unloading boats as well as for handling ore from the pile. Mr. Stenbol is mechanical superintendent of the Algoma Steel, and the manufacture of his design was made by the Blaw Knox Co., of Pittsburgh. One feature claimed and for which orders have been received from England, is its comparatively small cost of upkeep.

According to a report issued by the Bureau of Mines, Southern Illinois and Kentucky are credited with approximately 90 per cent of the fluorspar production of the United States. A small amount of high-grade acid spar is obtained from the ore by hand sorting; the greater part, however, is recovered by jigs and tables as gravel spar containing approximately 85 per cent. calcium fluoride. In the jigging and tabling operations, galena is recovered, and enough silica and calcite are removed to raise the calcium fluoride content of the gravel spar to 85 per cent. However, the removal of silica and calcite results in a large loss of spar. With increasing depth in the mines, zinc sulphide, sphalerite, is encountered in increasing quantity and the removal of this is said to have become a serious problem.

A cable from London, England, states that in some things Canada can beat Germany at her own game of cheap production. According to the Mercantile Guardian, after going the rounds of the world's markets, buyers for the first time in many months find Canadian Aluminum the cheapest, selling at 14½ pence per pound, while the German product, despite the deprecation of the mark, is 2 pence dearer. The Canadian product, which is often called American, because it is shipped from New York, is said to be of exceptional quality.

In last week's issue mention was made regarding the mayor of Sydney, Nova Scotia Mr. Fitzgerald, who visited the minister of railways together with presidents of railroad companies at Ottawa with the object of securing steel rail orders so as to help the unemployed problem. This has resulted in an order for 21,000 tons of steel rail, which has been given to the British Empire Steel Corporation by the Dominion Government. It is believed that an additional order will be coming along for a somewhat similar total in a very short time.

OBITUARY

The death of Lord Mount Stephen occurred at his residence in Hertfordshire, Brockett Hall, Hatfield, England, on November 30th. Lord Mount Stephen was in his 93rd. year. He was born in Scotland in the rural community of Aberdeenshire, June 5th, 1829. He spent his early days there and in Banffshire. He never forgot his school days in Dufftown. He was born a commoner and was known as plain George Stephen. He started life as a shepherd boy, later going into a draper's establishment in Aberdeen. He soon entered the services of a shipping office in London. An opportunity of coming to Canada presented itself shortly after, and he came to Montreal in 1850. He entered business as a woollen merchant, in 1862 was in control of the business. He also achieved great success and amassed a great fortune in the textile manufacturing business. He became a director of the Bank of Montreal and in 1876 became president of that institution. Through his connection with the bank he became interested in railways. With his Scottish cousin, Sir Donald A. Smith, (later Lord Strathcona) he accepted the responsibility of building the Canadian Pacific Railway across the continent. The Canadian Government had only built 700 miles of the road and the enterprise was apparently doomed to failure. This railway syndicate, as it was then known, received $25,000,000,00 in cash and 25,000,000 acres of land as a subsidy. Difficulties of all kinds, some almost insurmountable, confronted the railway builders time and time again. Lord Mount Stephen's brilliant personality, his faith in the future of Canada, and his courage, were outstanding in the days of political and financial difficulties. In order to complete the road, the personal fortunes of both Lord Mount Stephen and Lord Strathcona were pedged. Many of his securities had to be sacrificed to raise funds. Lord Mount Stephen became the firt President of the Canadian Pacific Railway. He was plain Mr. Stephen when he was elected to this office in 1881. He held office until 1888 when he resigned.

His gifts to hospitals and other worthy objects were princely, and he distributed his vast fortune in a lavish style. For the past twenty-five years he has lived quietly in retirement in England but always took a keen interest in Canadian affairs.

A MUTABLE ELECTRIC SIGN

Dwellers in cities have become quite accustomed to the large electric signs which flash out a variety of messages. They have little idea of the complicated mechanism which is required to provide a series of messages, or the ingenuity involved in their design. The latest type which has been evolved by a British inventor after more than ten years experiment constitutes a remarkable advance on existing types. Letters, words, sentences, and designs are produced by pneumatic power from movable spheres, each six inches in diameter. By day the spheres twinkle white or in contrasting colors as fancy may dictate, and at night they are automatically illuminated electrically. A sign may be withdrawn and another inserted in its place wthout stopping the machinery; in fact a whole speech could be expressed line by line, and thus delivered more effectively than by megaphone. There is no end to the variety of letters and words which may be made to appear on this sign. The mechanism depends on a simple arrangement of perforated sheets.

LONDON AND BIRMINGHAM WILL HOUSE ANNUAL BRITISH INDUSTRIES FAIR

THE EIGHTH Annual British Industries Fair will be held in London and Birmingham from Feb. 27th to March 10th, 1922. A large number of important lines of British trade will be shown, although the fair cannot be termed merely an exhibition, because it is purely a trade fair where buyer and seller meet. A considerable number of Canadian buyers are making arrangements to attend, and admittance is restricted to trade buyers on invitation of the British Government, thus business is not impeded by crowds of sightseers.

In organizing the fair, the British Government Department of Overseas Trade pays particular attention to the comfort and convenience of buyers from the various Dominions and other parts of the world. Special reading and writing rooms are available where buyers may consult qualified officers of the Department who will be able to indicate sources of supply of any goods required and to give information regarding tariffs, shipping and transport, trade conditions, etc., throughout the world.

The British Industries Fair covers the following industries at London: Cutlery; silver and electro-plate; jewellery, watches and clocks; hard haberdashery; glassware of all descriptions, china, earthenware and stoneware; paper; stationery and stationers' sundries and office appliances; printing; books; fancy goods, including traveling requisites and tobacconists' sundries; boots and shoes and shoe mercery; leather for the boot and shoe, fancy goods, bookbinding and upholstery trades; brushes and brooms; toys and games; sports goods (including sports clothing); scientific and optical instruments; medical and surgical instruments and appliances; spectacle ware and opticians' supplies; photographic and cinematographic apparatus and requisites; musical instruments; furniture of wood, cane, wicker; bedsteads and bedding; carpets, linoleum, etc.; basketware, chemicals, light and heavy; domestic chemical products; drugs and druggists' sundries; perfumery; dyes; foodstuffs (prepared and preserved) and beverages; confectionery (sugar and chocolate); tobacco, cigarettes and cigars.

At Birmingham

Lighting plant for electricity, gas, oil, etc.; cooking stoves and utensils, including aluminum, enamelware, etc.; foundry appliances; general hardware, including builders', marine and household ironmongery of all descriptions; general machinery of all descriptions and small tools; mill furnishings; india rubber goods for industrial and household purposes; motor cycles and cycles; accessories for motor cars, cycles and aeroplanes; weighing and measuring appliances and instruments; sanitary appliances; paints, colors and varnishes and painters' requisites; railway equipment; metals of all descriptions (excluding precious metals); agricultural and horticultural machinery and implements; mining, colliery and quarrying plant; brewing and distillery plant; metal furniture for house, shop, office, garden and camp use, including bedsteads; building construction; perambulators, mailcarts and push-chairs; saddlery and harness; firearms; fishing tackle and rods; tubes in copper, lead, brass and steel and steam and pipe fittings; architectural and ornamental metal work, including gates and fencing; ropes of steel and hemp, cordage and string.

The London section of the fair will, as in 1921, be housed in the White City, a large group of exhibition buildings within a few minutes of the centre of London, and connected with every part of the London area by trains, omnibuses and street cars, while the Birmingham section will again be in the buildings of the Castle Bromwich Aerodrome, which may now be regarded as permanent exhibition buildings, within easy reach of the centre of the city. There is a floor area of more than 1,130,000 square feet which is well suited for the purpose, and it is interesting to note that the gangways between the stalls total no less than 3 1-2 miles in length.

The British Trade Commissioners in Canada will be pleased to give full particulars and to issue invitation cards to Canadian buyers who propose to visit the fair at their following addresses: 248 St. James Street, Montreal; 260 Confederation Life Bldg., Toronto, and 610 Electric Railway Chambers, Winnipeg.

PROMPT SERVICE IN PIPE SHIPMENT

What may be considered as a record in the fabrication and shipment of riveted steel pipe was made in the extension of the Keele Street sewer at Sunnyside, Toronto, by the Dominion Bridge Company recently. The extension consisted of three pipes, each 560 feet long, two of these 90" in diameter and the third one 60" in diameter. The total weight of the contract was 612,000 lbs. The inland ends of three pipes are in the form of thimbles built into a concrete wall. The outer ends pass through the crib work which has been put in place as a retainer for the new "Marginal Way." The pipes are not quite straight throughout their length, they have each two elbows, but the angle of deflection at each of these elbows is less than 3 degrees.

The three thimbles were required in advance so that they could be set in the concrete, but the shipment of the balance—practically the whole of all three pipes—was called for to be made at one time and not later than November 1st, under penalty. The erection to be performed by the Toronto Harbour Commissioners who contemplated the laying of the whole pipe on trestles and sinking it altogether.

The contract was awarded to the first mentioned company, on September 30th. On account of the character of the work, they decided to fabricate the pipes at their Lachine plant, where their boiler department is equipped for this work. The specification called for boiler quality material. The orders for the material were mailed on October 1st, the day after the awarding of the contract. Prints of the shop drawings were mailed for approval on October 4th, four days after the date of the contract. The material was rolled promptly and was received at the Lachine plant between the 17th and 20th of October. The thimbles were shipped within the stipulated time. The final shipment of pipe was made from Lachine on October 29th and consisted of 29 carloads, each car containing one or two lengths of pipe about 40 feet long. The ends of each section were fitted with flange angles bent to a circle and welded, their outstanding legs being drilled for connecting bolts. This final shipment actually arrived in Toronto at twenty minutes past three on the afternoon of October 30th, two days ealier than the date on which the pipe was called for to be shipped from Lachine.



F. R. WHITTALL

F. H. Whittall, managing director of Whittall Can. Company, who was elected president of the Export Club of Montreal and district, which was recently organized under the direction of the Canadian Manufacturers Association and endorsed by the Department of Trade and Commerce. The Montreal Export Club is a branch of the National Export Clubs and is affiliated with the C.M.A.

T. P. Howard was elected honorary president by acclamation; Kenneth Laws of the National Breweries, 1st vice-president, and J. A. Lapres, of Canada Cement Company, 2nd vice-president.

What Will Steam Locomotive of Future Be?

THE GREATEST single item of a railway company's costs are those connected with the running of its locomotives. In the past, railway travel has developed along the lines of higher speeds and more luxurious accommodation, both of which have necessitated the building of more powerful locomotives, meaning in turn a greater fuel consumption and increased running expenses. There is no indication that the future holds anything different in store; in fact, with growing competition from other methods of travel, railways may have to offer still greater facilities than they have in the past. Mr. H. A. Ivatt once remarked that when an engine was built big enough to pull a street of houses—or words to that effect—the traffic department always wanted to couple up the schools as well. Perhaps a hotel will be now required in addition. Who knows?

Compounds And Simples

Speaking generally, continues "The Engineer," who thus speaks on the steam locomotive of the future, the locomotive, unlike other steam engines, has resisted all the efforts of those who have sought to change it from simple to compound expansion. In making this statement we do not overlook the various compounds working on the continent of Europe and in the United States, but compared with all the locomotives in the world, they form but a very small part.

The efforts of such eminent engineers as Webb and Worsdell in this country, Vauclain and Cole in America, and De Glehn and others in Europe, are still fresh in our memory, and it almost seemed at one time that through their ingenuity the compound system was in a fair way to be practically established as a real means of reducing locomotive operating costs through economies in the use of fuel and water. Indeed, there is little doubt that under certain conditions compound engines did effect some economy in fuel consumption; but certain inherent characteristics mitigated against their general adoption, the chief of which was the falling off in economy as the working speeds became higher. Under the same condition the economy of the simple engine improved, and against that fact the compound was unable to contend.

At St. Louis several different locomotives were tried on the testing plant. Amongst them were four different compounds, each having four cylinders variously arranged. Throughout the range of the tests these engines showed an economy in steam consumption per unit of power developed when compared with simple engines. The performance of the De Glehn compound, as against that of a simple Pennsylvania "Atlantic," tested at Altoona, may be particularly noted. The compound consumed at a piston speed of about 500 ft. per minute 20 lb. of steam, against 28 lb. used by the simple; but at 1100 ft. the consumption of the compound had risen to 23 lb., as against somewhat less than 24 lb., used by the simple. The Vauclain and Cole compounds, whilst they both seem to have given generally better results than the De Glehn engine, showed by their curves of water consumption the same characteristics as the De Glehn engine, a point of more than usual interest, for the French engine had four sets of valve gear enabling independent adjustment of cut-off, and the American engines were not so fitted. Of the Vauclain and Cole compounds, the former gave the best results at the higher speeds, its water rate varying from 20 lb. to 21.5 lb. at piston speeds of 650 ft. to 1250 ft. per minute, the latter figure showing an economy of 10 per cent. over the results given by the simple "Atlantic" at the same speed, while at 650 ft. per minute the simple engine required 24 per cent. more water than the compound.

The "Hanover" engine tried had, in addition to compound cylinders the important advantage of a superheater furnishing "low degree" superheated steam. The curve of steam consumption for this engine was, in character, almost exactly similar to that of the "Cole" locomotive. but at 500 ft. per minute, the speed at which it showed the least water rate, the consumption was 17.5 lb., and at 1100 ft. this figure was increased to 19 lb. At the same speed the simple engine using saturated steam showed that it required just less than 24 lb. of water per indicated horse-power.

Superheating

Since the introduction of the arch in the locomotive fire-box, no single improvement has, speaking generally, had such marked effects on the working of the locomotive from its economical aspect as the introduction of the superheater. Superheated steam has made the simple engine more economical almost throughout its entire range of ordinary working speeds than any compound experimented with on the St Louis plant. Comparing the water rate of the superheated "Hanover" compound with that obtained with the latest type of Pennsylvania "Pacific" type locomotive using superheated steam, the result show that at a piston speed of 800 ft per minute the water rate for the simple engine was 17.9 lb., that of the compound practically the same, about 17.7 lb., whilst at 1200 ft., 62 miles per hour, with 80 in. drivers, and 28 in. piston stroke, the water consumption of the simple engine was but 16.2 lb. against 19 lb. used by the superheated compound at 1150 ft. per minute, the highest speed at which that engine was tried. At higher speeds of 1400 ft. and 1600 ft. per minute, the simple engine gave 1 indicated horse-power for a water consumption of 15.6 lb. and 15.1 lb.

Enough has been said to show that compound engines, even if supplied with high degree superheated steam, will have to show a considerable improvement in water consumption amounting to at least 15 per cent. at the higher rates of speed before they can compete with superheated simple locomotives in express passenger service.

Superheated Compounds

From the fact that the water rate curves of both saturated and superheated compounds are generally alike in form, each displaying a similar increase in consumption with increase in speed, we gather that there is still room for improvement in the design and proportioning of compound locomotives, so far as the cylinder arrangement is concerned. Will the present pressing needs for economical working prompt designers to attempt again a solution of this interesting problem? We have on occasion seen it asserted that the express locomotive of the future will be a superheated compound, but considering the really wonderful results obtained with modern simple engines using highly superheated steam, we confess that at present we see no evidence of the re-introduction of the compound system into the practical politics of express locomotive design.

The Compounds on Goods Trains

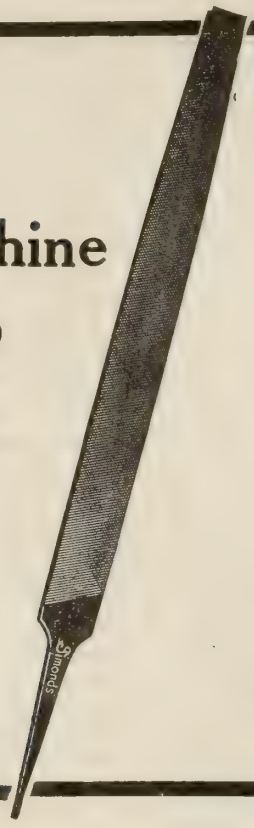
So far we have dealt with express locomotives only. What is the position of the goods engine? Can we expect any economic advantage from the application of a superheater, and with it compound cylinders? In the United States practically all freight traffic is handled by simple engines equipped, of course, with superheaters. For very heavy "pusher" or assisting services, however, four-cylinder compound "Mallet" engines are the rule. These engines by the nature of their work operate at very low speeds, and thus appear suitable for compound working. As a result, some remarkably low steam consumption figures have been attained, and, as we write, we have before us the published results of trials made with a large compound "Mallet" built for service on the Norfolk and Western in 1918. This locomotive at 8.16 miles per hour gave an indicated horse-power for 15.21 lb. of steam; at 10.5 miles per hour, 19.4 lb.; and at 12 miles per hour, 21,2 lb. were required These speeds correspond to piston speeds of 260 ft., 320 ft. and 385 ft. per minute.

(To be Continued)

*From Engineering.

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Machine Shop Files



Highest Quality

Good files are as necessary in a machine shop as any other tool—In fact files like Simonds are really essential for smooth work. All Simonds Files are made absolutely uniform and hold their cutting edge longer.

Mechanics should try Simonds Machine Shop Files.

Simonds Canada Saw Co., Limited

Montreal, Que.

St. John, N. B. Vancouver, B. C.

MONTREAL MARKETS

(Continued from page 45)

next few months, and this together with the business closed in the new field should make 1922 a good year for dealers in small tools and supplies.

Non-Ferrous Metals

The New York copper market has been strong the last few days and copper prices are up somewhat. There is not a great deal of additional business locally, although plants such as the Northern Electric Co. are taking on more men and are showing signs of an increasing amount of business. Tin quotations are also on the upgrade. Locally tin is bringing 37½ cents per pound. The fluctuations in tin do not always reflect business conditions regulated by supply and demand. Thus the present activity is rather hard to explain especially as far as any local business is concerned. Lead has also stiffened in price, and the London market is very firm. Lead is the only non-ferrous metal that is today above the pre-war price. Many consumers declare there is no reason for this. However, a demand exists, as is evidenced by the fact that a local firm had an inquiry for one thousand tons of Canadian Lead to be supplied to an Oriental country. As the metal was required immediately the company were unable to accept the order. Antimony, spelter and aluminum have not been very active the past week.

No further developments have occurred in the scrap metal market. The continued lack of business in foundries is responsible for the quiet scrap market. Quotations have been withdrawn for some time past, and there is little or no business moving.

PATENTS

Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

Paper Mill Machinery

BERTRAMS LIMITED
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BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.
Brantford, Canada

BLACK DIAMOND OVENS

NEW PLANER

(Continued from last week)

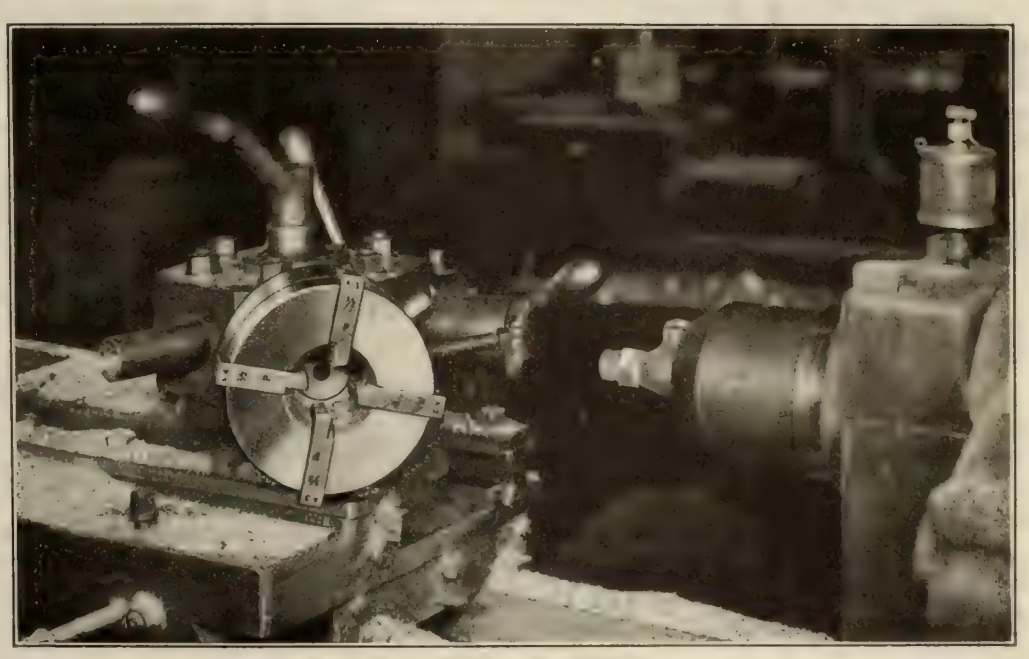
Centralized lubrication is one of the features of this machine, but probably the most important part of this machine is the new gear drive provided. Helical gears are installed throughout from pulley shaft pinion to table rack. It is a well known fact that helical gears produce end thrusts.

Advantage is taken of this fact by arranging the rack so that the end thrust of the bull gear and pinion, which amounts to about one-tenth of the driving force, opposes and compensates for the side thrust of the cutting tools when they are being fed away from the operator's side of the machine a condition which obtains at least 90 per cent. of the time. As the tool pressure increases the balancing thrust of the bull gear and pinion increases in proportion for more power is required to drive the table. This equalizes the pressure and wear of the two sides of the V's, and overcomes the tendency of the tools to push the table up the side of the V's. The diameters and helical angles of the remaining gears of the train are so proportioned that their end thrusts very largely balance one another. Bronze thrust collars, provided with forced lubrication, take the slight residual end thrusts.

Planer work is usually placed close to the operator's side of the machine. The rack is therefore placed slightly to the operator's side so that the driving force will coincide as nearly as possible with the line of action of the cutting tools. Particular attention is called to the unusual midth of the helical table rack, which gives great strength. It is cut with a very low pressure angle. This greatly reduces the tendency of the bull gear to lift the table. In order to obtain maximum stiffness the gears are keyed on the pinion hubs thus relieving the shafts of all torsional strain. To insure correct tooth action, the teeth are cut by the generating process to true involute forms, and to obtain great smoothness of action and stronger teeth, the pinion teeth are so cut that the greater part of the tooth face lies outside the pitch circle. The teeth have a low pressure angle, are cut full depth, and have a short arc of approach and long arc of recess, giving high efficiency, and greatly increasing the number of teeth in contact and the smoothness of action. This design has the advantage of permitting the use of pinions of larger diameters and stronger tooth form In other words, the special form of tooth is distinguished by its full length low pressure angle short arc of approach and the very long angle of action. The last is said to greatly increase the number of teeth in simultaneous contact; reduce the specific pressure at the lines of contact; long life and quiet operation, and produces work of accuracy.

Right in the Lead

A Busy Corner Of A Notably Successful Shop



The Geometric Die Head illustrated has just cut the ½ in. pipe thread on the bibb shown. The equipment of this shop consists of many standard and special Geometric Tools.

These people express themselves as very strong for the Geometric line, and are always glad to recommend the use of these Tools. They have themselves used Geometrics for a great many years.

If you can find a user of Geometric Screw Cutting Tools who is not satisfied with them, you will do us a great favor by telling us who he is and where we can find him.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

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WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

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Constructive Policies—Ways and Means—Diagnosis — Production — Managements — Sales — Exports.
W. J. Spencer, M.E., E.E., LL.D.
Manufacturer & Builders' Exchange.
410-416 Bond Building, Washington, D.C.
Pittsburgh - Cleveland - Chicago - Dallas.

FOR SALE

FOR SALE—1, 5, 7½ AND 10 H.P., 550 VOLT, and 3, 8, 15 and 20 H.P., 220 Volt, 25 Cycle, Motors; good condition. Canadian Linderman Co., Limited, Woodstock, Ont. (C20M.)

LOW PRESSURE HORIZONTAL STEAM ENgine 12 x 9 Deane Pump and Receiver. Cheap. Canadian Linderman Co., Ltd., Woodstock, Ont. (c24m)

SAWMILLS - PORTABLE MOUNTED AND unmounted; also portable engines on wheels, all sizes. Box 797G., Canadian Machinery.

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Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

SITUATION WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 795 Canadian Machinery. (c23m)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

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of Toronto, Limited
7-11 Sheppard St., Toronto, Ont
Phones: Adelaide 2841 and 1524
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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631: Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

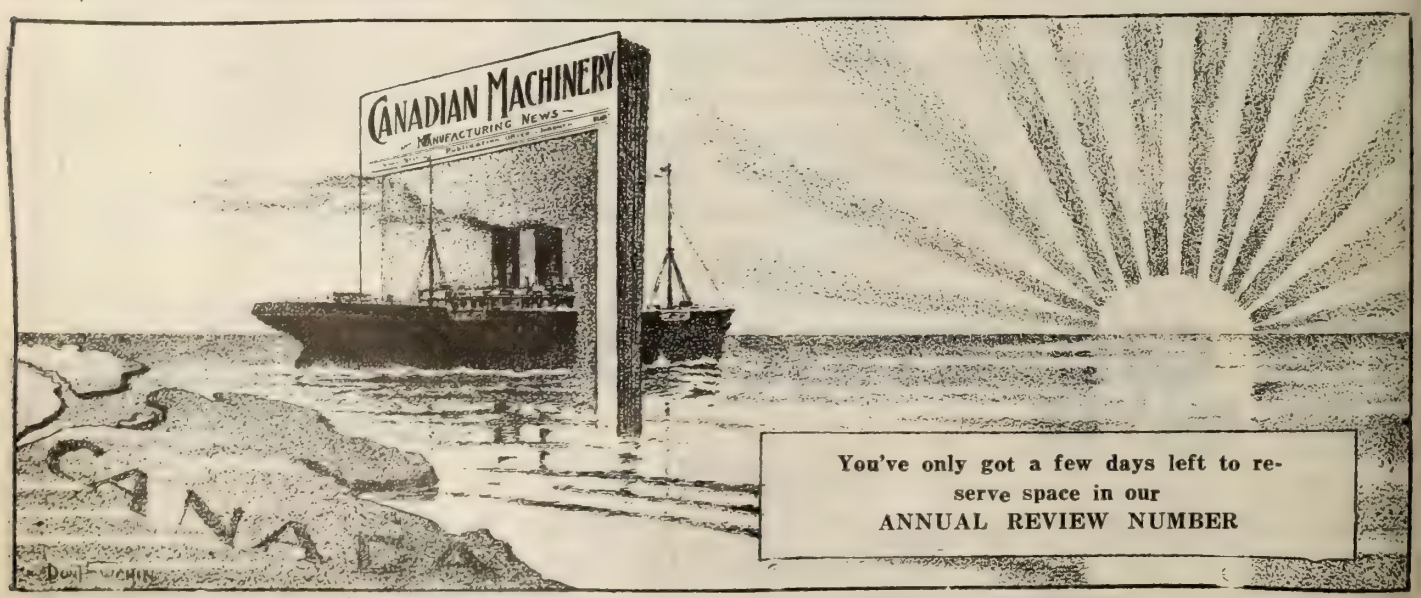
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3 spinning lathes, 28" swing, 6 ft. bed; 3 buffing spindles; 2 foot presses with deep throat for rivetting; 1 automatic rivetting machine with deep throat, 25 to 30 h.p. motor, alternating current, 550 volt; Rotary shear; 1 double action toggle press 12 to 16" stroke, 30 in. between uprights. Quick action requested. Box 797T, Canadian Machinery.

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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.



Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Lad., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.

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National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
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Liquide Air Company, Toronto.
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Stewart & Co., Duncan, Glasgow, Scot.

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Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
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Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

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Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., E., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Bars, Steel
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Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
A. S. Steel Co., Ltd., New Glasgow, N.S.
Pilot Steel & Tool Co., Montreal, Que.
Unlied Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
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Belt Dressings and Fillers
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Belt Hooks
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Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

For list of Dealers see the last page of This Buyers' Directory

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Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co. Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

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Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., E., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Brass Pipe Fittings
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

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London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

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Canada Metal Co., Ltd., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O

Bulldozers
Building Materials
Robertson Co., H. H., Cleveland.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., E., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Acetylene
Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, On
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthle, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss, Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, (

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, En
Burke Machine Tool Co., Conneaut Ohio.
Ford-Smith Machine Co., Hamilton, On
Hendey Machine Co., Torrington, Con
Kearney & Trecker Co., Milwaukee, W
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R
Burke Machine Tool Co., Conneaut Ohio.
Can. Fairbanks-Morse Co., Ltd., Montre

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Lt
Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, O

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, O
Pratt & Whitney Co., of Canada, Lt
Dundas, Ont.
United States Machine Tool Co., C
cinnati, Ohio.

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Belt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.
Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Perrin Ltd., W. R., Toronto, Ont
Stewart & Co., Duncan, Glasgow, Scot
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.
Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Gisholt Machine Co., Madison, Wis.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co of Can., Ltd., Montreal, Que
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.
Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Que.

Screens
Can. Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton,

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal. Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada. Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto. Ont.
Yeates Machinery Co., London, Ont.

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
Chas. A. Strelinger Co. of Canada. Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

Seven pages printed here each week for your convenience

Consult this Buyers' Directory when you want the names of reliable makers of machine tools, parts, steel, in fact any equipment you may need.

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Grind your cutting tools in exactly the right way to get best results—and you save time. That's obvious. It is precisely that that this Tool Grinding Chart enables you to do.

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Cleaning Costs Cut $6.74 a Day Since Using Oakite

A PLANT making steel horseshoe calks now uses Oakite materials (O.P.C.) for cleaning before dry-threading, because *pounds* of O.P.C. are doing the work of *barrels* of sal soda.

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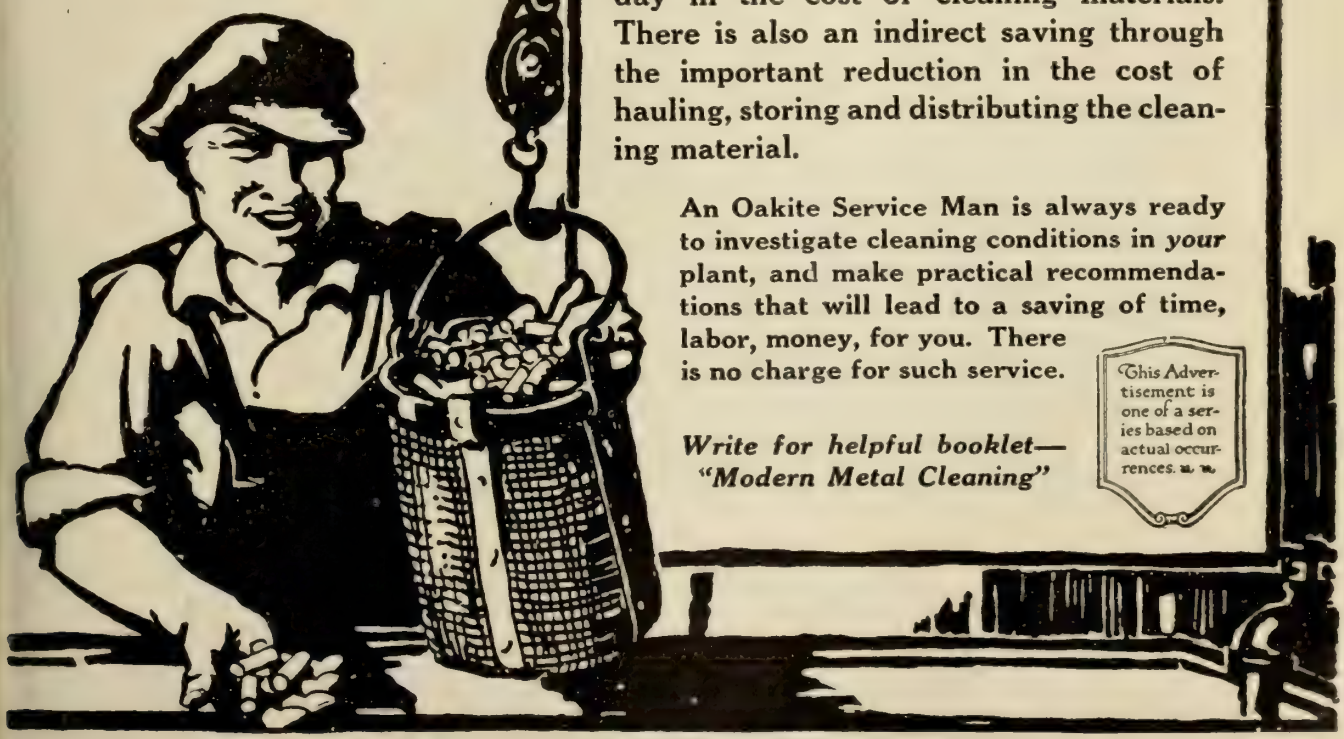
This results in a direct saving of $6.74 a day in the cost of cleaning materials. There is also an indirect saving through the important reduction in the cost of hauling, storing and distributing the cleaning material.

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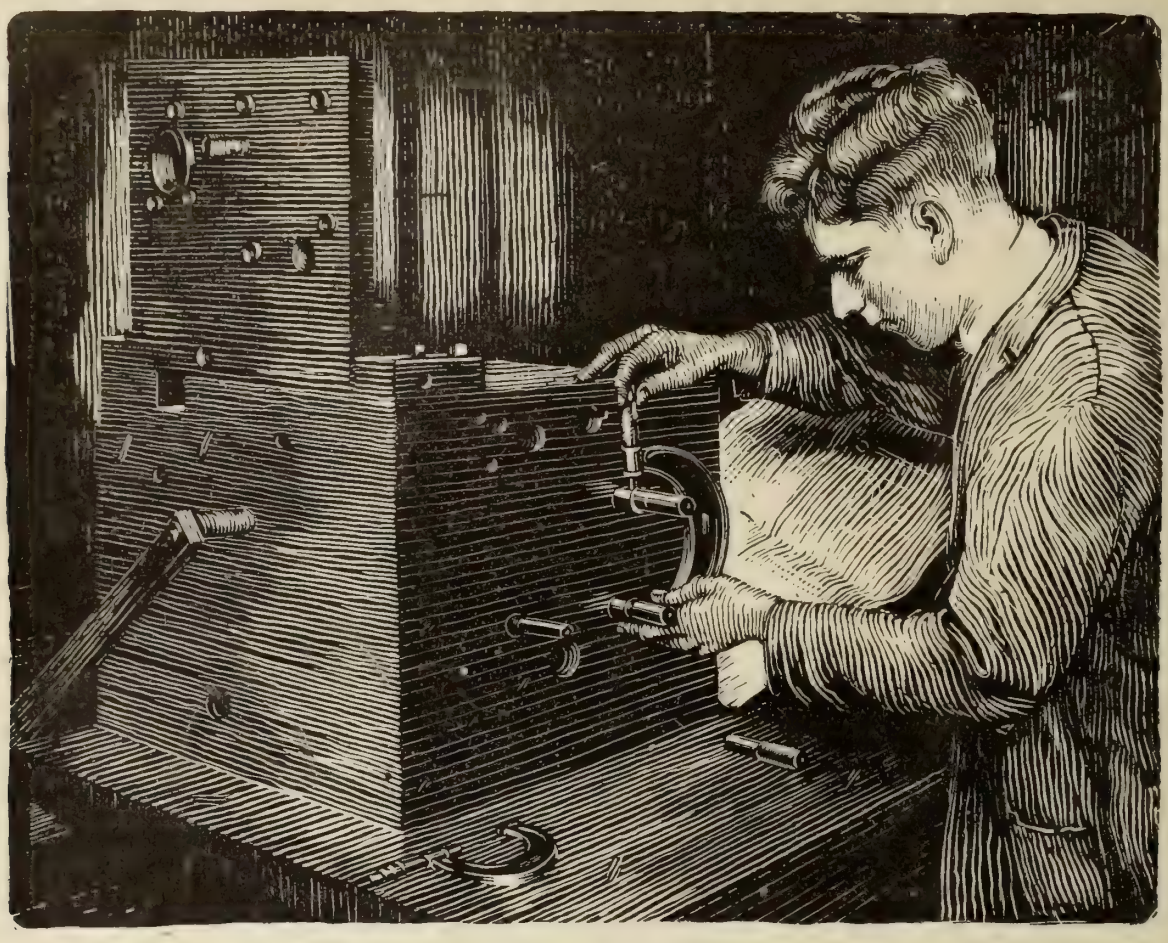
Write for helpful booklet—
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This Advertisement is one of a series based on actual occurrences.

Resident Canadian Representatives:
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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVI., No. 24 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Dec. 15, 1921 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

CHEER UP

THERE'S OCCASION FOR OPTIMISM

The Elections are over.
The Irish Question is practically settled.
The Washington Conference will do a World of good to this good old World.
"The Annual Review Number" of CANADIAN MACHINERY will be issued December 29.

A YEAR FOR GO-GETTERS

The coming year will be what we individually and collectively make it. If we sit back and wait for business, business will sit back and wait for us. If we go out boldly, determined to get business, business will come.

If we tacitly admit by our attitude that we do not expect our salesmen to get business they will not get business. On the other hand, if, by a forward policy, involving aggressive sales and advertising effort, we make our salesmen feel that we believe business can be secured and that we expect them to get it, THEY WILL GO GET IT.

Are we to throw cold water on our salesmen next year, or are we going to inspire them, and enthuse them, and imbue them with the idea that they can get the business? It's for you to say.

Are we going to intimate to the trade by our attitude that we do not expect the trade to buy? That would be fatal. Or, are we going to set a fine example by declaring our confidence and faith in no uncertain way? That, too, is for you to say.

One way of saying it is to present your sales message in the "Annual Review Number" of CANADIAN MACHINERY—December 29.

This year's number will be a gallery of leaders, a "who's who" of optimists, a directory of firms who are going after business in 1922. Give your salesmen the encouragement and inspiration they need. Tell the world you are out after your share of the business.

Reserve your space to-day. With a stroke of your pen you can make easier the road to bigger business next year.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

153 UNIVERSITY AVE. - TORONTO, ONTARIO

BRANCH OFFICES: Montreal, Winnipeg, Vancouver, London, Eng., New York, Boston, Cleveland, Chicago.

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The Better the Man, the More He Appreciates Them—

Not only good when new, but heat treated and seasoned to maintain this goodness. Can be ground on face of cutting edge without affecting their size. That's why you'll find Pratt and Whitney Stay Bolt Taps on the job long after cheaper, "just as good" tools are buried in the scrap pile.

Threads accurately and cleanly cut, with the least expenditure of time and effort, are other reasons why these better Taps are favorites in the shop.

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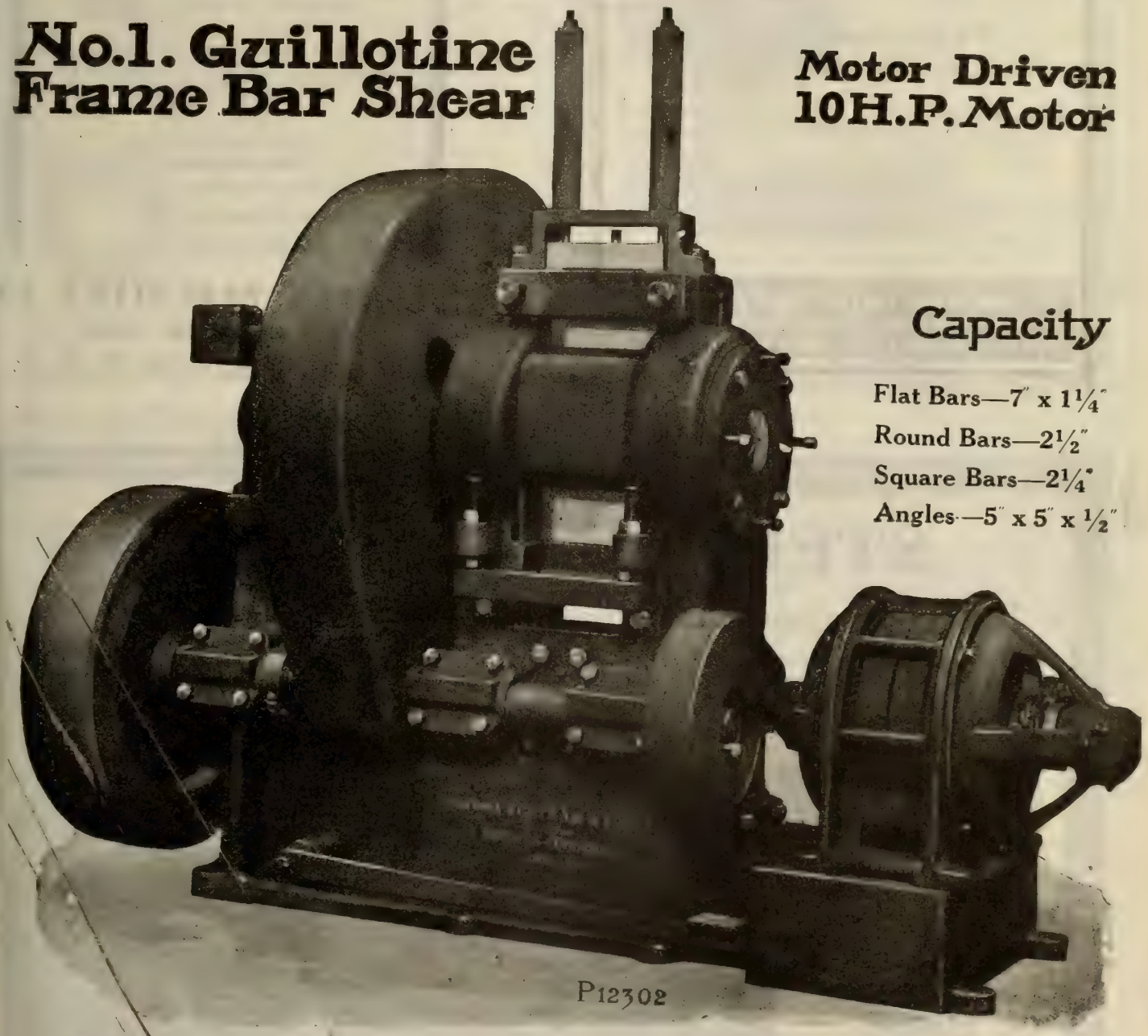
PRATT AND WHITNEY

The BERTRAM Page

MACHINE TOOLS

No. 1. Guillotine Frame Bar Shear

Motor Driven 10 H.P. Motor



Capacity

Flat Bars—7″ x 1¼″
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Square Bars—2¼″
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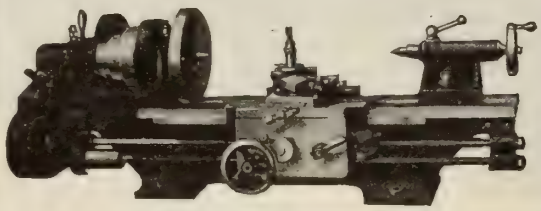
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Type B-6



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by the
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SPRINGS

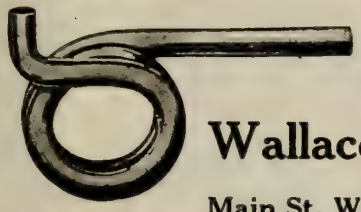


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STEEL
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Look Under the Surface!

Surface indications are not sufficient to tell how all-round dependable a spring is. **Therefore dig underneath!** An investigation of Wallace Barnes Springs discloses high efficiency made possible by over sixty years experience —correct materials—proper methods.

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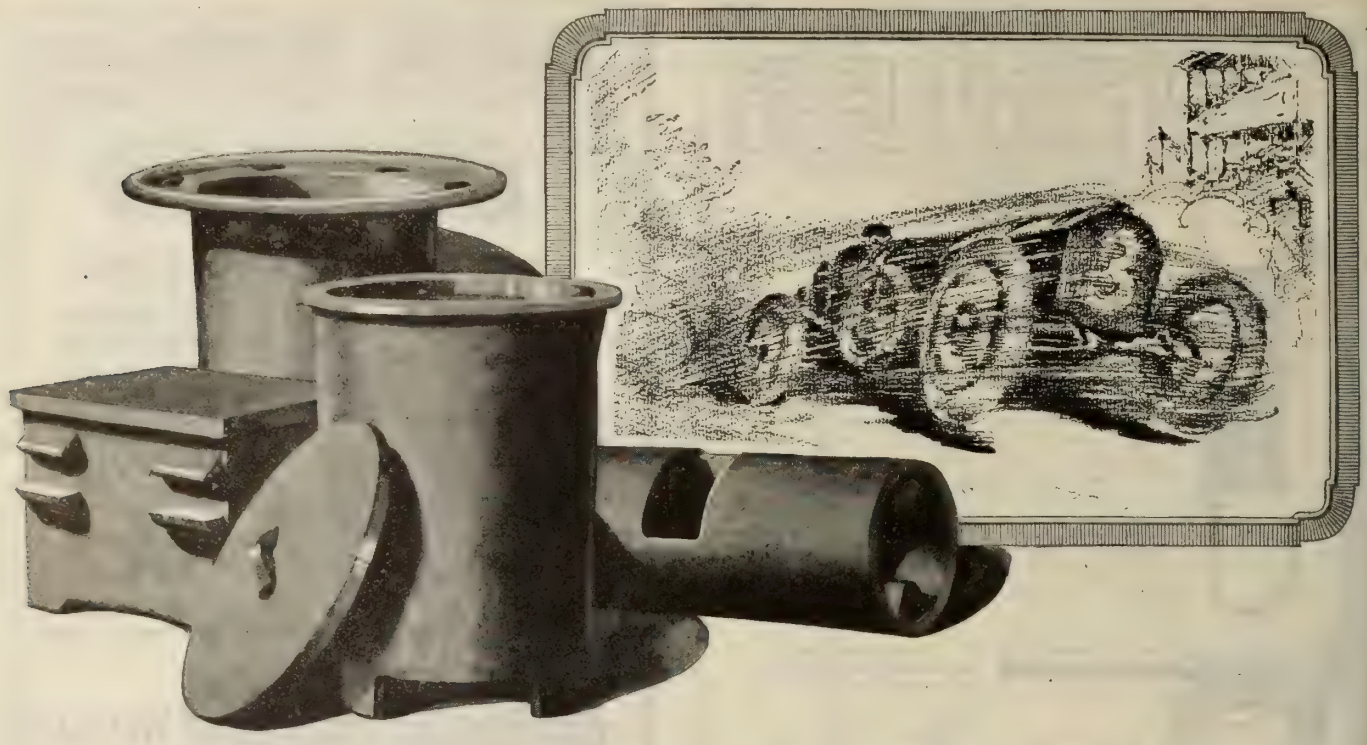
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HULL, Quebec



Winners!

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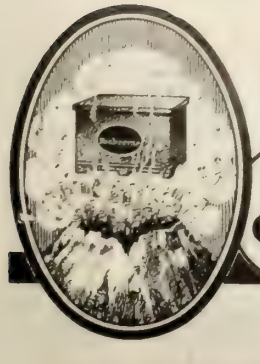
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Nichrome

CAST **Heat Treating Containers**

Endure in High Temperatures



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V., U.S.S. & S.A.E. Cap Screws
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S.A.E. Plain & Castellated Nuts
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Sold in 1898

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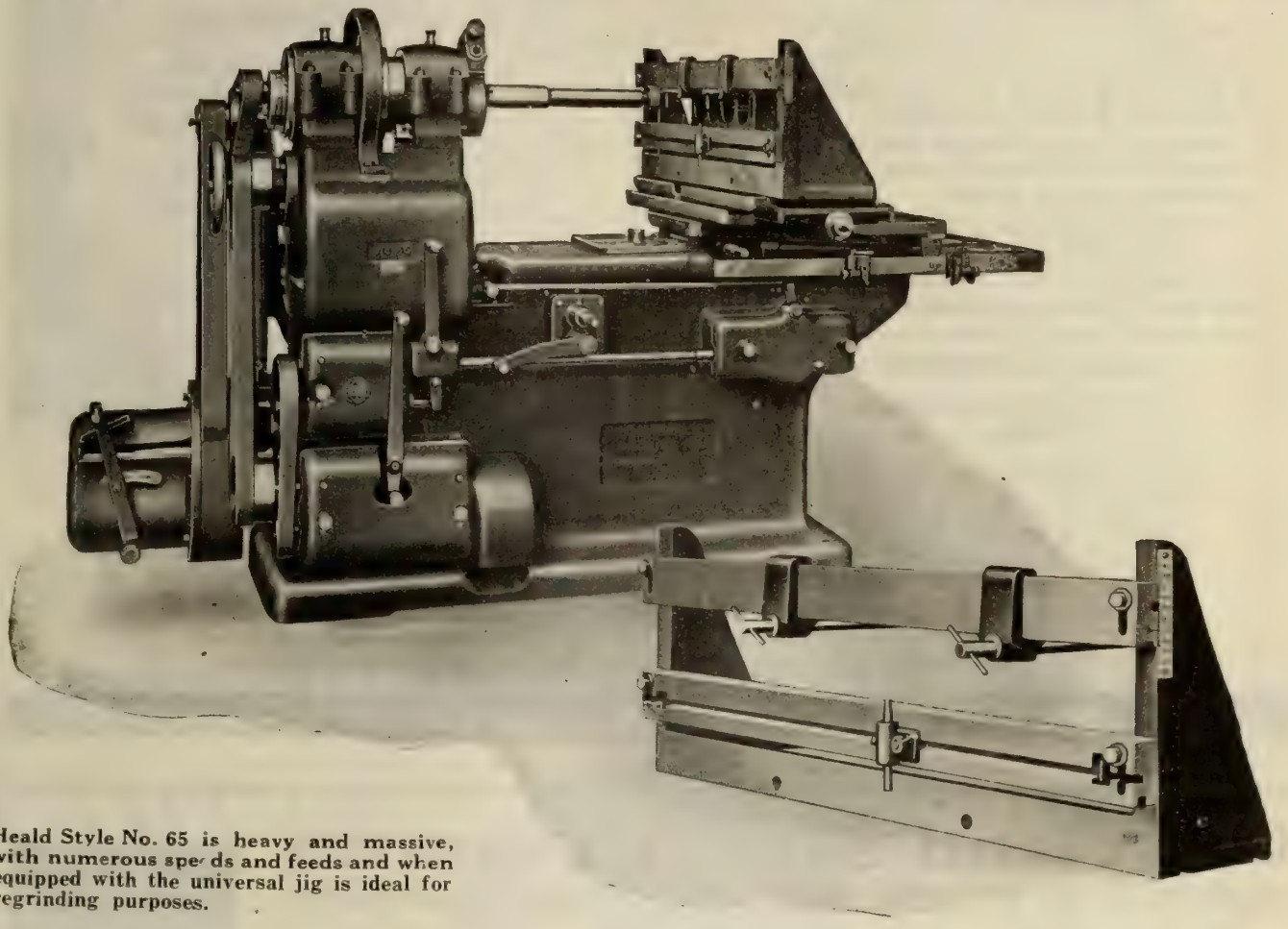
CHICAGO, People's Gas Bldg. DETROIT, Dime Bank Bldg. CLEVELAND, Union Bank Bldg. PITTSURGH, Keenan Bldg.
CINCINNATI, Union Trust Bldg. NEW HAVEN, 2nd Nat'l Bank Bldg. BUFFALO, Marine Bank Bldg. ST. LOUIS, Boatmen's Bank Bldg.

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Jigging Cylinders In Jig Time



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An operator only has to measure the hole to be ground, set the top bar so the locating mark will register the proper diameter in inches, and lift the cylinder up on the locating rods, having one in each end hole. After strapping the block in place he removes rods, pushes the bars out of the way and is ready for grinding. What could be simpler?

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Install a Johnson Lineshaft Drive

The practical experience of hundreds of our customers has established their belief in the Johnson Clutch Drive as the ultimate method of power transmission.

It replaces the countershaft, with its old fashioned tight and loose pulleys, and its troublesome overhead belting.

It avoids the expense of individual motors, and the waste of current they involve.

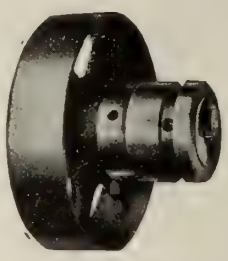
It substitutes reliable clutch control—economical in first cost, efficient in operation, durable under all kinds of service.

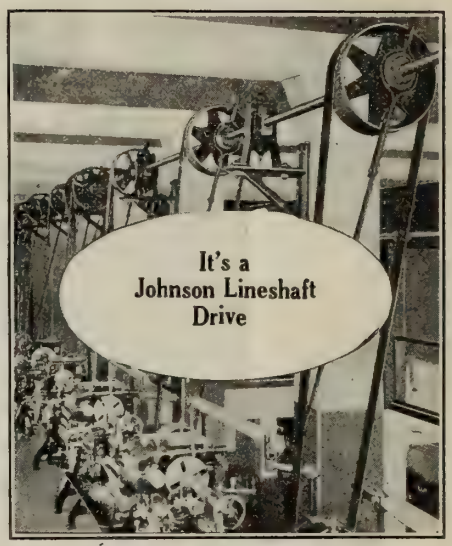
Friction Control Means Better Machinery

We specialize in friction clutches alone and can supply the right clutch for any drive. Hundreds of standard sizes in stock to fit all shaft and pulley dimensions.

"We are still using Johnson Clutches with very good success and have had them installed in our Nut Tapping Department for about ten years and at least half of that time they have been running night and day. We are also very greatly pleased with their operation in direct drives from lineshafts to lathes and other machines in our Machine Shop Department."

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An installation made ten years ago on American Tool Works Lathes. Still in perfect condition.

Write for our stock list and Yellow Catalog

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THE CANADIAN FAIRBANKS-MORSE CO., LTD., Montreal, Toronto, Winnipeg

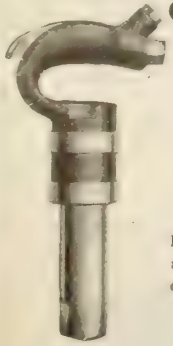
THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

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FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

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Are Standard Equipment Everywhere

Both Valves and Couplings are pressure tight.

Bowes Couplings are instantly connected or disconnected.



Bowes Couplings are absolutely air tight under all pressures.

Above cut shows the Never-Slip Clamp attached to Bowes Coupling.

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FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

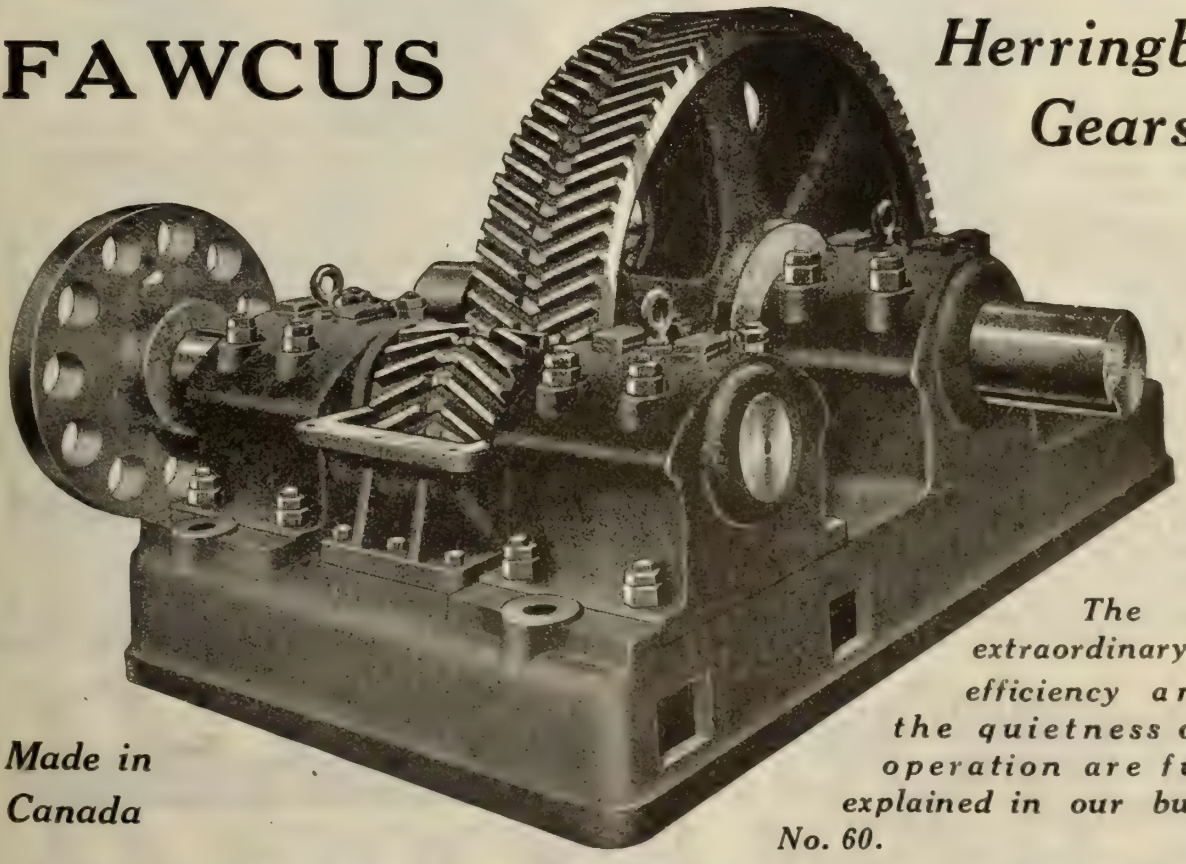
Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

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Transportation Building, Montreal

FAWCUS *Herringbone Gears*



Made in Canada

The extraordinary efficiency and the quietness of operation are fully explained in our bulletin No. 60.

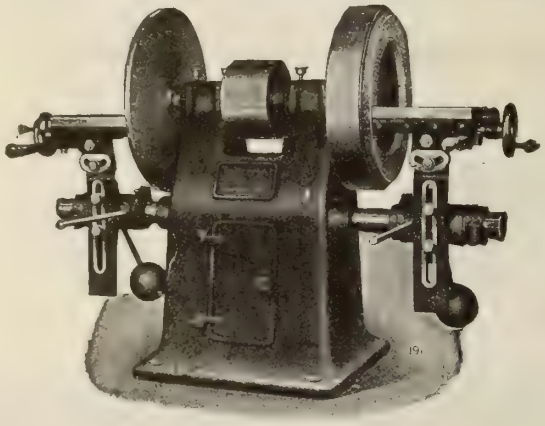
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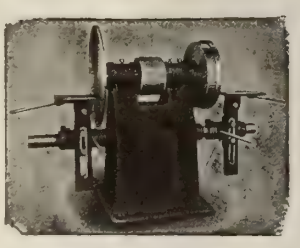
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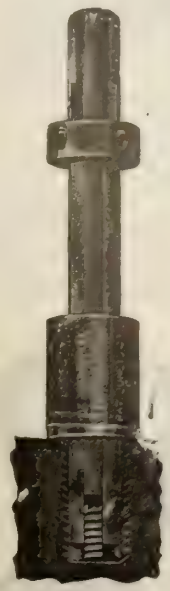




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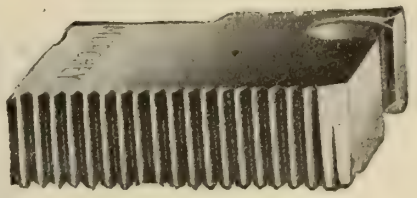
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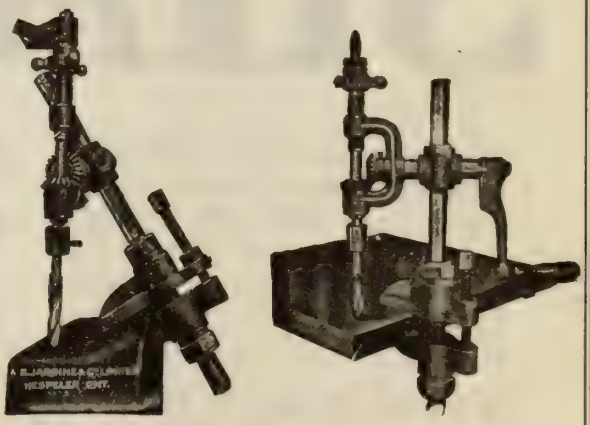
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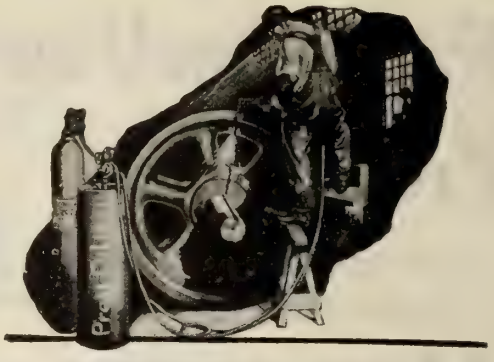


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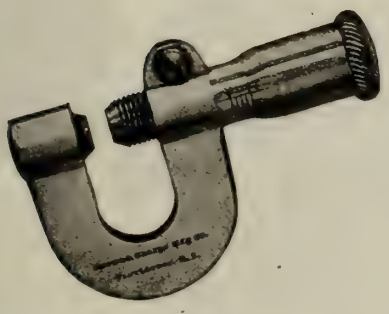
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVI No. 24 DECEMBER 15th, 1921

Five Examples Of Efficient Punch Press Work

Progress Made in Die Construction Has Been Wonderful—Making Die with Narrow Slot—Trimming Die for Drip Spout—Shearing Die for Same Piece—Combination Can Top Die

BY J. H. MOORE

INDUSTRY owes a great deal to the designers responsible for the advancement of punch and die practice in general. The progress made has been nothing short of marvellous, operations being performed in manufacturing plants that were considered absolutely impossible a few years ago. In place of two, and even three operations, pieces are now being turned out at one stroke of the press, and it would seem as if every victory over a difficulty, makes designers all the more determined to master some further manufacturing problem. Compare present day practice with the time when punching was a comparatively new art and what do we find?

Instead of grinding a die by means of a carefully selected grinding wheel, the old timer had to use emery to finish grind his dies. Mr. J. M. Brown, of the Brown & Briggs, Ltd., Hamilton, Canada, told the writer some very funny experiences of making dies in the old days, which shows what these all around mechanics were up against. In fact, when some of the points are viewed alongside of the up-to-date dies shown in this and which have all been made by the company with which Mr. Brown is associated, it illustrates clearly how things have progressed in this special line.

Mr. Brown is firmly of the opinion, that while the art of making dies has improved, the class of workmanship is not as good as it was in the earlier period. In those days a tradesman was an all round mechanic. He could handle any machine efficiently, and on bench work was nothing short of a marvel. Occasionally you came across a poor specimen, but such a man was the exception rather than the rule. The blacksmith often had a large part in the making of the die, but here again he was an all round man who know his trade, and the machinist trade, pretty thoroughly.

The class of machine tools were none of the best; die sinking machines did not exist, and as for magnetic chucks on which to hold small or large die sections while grinding, such a thing was never thought of. All things considered, it is surprising they made as much progress as they did. The good ideas were not all thought out on the draftsman's stool, or in the manager's easy chair according to Mr. Brown, for in many cases improvements took place due to accidental discovery. However, progress was made, which is the main thing, and although Mr. Brown is a modest executive, and did not care to admit it, he half-confessed that even in those days, as at present, many came to him seeking advice on die practice.

It's the little things that count in die work. Take for example the sketch at Fig. 1. Suppose you had a narrow slot to make in a die block as shown, how would you proceed? Would you drill

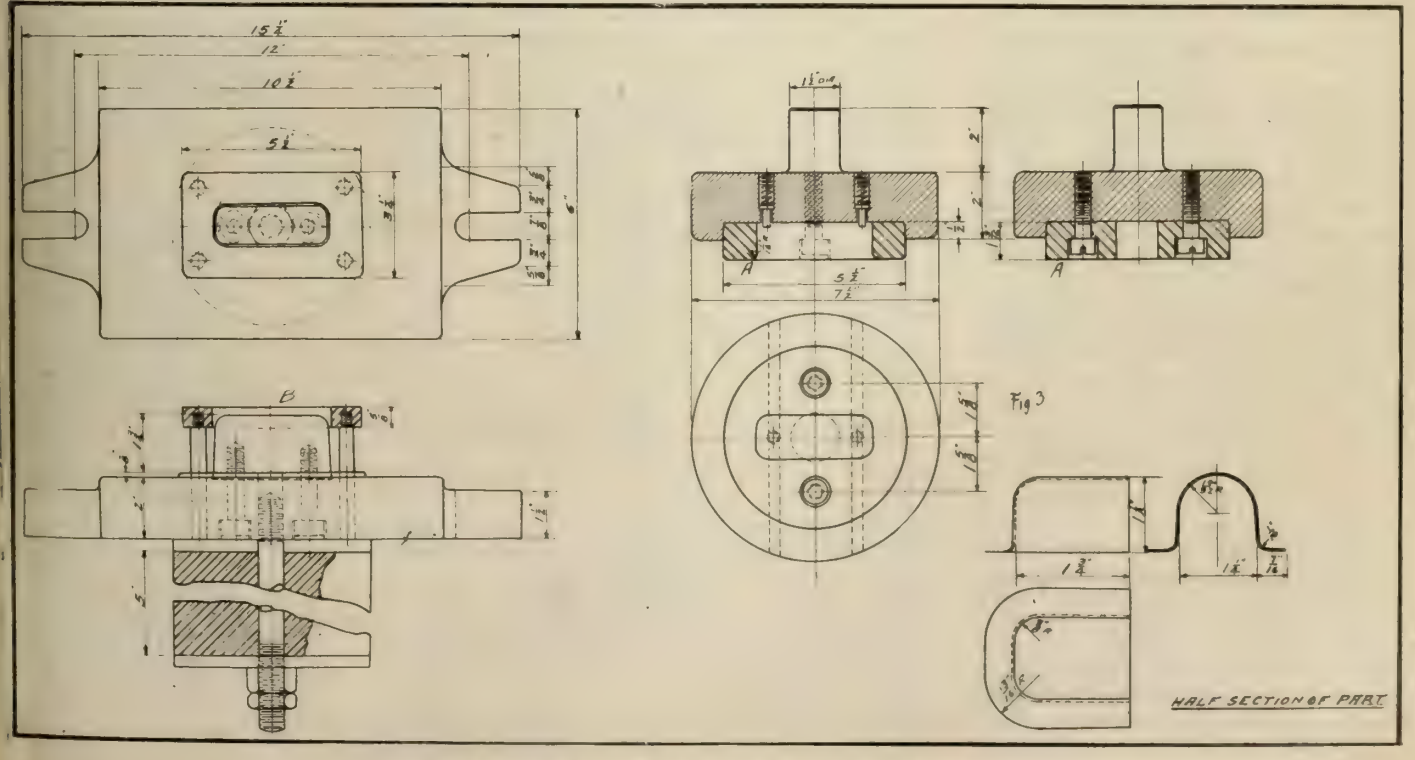
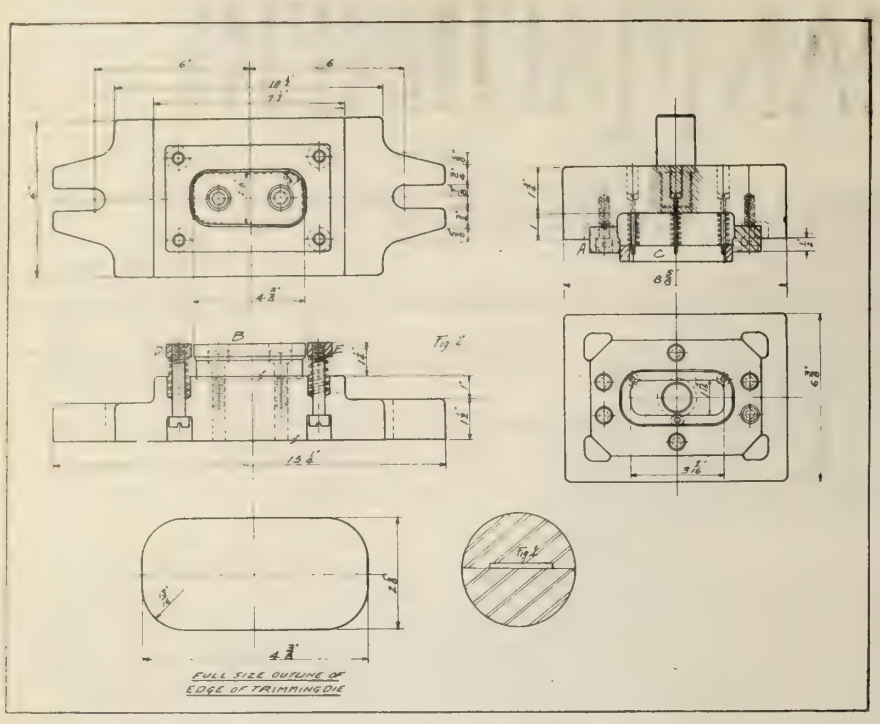


Fig. 3—Details of drawing die used to produce drip spout.



Figs. 1 and 2, showing trimming die; also method of making narrow slot die.

a series of small holes, then file the slot? Ten chances to one you would, and if so you would be doing exactly what the Brown & Bogg Co. did, until they suddenly decided the method shown at B was much better and quicker. They made an insert in two parts, and were thus able to machine the slot on the shaper, getting it to very close limits, and arranging for necessary clearance without trouble. Without further preamble, we will consider some dies which have proved real production assets. No attempt will be made to confine examples to any particular style of die, but we shall show as varied an assortment of ideas as possible in this space.

Making Drip Spouts'

In Brantford, they make an electric washing machine which is known under the trade name of "Bluebird." On this machine is a drip spout which is made from steel stock fifteen thousandths of and inch thick. After due consideration, it was decided to make these spouts two at a time, the last operation being splitting or shearing them apart.

Fig. 2 shows the trimming die used on the blank for the spouts, and it will be noted that the die is really the portion A, while the punch is the part B. In action here is what transpires. Upon reaching the work the stripper plate C comes down and grips the stock securely. As the ram further descends, the plate C pases up inside the die or punch A, (call it what you will) This A. die upon reaching the two plungers D. and E. proceeds to depress them sufficiently to allow the trimming of the blank. Upon the ram ascending, the stock is automatically stripped, as the two plungers mentioned come up to their proper level. This method of manufacture has been found very satisfactory, flat and accurate blank being obtained. As the size of blank is clearly shown, together with important dimensions of die, we can pass on without further comment to Fig. 3, which shows the drawing die for the same piece.

The separate view shows a half section of the spout, and as will be noted the punch A is held in place by means of two filister head screws. On the ram descending the punch A hits the plate B, depressing this until the stock is drawn over into the shape shown. The rubber stripper then relieves the part as the ram ascends.

Next comes the shearing operation, the parts now being separated. The piece goes over the horn as shown in lower bolster, at Fig. 4, then the shear B descends with ram and cuts the spout in half. As the shear blade is clearly shown in the lower view we need not dwell on any detail in connection with the dies' construction.

Can Top Die

The remaining illustration Fig. 5 shows a very interesting die which was designed to make penny lever can tops in one operation. The section of the shape formed is shown in separate view. As this die is of a very special nature we will take up each point in detail. First, note the careful design, the compactness of the various members, and how each part performs an important function. Suppose the stock to be in place and the ram on its way down. First, the punch A cuts out the center hole, the rubber stripper being strong enough to resist this pressure. Upon traveling further, the punch A, at surface B, hits the level C of center lower die. This causes the center lower die to move downward guided in forming block D, this in turn causing the portion of can top sticking over edge of block D to be drawn down into shape. As the ram still further descends the block E, coming within a distance equal to the thickness of the stock, causes the can top to take on the form shown. Before this occurs however, the blank has been punched on its outside diameter, and on completing its stroke, the ram, aided by the portion F, pushes down the sliding block G. This latter movement causes the can top to have its outside edge drawn down as shown.

The section of shape formed is slightly different from the die itself, but as we

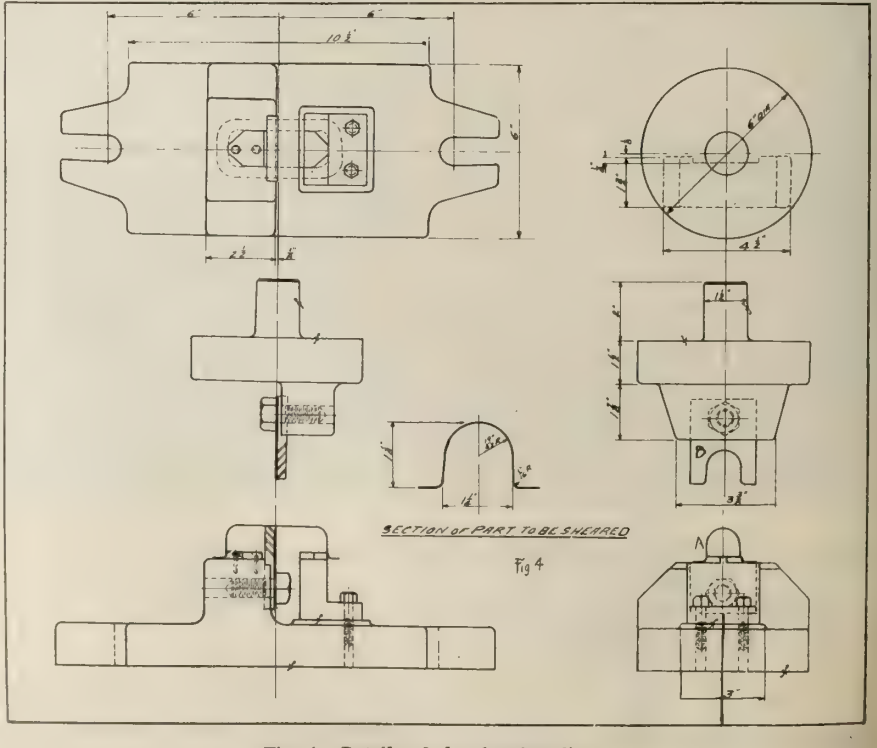


Fig. 4.—Details of the shearing die.

could not at the moment secure a can top produced by the die, we illustrated the section of another shaped form. This was done with a double purpose, viz, to show that the same principles embodied in this die, are used to produce different styles of can tops. In a later article we will show further examples of modern dies as designed and made by the previous mentioned firm.

WHY BELTS ARE STIFF

An excellent way in which to make a study of belt fibre action is to take a pad of scratch paper, a magazine, or something of that sort, and bend it. It is easy to bend a pad of paper when the motion of the ends of the paper is unrestricted. You will note that one sheet slips along on the other a short distance. There is no tension on the convex side, or compression on the concave side of the bent pad. Glue the ends together, or hold the ends tightly with the hands, however, and it will be found more difficult to bend the pad. There will be a "buckling" on the concave side. The convex side will be in tension.

Next glue the complete pad together by saturating it in glue and drying, and you will have a chunk of material that will be as difficult to bend as cardboard, or even as difficult as wood. This is because buckling becomes impossible on the concave side if the gluing job is properly done, and there is no sliding. There is a certain plane close to, or at the centre, that is neither stretched nor compressed when the "board" is bent. That plane is called the "neutral axis." On the concave side of that axis the fibres of the board are in compression. On the convex side the fibres in tension.

The thicker the board the greater the force required to bend it. This is true because the fibres farthest away from the neutral axis have a longer level arm than in a thinner board. And that is why I-beams, channels, Z-bars, etc., are made for engineering structures—to put the outside steel fibres as far away as practicable from the neutral axis.

This explains why belts may be stiff or pliable. The dry, hard belt that is not lubricated in its fibres is naturally stiff because the fibres have difficulty in rubbing one over the other. Thus you will find it more difficult to bend a pad of sand paper or emery paper, for example, than a pad of smooth writing paper. The dry, hard belt does not permit its fibres to slide on one another so easily on the tensile side nor on the compression side. The treated lubricated belt on the other hand, permits its fibres to slide with greater freedom. There is no "grinding" as in a pad of sand paper.

This method of studying the belt will clear away many of the points that have possibly been troubling many belt users. It explains why double or threeply belts are stiffer than single belts. It explains why treated belts are more pliable than untreated belts of the same thickness. It shows why lapped cement joints have a tendency to loosen or "shear" and why the cement used in any belt must be good. Pick up a pad or magazine one-fourth of an inch thick and try it.

This brings to the front the question of belt dressing. Our advice is to use the dressing recommended by the manufacturer. There is no need for you to experiment. He has done so for you. If you use his experience you will probably save a lot of time as well as save your belt.

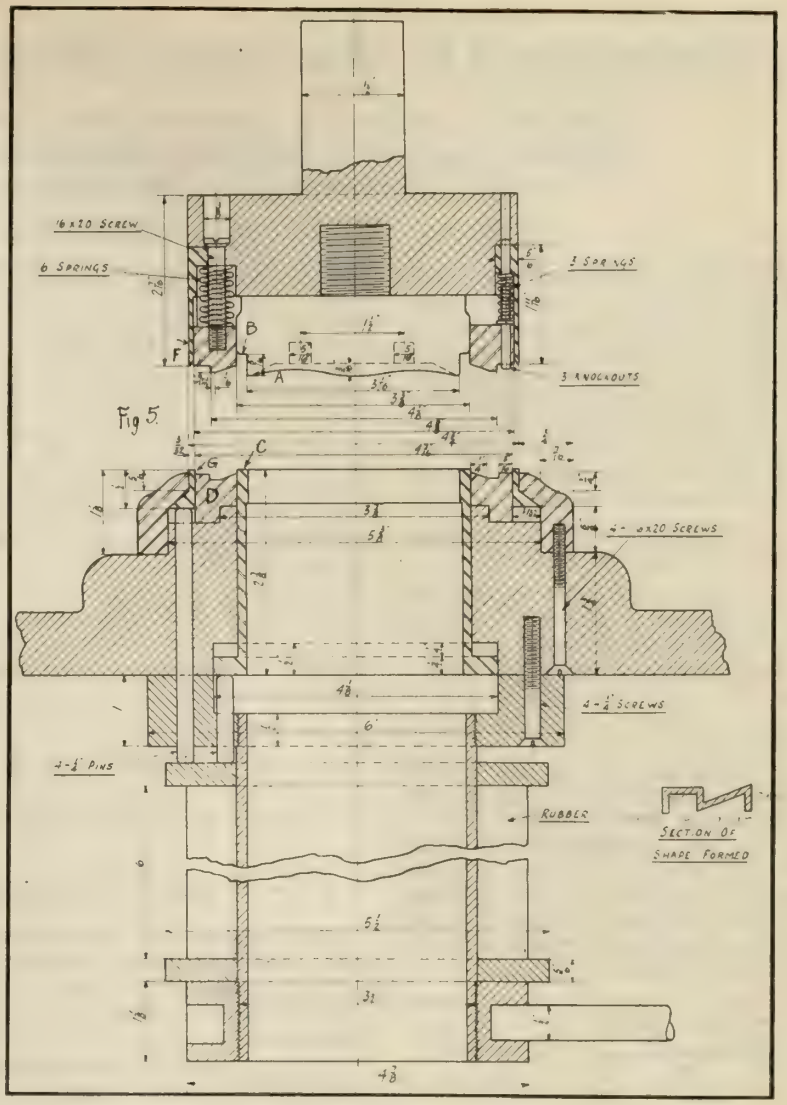


Fig. 5.—Details of the combination can top die.

NEW TYPE OF FLOW METER

Many ingenious devices have been invented to measure the rate at which water or other fluid is flowing along a pipe. A simple and most effective type is now produced by a British firm of instrument makers. The essential part of the instrument is a small paddle wheel placed inside the pipe so that it rotates as the fluid moves along. This paddle wheel has attached to it a magnet, and in a separate steel chamber immediately outside there is another magnet which rotates like the first. When the paddle wheel moves and carries its magnet round with it, the movement of the magnet pulls the second magnet round; and the speed of this second magnet therefore indicates the ratio of the flow in the pipe. The advantage of this arrangement is that the indicating part of the mechanism is quite distinct from that through which the fluid is passing. All risk of the fluid finding its way into the indicating chamber is avoided, and the instrument is therefore particularly well suited for use where crude or hot oil is employed. The makers suggest that this instrument is well adapted to measuring the rate of flow of oil in lubricating systems, and also the flow of oil fuel or cooling water in oil engines.

The Georgetown Foundry and Machinery Co., of Georgetown, Ont., report a steady increase in sales. Business took an upward trend two months ago and the past month's sales have been greater than any previous month. This is the statement made by the manager of the above company to the correspondent of Canadian Machinery.

Elements Of Machine Design—Lesson No. 4

Eccentric Loading Is Cause of Many Failures in Structures — Typical Cases of Eccentricity—Methods of Solution for Determination of Stresses—Eccentricity in an Angle Connection

*By L. T. RUTLEDGE

ONE OF the many causes of failure in various structures is eccentric loading for which no provision has been made in the design. In some cases, the eccentricity is not very apparent and consequently often ignored. The purpose of this discussion is to illustrate typical cases of eccentricity and to provide methods of solution for determination of stresses.

1. Eccentricity of Loading on a Short Post or Compression Member:

In Fig. 17 is shown the plan and elevation of a short post loaded on its top surface with a concentrated load "P." The point of application of the load is distant "e" from the vertical axis of the post as shown. The eccentricity is therefore equal to "e."

The eccentricity of the load causes an unequal distribution of stress. The compression is greater on the side on which the load is located, that is, on the right hand side. Let f_1 and f_2 be the stresses on the right hand and left hand sides respectively as is shown on the stress diagram, the elevation in Fig 17. The average stress is

$$\frac{f_1 + f_2}{2}$$ so that

P=average stress x area of the section

$$\text{or } P = \left(\frac{f_1+f_2}{2}\right) bd \quad -(24)$$

In addition, we know that the moment of the force P about the vertical axis is equal to the sum of the moments of all the stresses from f_1 to f_2 about the same axis. Now the sum of all the individual stresses is given by the area of the stress diagram.

To make use of the equation of moments, assume an infinitely small area.

ΔA of width Δx

distant x from the axis and assume the unit stress on this area to be "f." The strip is so narrow that the stress is uniform over it. The area

$$\Delta A = b \Delta x$$

and the total stress on it is

$$f b \Delta x$$

The moment of this stress is

$$f b \Delta x \, x$$

There are an infinite number of these strips and moments, therefore the total moment of all the stresses is the summation of all the

$$f b x \Delta x$$

This is expressed mathematically thus

$$\sum f b x \Delta x$$

So that, for equilibrium, we have

$$Pe = b \sum f x \cdot \Delta x \quad -(25)$$

The quantity b is a constant and may be passed through the summation sign, all the letters to the right of the summation sign standing for variable quantities.

Now the area of the corresponding strip on the stress diagram is

$$f \Delta x$$

and the moment of this area is

$$f \Delta x \cdot x$$

The total moment of the entire stress diagram is therefore

$$\sum f x \Delta x$$

Thus

Pe=b x moment of stress diagram about vertical axis.

The stress diagram consists of the rectangle A B C D and the triangle C D E. The moment of the rectangle about the vertical axis is zero since its lever arm is zero, its centre of gravity being on the axis. But the centre of gravity of the triangle is $\frac{d}{3}$ from the base or $\frac{d}{6}$ from the axis.

Therefore the moment of the triangle equals its area x $\frac{d}{6}$ or

$$\frac{1}{2}(CE \times CD) \times \frac{d}{6}$$

which is

$$\left(\frac{f_1 - f_2}{2}\right) d \times \frac{d}{6}$$

Thus, we have

$$Pe = b \left(\frac{f_1 - f_2}{12}\right) d^2$$

$$\text{or } Pe \left(\frac{f_1 - f_2}{12}\right) bd^2 \quad -(26)$$

From equation (24) we have

$$\frac{f_1 + f_2}{2} = \frac{P}{bd}$$

and from (26)

$$\frac{f_1 - f_2}{2} = \frac{6Pe}{bd^2}$$

adding, we get

$$f_1 = \frac{P}{bd} + \frac{6Pe}{bd^2}$$

$$\text{or } f_1 = \frac{P}{bd}\left\{1 + \frac{6e}{d}\right\} \quad -(27)$$

Subtracting the above equations we get

$$f_2 = \frac{P}{bd}\left(1 - \frac{6e}{d}\right) \quad -(28)$$

Now if e=o, that is, if there is no eccentricity, then $f_1 = f_2 = \frac{P}{bd} = \frac{\text{load}}{\text{area}}$, the old familiar formula. If $e = \frac{d}{6}$, then we have

$$f_1 = \frac{P}{bd}\left\{1 + \frac{6d}{6d}\right\} = \frac{2P}{bd}$$

and f_2=0.

So that the stress on the extreme fibre is twice the value it would have for a non-eccentric load and the stress on the extreme left fibre is zero. If the eccentricity is greater than $\frac{d}{6}$, we have increased compression on the right

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

side of the load and at the extreme left the stress will be a tensile stress. It is quite apparent from these calculations that for the stable equilibrium the load must be placed within the middle third, that is within $\frac{d}{6}$ to the right or $\frac{d}{6}$ to the left of the axis.

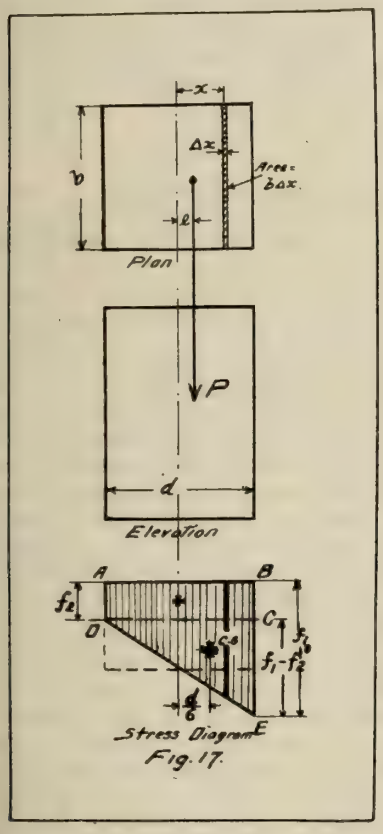


Fig. 17.

2. Eccentricity in an Angle Connection

A very common method of connecting a single angle, in tension or compression, is shown in Fig. 18. The connection of the angle to the gusset plate, where the connection is made to one leg only, will cause the angle to be loaded eccentrically. The stress resulting from the load is very much increased over the value it would have due to central loading, by reason of the aforesaid eccentricity. The solution of a concrete problem will best illustrate the method of procedure for the determination of the value of the stress involved.

Let it be required to determine the size of angle and the number of rivets for a connection similar to that illustrated in which the load P, causing tensile stress in the angle, is 20,000 lbs. Assume that the allowable working stresses in tension, bearing and shear are 16,000, 20,000 and 10,000 pounds per sq. in. respectively, and take the thickness of the steel gusset plate as ⅜ inch.

The net area of the cross-section of the required angle, if eccentricity is ignored and central loading assumed is the total load divided by the unit stress, or $\frac{20,000}{16,000}$ which gives 1.25 sq. ins. as being necessary. This condition will be satisfied by the selection of a 3 x 3½ x 5/16 inch angle, whose gross area is 1.63 square ins. and whose net area is 1.38 sq. ins., after making due allowance for the metal removed in one rivet hole. But considering eccentric loading it will be apparent that a larger section will be required to keep the unit stress below the maximum value of 16,000 permitted in the specifications. For a first trial, select a 3½ x 3½ x ⅜ inch angle which has a gross area of 2.49 sq. ins. or a net area of 2.19 sq. ins.

In a table on the properties of angles, we note that the distance from the back of the angle to the centre of gravity of the section is 1.01 ins. It is denoted by y in the figure. The eccentricity of the loading is the distance from the centre of the plate to the centre of gravity of the angle which is 1.01 + .1875 or 1.1975 ins. or almost 1.2 ins. Then the maximum tensile stress in the angle is given by the familiar formula:

Maximum unit stress = direct stress + secondary stress

$$= \frac{P}{A} + \frac{Pey}{I} \quad \cdots (29)$$

Where

P = load in lbs.
A = net area of section under stress.
e = eccentricity in ins.
y = distance in inches from back of angle to centre of gravity.
I = moment of inertia of the section.

The value of the secondary or flexure stress is obtained from the flexure formula $\frac{S}{y} = \frac{M}{I}$ or $S = \frac{My}{I}$ and $M = Pe$.

Introducing the arithmetical values into (29) we have:—

Maximum unit stress in lbs. per sq. in.

$$= \frac{20,000}{2.19} + \frac{20,000 \times 1.2 \times 1.01}{2.87}$$

$$= 9,132 + 8,446 = 17,578$$

The result shows the stress to be higher than that permitted by the specifications, therefore it will be necessary to choose a larger section. As a second trial, select a 4 × 4 × ⅜-inch angle. Obtaining, as before, the necessary values for substitution in (29) we have the maximum stress in lbs. per sq. in.

$$= \frac{20,000}{2.55} + \frac{20,000 \times 1.31 \times 1.14}{3.71}$$

$$= 15,893.$$

Apparently the section selected in the second trial will be satisfactory. The above analysis must surely show that eccentricity of loading cannot be ignored.

To determine the number of rivets to be used in the joint, it will be necessary to know the bearing and shearing value of a rivet for this case and use the smaller value. The single shearing value of a ¾-inch rivet is .4418 × 10,000 lbs. = 4,418 lbs., where .4418 is the area in sq. ins. of a ¾-inch rivet. The bearing value of a ¾-inch rivet against a ⅜-inch plate is 20,000 × ¾ × ⅜ or 5,625 lbs. The shearing value being less governs. The number of rivets required is $\frac{20,000}{4,418}$ or 5.

3. Eccentricity in a Beam Connection

In Fig. 19 is shown an ordinary beam connection. The load on the beam is such that "P" is the value of the end reaction, so that P is the load on the riveted joint. The line of action of P is located at the back of the connection angle as shown. Assume six rivets in the connection, distant d_1, d_2, d_3, etc. from the centre of gravity of the riveted connection. There are two forces acting on each rivet as follows:

(1) A direct shearing force due to the load and acting vertically through the rivet.

(2) An eccentric force P acting at a distance "a" from the centre of gravity of the riveted area. Its moment is Pa.

The direct force on any rivet is

$$\frac{P}{\text{No. of rivets}} = D_1 \text{ or } D_2 \text{ or } D_3, \text{ etc.}$$

The turning moment Pa is balanced by the resisting moments of the stresses in the rivets acting about the centre of gravity of the riveted area.

Let T be the turning force on a hypothetical rivet at unity distance from the centre of gravity. Then Td will be the turning force on a rivet at distance d from the centre of gravity, since the stress increases proportionally with the distance. The moment of this turning force Td about the centre of gravity is

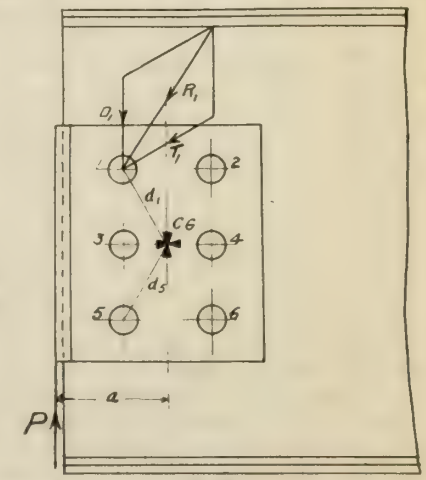


Fig 19

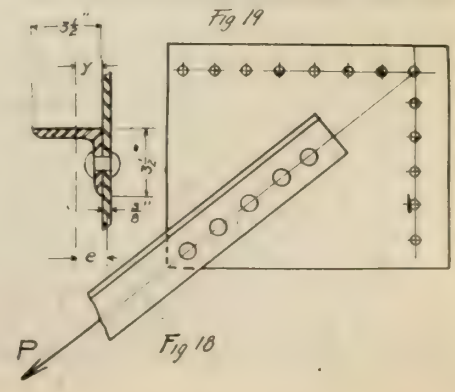


Fig 18

Td × d or Td^2. Then the resisting moment of all the rivets is the summation of all the Td^2 for all the rivets or Td^2, expressed mathematically, and this must equal Pa for equilibrium.

Therefore

$$Pa = \sum Td^2 = T\sum d^2$$

the T going through the summation sign since it is a constant.

Thus

$$T = \frac{Pa}{\sum d^2} \cdots (30)$$

Considering rivet No. 1, the direct shear is $\frac{P}{6}$ since there are six rivets and the turning force causing the secondary stress is Td_1, which is

$$\frac{Pa}{\sum d^2} \times d_1$$

The direction of the secondary stress is at right angles to the line joining the centre of rivet No. 1 to the centre of gravity of the joint. The combined stress is the vector sum of the two stresses and the graphical solution is indicated in Fig. 19. The solution by parallelogram of forces gives the vector sum and takes into account direction as well as magnitude. The resultant R_1 is the combined total stress in magnitude and direction as indicated.

(To be continued)

WELDING BROKEN ARMATURE SHAFTS

LARGE armature shafts occasionally break at the junction of the journal and the pulley end. While recognizing the adaptability of the Thermit welding process to the welding of all kinds of large steel shafts, operators sometimes in this case decide to scrap the old shaft, fearing that the heat of the steel produced by the Thermit reaction might injure the armature coils and produce short circuits. Where the armature coils, however, can be separated from the fracture by a few inches of molding sand (at least about 4 inches in the case of a 3 inch diameter shaft) a repair by this method is entirely feasible without injuring them, according to a statement by the Metal & Thermit Corporation, New York, if the following simple precautions are observed. There is no danger of damaging the armature windings through the effect of direct heat as the fracture is completely surrounded by molding sand and all preheating subsequent to heat from the Thermit steel is confined within this molding sand. The heat which is conducted along the shaft is readily taken care of either by directing an air blast on the shaft or, where necessary, by means of a specially constructed water cooler box with packing box on the shaft to prevent the possibility of any water whatsoever coming in contact with the windings. The windings themselves are further protected by being totally encased in an oil cloth and burlap bag.

In case the keyway of the pulley end of an armature shaft becomes badly worn, this worn end can be removed and a new oversize extension welded on and machined down. A large number of such extensions have been Thermit welded in the past.

Thermit, it may be explained is a mixture of finely divided aluminum and iron oxide. When this mixture is ignited a chemical reaction takes place with the result that the aluminum combines with the oxygen of the iron oxide to form aluminum oxide or slag in a highly superheated molten state while the iron is set free and is produced as liquid steel, also highly superheated (temperature approximately 5,000 degrees F.). The steel at this high temperature is poured around and between the sections to be welded which have been previously heated to a bright red heat. The sections at the fracture become dissolved and amalgamate with the Thermit steel so that finally the entire mass cools down to form a single homogeneous section.

VIGOROUS CAMPAIGN

The Canadian Pulp and Paper Association is conducting a vigorous campaign for the increase in exports of the Canadian product to the States. A recent statement has been prepared by the Association which explains the ability of the Canadian manufacturer to supply the requirements of the United States consumer. In the foreword of the statement the following appears, which would tend to do away with any uncertainty as to prices, etc. Production of paper increased from 150,000 tons in 1909 to over 850,000 in 1920. Today the Canadian newsprint mills are equipped to produce about 1,000,000 tons of paper a year. They are supported by what are admitted to be the greatest potential pulwpood reserves in the world.

"About 80 per cent. of the output of these mills is marketed in the United States. During the twelve months ended August 31st American newspaper publishers purchased and used no less than 637,266 tons of Canadian newsprint, exceeding the record of the preceding twelve months which included the period of the greatest demand for newsprint ever known.

"Contracts for next year's supplies of newsprint are now being negotiated. They show no diminution in the American demand for Canadian paper.

Iona, B. C.—The Iona Gypsum Co., who have been shipping a large amount of Gypsum to the U. S. market, principally Philadelphia and New York are about to reorganize. This will mean new management. It is stated by well informed persons that a large amount of money will be spent on improvements in order to make the plant a large producer on an efficient working basis. The product of the Iona gypsum mines is said to be equal to that of any gypsum deposits on the American continent. It is reported that a representative of Montreal capitalists is at present looking the plant over and the indications are that the coal interests will sell out. Should the proposed deal go through, there will be extensive alterations made to the plant and improved shipping facilities will be provided.

BUSINESS BETTER IN UNITED STATES

The First National Bank of Boston notes a distinctly better feeling toward business, not in the sense that business is free, active and profitable—for it is not—but because many, and the most difficult, steps in the business readjustment have already been taken, and persistently, if slowly, the products of the farm are being brought more nearly into balance with retail prices of goods. The downward trend of commodity prices for the moment has been checked, and in fact the average has risen slightly in recent weeks, lumber, copper, cotton, oil, wool, and some steel products contributing to the increase. While building construction awards are increasing and are now in normal proportions, the recovery in steel is being blocked by scant buying on the part of the railroads. The reason is obvious. The railroads' gross earnings for September were $120,000,000, or 20 per cent. less than in September, 1920. Only by cutting down expenses in every way, including paring down maintenance materials, was this enormous shrinkage offset. Heavy buying of steel by the roads under these conditions is out of the question. Transportation charges form so large a part of the final cost of goods that the demand for lower railroad rates, meaning further reduction in railroad wages, is growing more insistent and is being recognized as the barrier to a revival of business. The eleventh-hour rescinding of the railroad strike order was mainly in response to this public demand.

INCORPORATION

Samuel & Benjamin, Ltd., composed of S. Samuel, merchant, George T. Pepall, manager. C. Miller, H. M. Samuel and W. T. Louden all of Toronto and F. D. Benjamin of London, England. has been formed to purchase the business carried on in metals in Toronto under the firm name of M & L. Samuel Benjamin & Co. Capitalization of the new company is $2,000,000, head office in Toronto.

How to Make Use of Logarithm Tables

In This, the Second Article, the Method of Finding Logs and Anti-Logs Is Shown—Proportional Differences and the Treatment of Logs Having Negative Characteristics Are Also Taken Up

By F. H. FENNER

IN OUR last article we gave an illustration of the kind of problem that makes it absolutely necessary to use logarithms. We will not attempt at present to show the method of working that particular problem but will give some illustrations of applying logarithms to ordinary multiplication and division sums.

The cut herewith shows a partial table of logarithms, which are taken to six places of decimals. The column at the left marked N contains the number of which the logarithm is to be found. The next column contains the mantissa of the logarithm of that number, the characteristic being omitted. The reason that the characteristic is not put in is because, as explained in our last article, the characteristic depends on the number of integers, or whole numbers in the number. Thus, if the log. of 415 is sought, the characteristic would be 2. If the number is 41.5 then the characteristic would be 1, while if the number was 4.15 the characteristic would be 0. If the number was .415 the characteristic would be minus 1. .0415 would be minus .00415 would be minus 3 and so on. The mantissa in case would be .618048, as given in the first column of mantissa. The columns following the one containing the mantissa, and headed 0, are followed by columns headed 1, 2, 3, 4. 5, 6, 7, 8, 9, and a final column headed Diff. The way that these are read is as follows. If we want the logarithm of 4151 we first find the number 415 in the left hand column. The first two figures of the mantissa are 61. Looking under the column headed 1 we find four more figures 8153. The logarithm of 4151 is then 3.618153. The logarithm of 4152 would read by taking the first two figures from the column headed 0, and the next four from the column headed 2, and would be 3.618257, and so on, up to 4159.

Now if we have the logarithm and wish to find the anti logarithm or the number corresponding to the logarithm, we proceed in the opposite manner. If for instance we have the logarithm 2.-618571, we look up in the table till we find a logarithm beginning with 61 in the first column of mantissa. We then look along the other columns until we find the one containing the last four figures of the log. 8571. At the top of this column is the figure 5. The number is then 4155, and as the characteristic is 2 the number will be 415.5.

Now supposing instead of the logarithm or log. as it is usually abbreviated was 2.618469. There is no log exactly the same as this in the tables. The log. of 4154 is 618466, and the log. of 4155 is 618571. How are we to get the exact number? We must find the proportional difference. and to do so proceed as follows:

The nearest log. below the one we have is 618466, and the number corresponding to this is 4154. Now subtract the log. in the table from the log. whose number we wish to find. Thus 618469 less 618466 gives a difference of .3. Now multiply this difference by 100, which gives 30 and divide it by the number in the difference column, which is 105. This gives $\frac{30}{105}$ .1857 and this number must be added on the number already found which makes the

LOGARITHMS

COMMON LOGARITHMS OF NUMBERS (*continued*).

No.	0	1	2	3	4	5	6	7	8	9	D.
408	610660	610767	610873	610979	611086	611192	611298	611405	611511	611617	106
409	611723	611829	611936	612042	612148	612254	612360	612466	612572	612678	106
410	612781	612890	612996	613102	613207	613313	613419	613525	613630	613736	106
411	613842	613947	614053	614159	614264	614370	614475	614581	614686	614792	106
412	614897	615003	615108	615213	615319	615424	615529	615634	615740	615845	105
413	615950	616055	616160	616265	616370	616476	616581	616686	616790	616895	105
414	617000	617105	617210	617315	617420	617525	617629	617734	617839	617943	105
415	618048	618153	618257	618362	618466	618571	618676	618780	618884	618989	105
416	619093	619198	619302	619406	619511	619615	619719	619824	619928	620032	104
417	620136	620240	620344	620448	620552	620656	620760	620864	620968	621072	104
418	621176	621280	621384	621488	621592	621695	621799	621903	622007	622110	104
419	622214	622318	622421	622525	622628	622732	622835	622939	623042	623146	104
420	623249	623353	623456	623559	623663	623766	623869	623973	624076	624179	103
421	624282	624385	624488	624591	624695	624798	624901	625004	625107	625210	103
422	625312	625415	625518	625621	625724	625827	625929	626032	626135	626238	103
423	626340	626443	626546	626648	626751	626853	626956	627058	627161	627263	103
424	627366	627468	627571	627673	627775	627878	627980	628082	628185	628287	102
425	628389	628491	628593	628695	628797	628900	629002	629104	629206	629308	102
426	629410	629512	629613	629715	629817	629919	630021	630123	630224	630326	102
427	630428	630530	630631	630733	630835	630936	631038	631139	631241	631342	102
428	631444	631545	631647	631748	631849	631951	632052	632153	632255	632356	101
429	632457	632559	632660	632761	632862	632963	633064	633165	633266	633367	101
430	633468	633569	633670	633771	633872	633973	634074	634175	634276	634376	101
431	634477	634578	634679	634779	634880	634981	635081	635182	635283	635383	101
432	635484	635584	635685	635785	635886	635986	636087	636187	636287	636388	100
433	636488	636588	636688	636789	636889	636989	637089	637189	637290	637390	100
434	637490	637590	637690	637790	637890	637990	638090	638190	638290	638389	100
435	638489	638589	638689	638789	638888	638988	639088	639188	639287	639387	100
436	639486	639586	639686	639785	639885	639984	640084	640183	640283	640382	100
437	640481	640581	640680	640779	640879	640978	641077	641177	641276	641375	99
438	641474	641573	641672	641771	641871	641970	642069	642168	642267	642366	99
439	642465	642563	642662	642761	642860	642959	643058	643156	643255	643354	99
440	643453	643551	643650	643749	643847	643946	644044	644143	644242	644340	98
441	644439	644537	644636	644734	644832	644931	645029	645127	645226	645324	98
442	645422	645521	645619	645717	645815	645913	646011	646110	646208	646306	98
443	646404	646502	646600	646698	646796	646894	646992	647089	647187	647285	98
444	647383	647481	647579	647676	647774	647872	647969	648067	648165	648262	98
445	648360	648458	648555	648653	648750	648848	648945	649043	649140	649237	97
446	649335	649432	649530	649627	649724	649821	649919	650016	650113	650210	97
447	650308	650405	650502	650599	650696	650793	650890	650987	651084	651181	97
448	651278	651375	651472	651569	651666	651762	651859	651956	652053	652150	97
449	652246	652343	652440	652536	652633	652730	652826	652923	653019	653116	97
450	653213	653309	653405	653502	653598	653695	653791	653888	653984	654080	96
451	654177	654273	654369	654465	654562	654658	654754	654850	654946	655042	96
452	655138	655235	655331	655427	655523	655619	655715	655810	655906	656002	96
453	656098	656194	656290	656386	656482	656577	656673	656769	656864	656960	96
454	657056	657152	657247	657343	657438	657534	657629	657725	657820	657916	96
455	658011	658107	658202	658298	658393	658488	658584	658679	658774	658870	95
456	658965	659060	659155	659250	659346	659441	659536	659631	659726	659821	95
457	659916	660011	660106	660201	660296	660391	660486	660581	660676	660771	95
458	660865	660960	661055	661150	661245	661339	661434	661529	661623	661718	95
459	661813	661907	662002	662096	662191	662286	662380	662475	662569	662663	94
460	662758	662852	662947	663041	663135	663230	663324	663418	663512	663637	94
461	663701	663795	663889	663983	664078	664172	664266	664360	664454	664548	94
462	664642	664734	664830	664924	665018	665112	665206	665299	665393	665487	94
463	665581	665675	665769	665862	665956	666050	666143	666237	666331	666424	94
464	666518	666612	666705	666799	666892	666986	667079	667173	667266	667360	94
465	667453	667546	667640	667733	667826	667920	668013	668106	668199	668293	93
466	668386	668479	668572	668665	668759	668852	668945	669038	669131	669224	93
467	669317	669410	669503	669596	669689	669782	669875	669967	670060	670153	93

Partial Table of Logs.

number 41541857, and if the characteristic was 2 the number will be 415.41857. or 415.4186. The number thus lies between 415.4 and 415.5 and unless the calculation is to be very exact it is usually sufficient to take the nearest log. in the tables and neglect the proportional difference.

In case we wish to find the log. of a number that contains more figures than the tables give, for instance 41569. The characteristic will be 4 and the mantissa will be somewhere between 618676 and 618780. If we wish to get the exact log. we must find the proportional difference. To do this we multiply the figure or figures after the first four, in this case 9, by the number in the difference column. That is we multiply 9 by 105, and divide by 10. Add the quotient to the log. of the first four figures. Thus the log. of 41569 would be 4.618676+9x105945

As we have to divide by 10 this means that we place the 945 under the log. beginning at the second figure from the end thus

```
4.618676
      945
-----------
4.6187705
```

Thus the log. required is
4.6187705

Suppose we wanted the log. of 415698. The characteristic of the log. would be 5 and the mantissa would have to be found by proportional parts. If there is more than one figure over the number to be obtained directly, we must multiply the difference and divide by 100. This is most conveniently done as follows:

Find the log. of 4156 as before which is 618676 as before.

The figures remaining are 98. Then we have log. 415698

```
      =5.618676
9x105      945
8x105      840
-----------------
5.61877890
```

As already mentioned, it is but seldom that such a degree of accuracy is required but it shows how simply it can be attained if necessary.

Some Simple Examples

Having made clear just what logarithms are, we are now in a position to see the actual application in some of the simpler cases. We have stated that in order to perform multiplication of numbers we add their logarithms.

Multiply 4.5 x 4.
Log. 4.5 plus log. 4

```
.653213
.602060
-------
1.255273
```

Then the logarithm of the product is 1.255273. We must look up in the log. table for the anti-log. The small part of the logarithm table which we have been able to reproduce here does not contain this log. but it can be found readily by those possessing the full tables. Looking up this logarithm, we find that the anti logarithm is 1800, and as the characteristic is 1, our answer is 18.

Suppose now that we had wanted to divide 4.5 by 4, instead of multiplying we should have had to substract the log. of 4 from the log of 4.5 instead of adding. Thus

Log. 4.5 minus log. 4

```
.653213
.602060
-------
.051153
```

The anti logarithm of .051153 is 1125, and as the characteristic is nothing the answer is 1.125.

These are simple cases for illustration.

Now let us come to an important application of logarithms, and one where their usefulness will be apparent to all: We mean in the raising of numbers to powers or the extraction of the roots of numbers, in other words evolution and involution, or as many prefer square and cubes and their roots. Instead of the long and abstruse calculations with their immense possibility of error, the use of logarithms substitutes a simple subtraction or addition sum, or an even more simple multiplication or division sum. Let us take again the figures 45. We will say first of all that we want to square them, that is 45 x 45.

The log. of 45 is 1.653213, so that we must add the log of 45 to itself to get the log. of 452. This is exactly the same as multiplying the log. of 45 by 2, and as a matter of fact this is what is done. Thus to find the square of 45 we take the log. of 45 which is 1.653213 and multiply it by 2, which gives 3.306426 as the log. of the square of 45. Looking up the tables we find the number is 2025 and as the characteristic is 3.2025 is the square of 45.

Now if we wanted the square root of 45, instead of multiplying its log. by 2 we should divide its log. by 2 Thus the log. of the square root of 45 would

$$\text{be } \frac{\text{log. } 45}{2}$$

```
1.653213
---------
2
.826606
```

and the anti logarithm of .826606 is between 6708 and 6709. We can find this exactly by the method shown earlier. The next lowest log. to .826606 is .826593 and the difference is 13. The number in the difference column of the log. table is 65, so that we have 1300 divided by 65 which is 20 and the anti-log. of .826606 is 67082, and as the characteristic is 0 the square root log. 45 is 6.7082. It can be readily seen that if we had taken the number corresponding to the next lowest log. it would have made practically no difference in the result in this case.

From these two examples we get the rule. To raise a number to any power, multiply its logarithm by the index of the power. To extract any root of a number, divide its logarithm by the index of the power. To extract any root of a number, divide its logarithm by the index of the power. Here we have a very easily applied method of getting odd powers or roots or fractional powers or roots which it would be extremely difficult to get in any other way. This application of logarithms is worth the study if they are used for no other purpose. We now come to what may be called a special case, although they occur fairly often.

Suppose we have to raise a decimal quantity to a higher power or to find the root of a decimal quantity. Let us take first of all the raising to the 2nd power of a decimal quantity, or getting the square of a decimal quantity, say, .45. Now the log. of .45 is $\overline{1}.633213$ that is the characteristic is a minus quantity. Now how are we to multiply a log. containing a minus characteristic and a positive mantissa. There are several ways of doing this.

Let us take the easiest method first. which is to multiply the mantissa first, and then multiply the characteristic, and then add the two together. Thus we should have .653213 x 2=1.306426, and to this must be added the product of $\overline{1}$ x 2 which is of course $\overline{2}$.

Then we have

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1.306426
  2.
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1.306426
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The anti-log. of this is 2025 and as we have a minus characteristic the square of .45 will be .2025.

A second method is to add a positive number to the negative characteristic, and multiply in the ordinary way. After that is performed, the product of the added positive number and the multiplier is subtracted from the log. already found.

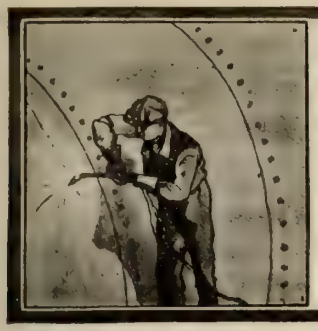
Using our same figures again for illustrative purposes, we have log. of .45 is $\overline{1}$ .653213. If we add 10 to the negative characteristic we shall have a positive characteristic 9. That is 10 plus $\overline{1}$ is 9. The log. would then be 9.653213 and this multiplied by 2 is 19.306426.

As we have added 10 we must now compensate for that by subtracting the product of $\overline{10}$ and 2 which is $\overline{20}$ and the log. will be

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19.306426
20.0000000
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1.3064260
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which is we see the same as before.

In our next article we shall give various examples of logs. applied to the working of actual formula.



WELDING AND CUTTING



Some of the Possibilities of Welding

How To Go After Business—Certain Points on Which the Success of Welding Hinges—Boiler Regulations—Usual Marine Repairs—Oxy-Acetylene Process

*By A. M. BARRY

ONE OF the most marked peculiarities of the business that comes to the door of the average welding shop is the tendency to suddenly vary in volume. One day the entire force will be on the jump from morning till evening, with part working overtime on the repair of an exceptionally heavy casting, which naturally calls for a prolonged and continuous performance of preheating and welding, and the very next day the boss finds himself puttering around the shop in search of jobs to keep the men busy. Quite naturally all repair work is wanted in a hurry, since a broken piece of machinery means a machine standing idle, so that there is a limit to the amount of work that can be carried over for the sake of having something for all the welders to do. Shall the welder sit down calmly when he has finished one repar and wait for something else to break? Not if he can help it. If it is a good sized shop there is probably a salesman out looking for machinery accident cases to hustle in for treatment, and if things refuse to break he investigates manufacturing processes to see if he can have parts of products sent to his shop to be assembled by welding. The names "Blank Welding and Mfg. Co.," and "Blank Welded Products Co." so frequently found over the doors of welding shops, indicate that production work is an important part of a thriving welding business.

A considerable volume of production welding for outside concerns has to be secured on each job in order to make the work profitable, because it requires practice to obtain sufficent speed on the work to justify making a price that will mean a saving to the manufacturer. Very often it is necessary to go to the trouble of making special jigs for holding the parts, or to the expense of having them made. Still the work is worth while if the price paid for it is enough to cover all the overhead with a slight margin of profit, for it can usually serve to keep the shop busy during the slack days.

When all other signs fail, that is when repair work inside and outside the shop falls off, and there is no demand for production work from other manufacturers, the welder still has a chance to keep busy by becoming a manufacturer himself. There is an almost unlimited number of metal specialties which can be turned out at small cost in a well equipped welding shop, and for which a local demand can be found.

The metal can be obtained in sheets, rods, tubes, plates, etc., and cut to any desired pattern with a cutting torch then welded together at odd moments, so that the cost of manufacturing is comparatively low. Some interesting work of this nature has been done, such as, auto axles, tanks, pans, screens, refrigeration equipment, house furnaces, depth bombs, aerial bombs, etc. The oxy-acetylene torch has scrapped many war vessels and guns. It saved the day on more than one occasion in quick repairs to the Allied Forces equipment both at sea and on land. Welding equipment is indispensible to every large industrial plant for repair work, so as to enable them to quickly repair small breakdowns. The larger repairs are usually handed out to an outside shop to handle because on large work special facilities, equipment, and organization is required to handle this work.

New uses and applications of these processes are being found every day. The field offered unlimited opportunities to the workman and expert to show his initiative and skill, but let me put before you that the success of welding depends on:

First—The proper preparation of the work.

Second—The proper selection of process.

Third—The use of reliable equipment and supplies.

Fourth—The skill of the workmen.

Fifth—The necessary equipment for preheating.

Sixth—The proper use of the preheating equipment before, during and after the welding.

Seventh—The necessary facilities to take care of the cooling of the casting after heating.

Eighth—The necessary and proper skilled supervision of the expert.

The following is descriptive of the industry:

Welder—The other day a big casting broke down in John Doe's Machine Works. Doe and the rest of his bunch all knew it was impossible to weld it.

Billy—Well, what became of it?

Welder—Why, they fooled me, I didn't know it was impossible to weld and they didn't tell me, so I went ahead and did the job O. K.

It is utterly impossible in this small space to go into detail or thoroughly cover the possibilities of welding. Every day new fields open up; jobs that were considered impossible a few years ago are today being welded as ordinary shop practice. Let me impress upon you that there is no guess work or chance in the welding field today, as it is accepted as standard practice in the railroad shops both here and on the American continent, and in Europe.

Shipyards throughout the world use all processes, and a great many large industrial plants have well organized welding departments to handle their repairs, where they save many thousands of dollars a year. In many countries there are large welding organizations manufacturing principally by the use of welding, —in some cases having on their staff as many as four hundred welders. In France during the war one shop alone employed twelve hundred women welders, working eight hours a day making bombs. Therefore you must realize it is impossible to do full justice to this field in so short a space. However, I will try to put before you what is being done, and some of its possibilities.

Failure and condemnation of welding is the direct result of welding equipment being placed in the hands of the unskilled and untrained workman, who with his unlimited nerve and irresponsibility undertakes, sometimes through force of circumstance, work utterly beyond the capacity of his equipment and skill. Result, a complete failure usually after considerable time and expense has been

*Presented before the Montreal Branch of Canadian Welding Society.

incurred taking out the broken part and replacing. This always creates a bad impression and unfortunately not the workman but the process is blamed. The Canadian Inter-Provincial Boiler Regulations in regard to welding are as follows:

Boiler Regulations

Autogenous Welding may be used in boilers in approved cases where the stress is carried by staying or other construction which conforms to the requirements of these regulations, and where the safety of the structure is not dependent upon the strength of the weld. Autogenous welding shall not be used in place of cauling or girth seams.

The efficiency of the longitudinal joint of a shell or drum when welded by the forging process shall be taken at not more than 50 per cent. of the solid plate for butt-welded joints, and 60 per cent. of the solid plate for lap-welded joints when calculating the maximum working pressure allowable by the formula in Section 193 of these Regulations.

Steel stays may be upset at ends but not welded in any way.

The ultimate strength of a joint which has been properly welded by the forging process may be taken at 50 per cent. of the tensile strength of the solid plate.

Cracks in shell plates or other parts of boilers subject to tensile stress shall not be welded.

Cracks not exceeding sixteen inches long in plain and corrugated cylindrical furnaces of internally fired boilers, and cracks not exceeding thirty inches long in stayed surfaces, such as fireboxes, back sheets and water legs of locomotive type boilers, boiler heads, tube sheets, combustion chambers, etc., may be welded, a hole being drilled at each end of the crack before welding to prevent the crack extending.

Cracks extending through the rivet holes in stayed plates only, may be welded, or if preferred the outer strip of plates extending from the rivet holes to the lap may be removed and the place where the strip of plate has been removed may be built up and reinforced by either of the above processes.

Cracks extending from the outer edge of rivet holes to the edge of lap in externally fired boilers may be welded, if not below the fire line of the boiler.

The beading on the ends of tubes may be welded to the tube sheet.

All caulking edges of plates of internally fired boilers may be reinforced by autogenous welding, but caulking edges of shell plates of externally fired boilers may be reinforced above the fire line only. When caulking edges of plates are thus reinforced the rivets must be cut out and redriven where considered necessary by the Inspector.

Shell plates of internally fired boilers only, and tube sheets in all boilers, which are reduced in thickness by corrosion, etc., may be reinforced, provided that the reduction in thickness does not exceed 25 per cent. of the original thickness of the plate and that such reinforcement does not exceed 200 square inches in area in any one plate.

Stayed surfaces such as wrapper sheets and legs of furnaces, etc., which are reduced in thickness by corrosion, etc., may be reinforced provided that the reduction in thickness does not exceed 40 per cent. of the original thickness of the plate ad that such reinforcement does not exceed 200 square inches in area in any one plate. If the reinforcing extends over braces or stays, the stays shall be removed and replaced so that the stays and braces shall come completely through the reinforcing. Where metal is deposited on stayed surfaces the operater shall hammer the deposited metal, when practicable, while in a glosing state.

When the corroded portion of a stayed surface exceeds 300 square inches in area the corroded part may be cut out and a new piece of plate welded in, the welding edge being V'd or bevelled along the joint, prior to welding. The size of the piece of plate welded in should not exceed 24 inches square or if other shape than square it should not be longer than 30 inches in any one direction. Stays, braces or rivets must be replaced so as to pass through the new plate as before.

Cracks in wrought iron or wrought steel headers of water tube boilers and cracks and sandholes in cast steel or cast iron headers, manifolds, crosses, tees and elis, may be repaired by welding cracks or flowing metal into sandholes but may not be reinforced by building up. After repairing they shall be subjected to a hydrostatic test pressure of three and a half times the working pressure before being used.

Thermit, electric and oxy-acetylene welding are all known as the autogeuous welding processes, the proper selection of which for the individual job usually calls for the highest skill on the part of the expert, although he has certain definite rules to go by. For instance, the heavy welds in steel or cast iron are at once, to my mind, thermit welding jobs. The prncipal reason is its speed therefore low cost, its automatic action, and that the heavy work is done by the air compressor. Its competitor, in my opinion, is the oxy-acetylene process, which is slow in comparison, altogether dependent on the skill, mood, humor, and endurance of the operators, who would make the weld drop by drop, who would have to contend with heat, smoke sweat, cramped positions for hours at a time. This usually results in failures. Not because the process is at fault, but because of the physical difficulties to be overcome.

The oxy-acetylene process is selected for bench work or the smaller castings in steel and cast iron and always for the other metals such as, malleable iron, aluminum, brass, copper, platinum, tin, zinc, bronze, or bell metal, silver or gold. The oxy-acetylene and electric salesmen of apparatus are constantly at war with each other on the merits of their respective apparatus', both claiming that they can do the job by their process cheaper and better than the other fellow. Experience goes to show that electric welding is selected for steel welding, principally on boiler repairs and steel tank manufacturing. In boiler repairs not because this weld is a better weld, (in fact according to my observation, it is not as perfect a weld as the oxy-acetylene), but because the heat is more concentrated. While making repairs to boilers, which usually consist of building up of corroded or wasted places, building up leaky caulking edges, welding up of cracks and fire cracks; further trouble is not started by the loosening of rivets from the heat of welding which would be the case should oxy-acetylene be selected on account of the great radiation of heat during the progress of the job. By the electric welding process the heat is much more concentrated, therefore the work is nearly cold, while with oxy-acetylene process we have large sections white hot, with more metal red hot. If rivets or staybolts are in these sections we have rivets that are loose in the hole, the same arguments applying to staybolts.

We will discuss briefly the class of work that thermit welding is used on.

Principally in weldng heavy sections, when broken, such as locomotive frames, steam-shovel parts, heavy frames, rolls, stone crusher parts, contractors' equipment, heavy crank shafts, shears, either in cast iron or steel. Results in steel are to my mind always perfect. In cast iron a small percentage of failures and hard welds. The marine repairs by the Thermit processes usually consist of repairs to shafts, connecting rods, stern frames, rudder shoes, stem posts, rudder frames, anchors, and heavy davits. The Thermit process is also used in pipe and track welding to elimiñate joints. Electric welding consists of two processes, A.C. and D.C. with both processes, using two systems, metal electrode and carbon.

The carbon is used principally in cutting steel, in welding, in building up metal where required, such as in defective steel castings. The metal electrode is also used in building up of corroded or wasted parts, welding up of cracks and fractures in boilers, tanks, and of course in the manufacturing of steel tanks, smokestacks, acid-stills, pressure vessels, vacuum tanks and equipment, also making good, worn parts in machinery, such as building up of shafting after wear to oversize, ready to be machined to full size. Electric welding of cast iron is usually done by first opening the fracture by chiselling a "V" then drilling and tapping in steel studs into the V leaving them about 1-8 in. high, then using a good Swedish iron electro. This electrode is usually 5-32 in diameter filling up the "V" and heavily reinforcing when possible.

Usual Marine Repairs by Electro Welding

The usual marine repairs are filling up corroded parts and making good wastage by building up. Welding up of cracks, and in some cases building up heads of staybolts when the threads are stripped.

In marine construction electric welding is used for the manufacture of steel bulls instead of rivets; fastening on of brackets to houses of ships, fastening of railings, manufacturing of covers, holds, smoke boxes, stacks, steel masts, oil tanks, tank wagons, oil drums, transformers, air receivers, brine tanks, double jacketed tanks, etc. Sometimes a combination of welding and riveting is used, as example, riveting seams of the ordinary tanks, and welding on the heads thus saving the labor of flanging, punching, rivets, and material.

The Oxy Acetylene Process

The oxy-acetylene process, to my mind at least, is the only process by which all metals can be welded or any combination of metals. By its use it is possible to weld any broken part that is made of metal. Its usual application in a welding shop is to repair automobile parts, cylinders, frames, brackets, gears, shafting, (boiler tubes) crank cases, pipe and pipe fittings, intricate machinery parts (anything from artificial legs to marine boilers, from piping 40 ft. under ground to bells in church towers.)

Oxy-welding is not a cheap repair process when working on small castings on account of the high cost of labor, gases, material, maintenance of equipment and unseen losses such as ends of rods, gas not accounted for, occasional idleness, defective work and the high overhead necessary. In manufacturing by oxyacetylene the field is the same as above in Electric process, with what I consider the additional advantage of the cutting of steel, which can be done by hand or machine. In flat surfaces, and heavy cuts, such as Armord plates and ship plates, the Oxy-graph is used, giving cuts that are smooth and accurate. By hand, ordinary cutting of plates, using a roller attachment gives good results up to 1 in. thickness. Heavier cuts requiring accuracy should be made by these of the machines already mentioned. By hand we cut up cast iron, scrap steel, castings, old boilers, remove rivets, wreck bridges, steel cars, ships, fortifications, guns, etc. It is possible to use the cutting torch under water in depths possible for divers. Some remarkable underwater cutting has already been accomplished such as cutting to the bullion rooms and mail rooms in the Empress of Ireland. The girders and steel work of the Quebec Bridge that were under water were cut by divers using oxy-cutting equipment. These examples are local ones, but during the recent Great War the British Admiralty used the torch under water very extensively. I understand that the Germans removed the blockade ships that were sunk in the channel at Zeebrugge by the use of the cutting torch. Therefore, you must realize that the oxy-cutting torch and its twin, the oxy-welding torch are two very important tools, that are comparatively new instruments placed in the hands of the Engineering Profession.

The Demand for Canadian Mica

Recently, several Canadian firms have been requesting information regarding the possibilities of marketing mica in the United Kingdom. This has led to a thorough investigation, the result of which, according to trade commissioner Harrison Watson of London, England, is as follows:

Although the mica trade, in common with other branches of business, is quiet, the situation is less bad than in most other commodities, and the chaotic condition which prevailed some years ago has to a great extent passed off. Unfortunately, however, the discovery and development of important new sources of supply of amber mica have radically impaired the demand for Canadian mica.

The consumption of mica in the United Kingdom, although temporarily interrupted by the war, has steadily increased, and whereas total importations in 1910 amounted to 28,113 cwt., these reached 72,383 cwt. in 1918 (the top year) and amounted to 65,866 cwt. in 1919, and 71,500 cwt. in 1920. For many years British India, partly owing to the perfected organization of the industry and trade, has been the chief source of supply, while Canada's contribution has been comparatively small; her share, which in 1910 amounted to 1,366 cwt., had fallen in 1918 to 480 cwt., and in 1919 was 780 cwt. The figures for 1920 have not yet been issued.

Even if these quantities do not really represent all the Canadian mica which has come to this country, because it is certain that owing to American control of the business, a considerable proportion of Canadian mica has reached this market through the United States, and been attributed not only by the Customs but by the trade here to that country instead of to Canada, the amount has been insignificant in comparison with Indian supplies.

It is to be regretted that, owing to carelessness shown by certain shippers as regards preparation and grading, the reputation of Canadian mica in this market has never attained the position to which its quality entitles it, and the bulk of the trade has been conducted by one firm which has throughout championed its merits. Indeed, one of the leading London mica firms interviewed, states that not only is there no established market in London for Canadian mica, but as far as their knowledge goes none has been directly offered in London for many years past.

The firm in the north of England which has practically had a monopoly of such Canadian amber mica as has reached this country, now reports that the demand for Canadian mica has completely fallen away, and it is not the everstocked condition of the market and dullness of trade which is responsible for this, but the discovery in recent years of excellent amber mica in Madagascar, where such quantities exist, and have been mined and finished, that supplies at the moment exceed the world's present demand, and large quantities are awaiting shipment with no buyers.

This mica runs to a much larger grade than the Canadian (over 50 per cent. of the production being equal in size to 2 by 4 to 3 by 5 Canadian grade). It has a high dielectric strength, and it is stated that it is "free from the cracks and waves and internal faults so common in Canadian amber." It is sickle trimmed, sent out with all the waste cut off, and is 33-1/3 per cent. below the present Canadian amber mica prices. The very cheap labor obtainable in Madagascar and the present rate of exchange (the currency being French francs), while Canadian funds are at a premium, absolutely prohibit business from Canada. While this latter feature is of course temporary, there can be no doubt that the quality of the Madagascar mica and the favorable conditions under which it is mined and finished, will render it extremely difficult for Canadian producers to compete in this country upon a profitable basis in the future unless they can substantially reduce their prices.

It is advantageous to take this opportunity to point out to Canadian correspondents who apply for information as to prices which they can anticipate being able to obtain for their mica in this market, that the value of the article depends entirely upon the quality, size, color, grading, and similar attributes of the particular consignment, and that importers repeat their inability to express even the vaguest opinion as to values until they can personally examine the mica offering. Consequently, the only method of testing prospects is for the Canadian shipper to submit a small trial lot, say one case of each variety, to a responsible firm, and ask for their report.

VERTICAL HOLLOW CHISEL

An electric driven vertical hollow chisel mortiser has been recently placed on the market by the Oliver Machinery Co., Grand Rapids, Mich. The driving motor is built into the mortising head or ram. This motor operates on either two or three phase 60-cycle current, at a speed of 3,600 r. p. m. The housing for the motor and head is in one piece and the rotor of the motor is mounted directly on the machine spindle, which runs in ball bearings. The motor is connected by means of a flexible Greenfield conduit to a safety enclosed starting switch with fuses. This construction does away with a countershaft pulley and belts. The machine is equipped with a compound table having a handwheel, rack-and-pinion-feed and a clamp for the work. It is provided with the usual bushings and wrenches.



WHAT OUR READERS THINK AND DO



COMPOUND COLD TRIMMING DIE

By A. J. Q.

The sketch at Fig.1 shows a forged steel barrel spud in its finished condition, that is after it had been cold trimmed, this process removing the excess metal from both the outside and inside diameters The usual method of accomplishing this is to make two dies, one for the inside and one for the outside. Of course this means two operators and two handlings.

The punch and die shown at Fig. 2 was designed to accomplish the work in one operation. The construction is quite clear, and the die on the top side is fitted with a mechanical knockout. The action is as follows: On the up stroke of press the knockout plate hits the knockout bar, and three pins eject the trimmed piece out of the die.

The punch on the bottom is cupped out to fit the forging, and is provided with a spring stripper which strips the outside fin. The fin or slug from the center hole drops through the die to the floor. The die was built correctly, yet was not a success for the following reasons:

A large number of forgings were made before any trimming was attempted and it was found that the forgings were not concentric as to their outside and inside diameters. Therefore when placed on the trimming die, (which of course has two concentric cutting edges) the outside trimming die instead of simply cutting away the flash, also took a shave from the forging itself. In addition to disfiguring the work, this caused a very heavy strain on the die itself and on the punch press in which it worked. For this reason it was necessary to revert to the old method of trimming the outside and inside in two separate operations. The eccentric forgings were caused by the forging dies "shifting" thereby changing from the correct alignment of the top and bottom impressions.

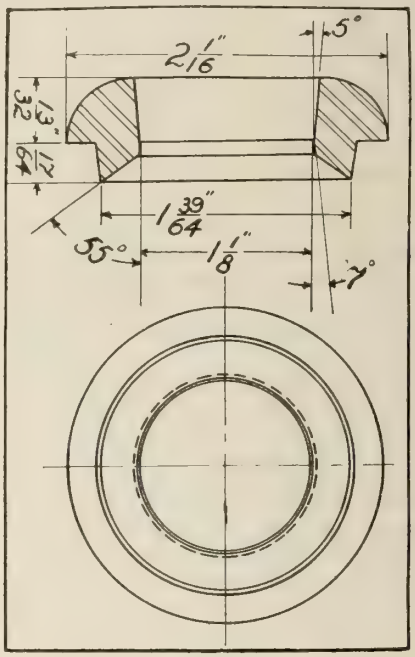


Fig. 1.—Detail of Barrel Stud.

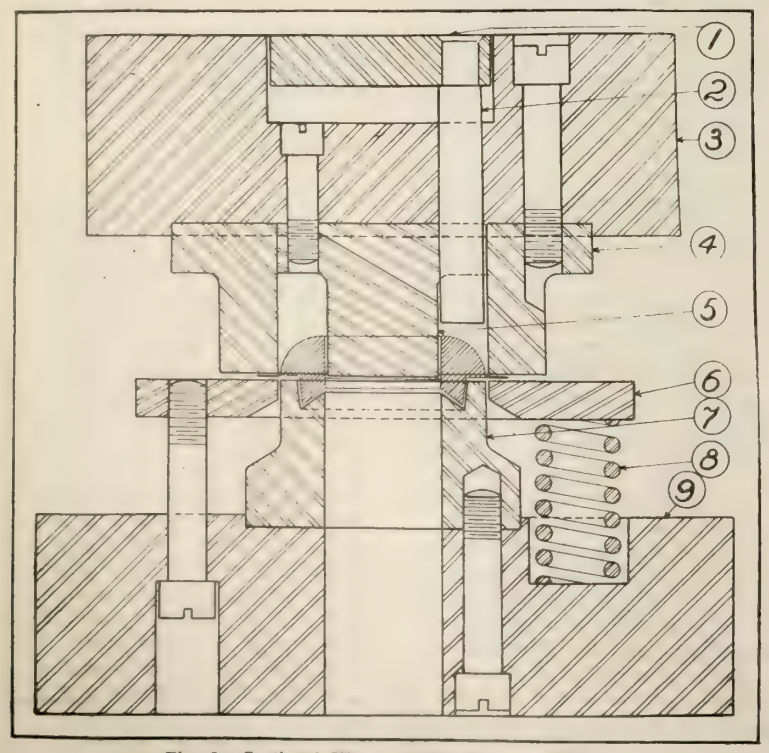


Fig. 2.—Sectional View of Cold Trimming Die.

THE WINNING NEWS ITEM

Firstbrook's box factory at Thessalon, Ont., which has been closed for the past two months, has re-opened under new management, and have taken on all their old employees. Submitted by John McCampbell, Thessalon, Ont.

Editor's Note:—Have you an item that will secure a prize. If so—send it in NOW.

CONTEST WINNERS

We now clean up the results of all answers in the recent contest regarding references to advertisements appearing on various pages of Canadian Machinery. First we will consider the November 17th contest. No reader submitted a correct list to this issue, while in the Nov. 24th contest, several contestants were correct, but L. T. Churchill, 912 First Ave., Calgary, Alta., was the lucky reader to have his list picked up.

A. H. Scollide, London, Ont., was the fortunate winner in the Dec. 1st. contest, and in this case four readers submitted correct lists. Lack of space prevents publishing these names in detail. Scales are being forwarded the winners. Have you tried our new contest yet?

PAPER MACHINES

In the Sept. 22nd. issue of Canadian Machinery, also in the Oct. 20th Power House, we published a news item regarding Canadian built paper machines. An error was made in this item, a portion of the same reading as follows: "While these machines were being built, the makers rebuilt parts of these other machines." The word these, should have read **three.**

As first published, the item might create the impression that the Dominion Engineering Works, Montreal, the firm

making these machines, had to re-build parts of the machines they were building. The intention of course was to point out that they not only built the two 166 in. machines, but at the same time built a 90 in. and a 148 in. machine, and rebuilt three machines for other mills.

The item also mentioned a 1418 in. machine. Naturally readers will readily understand that 148 in. was intended and that the linotype operator merely got very generous with his figures.

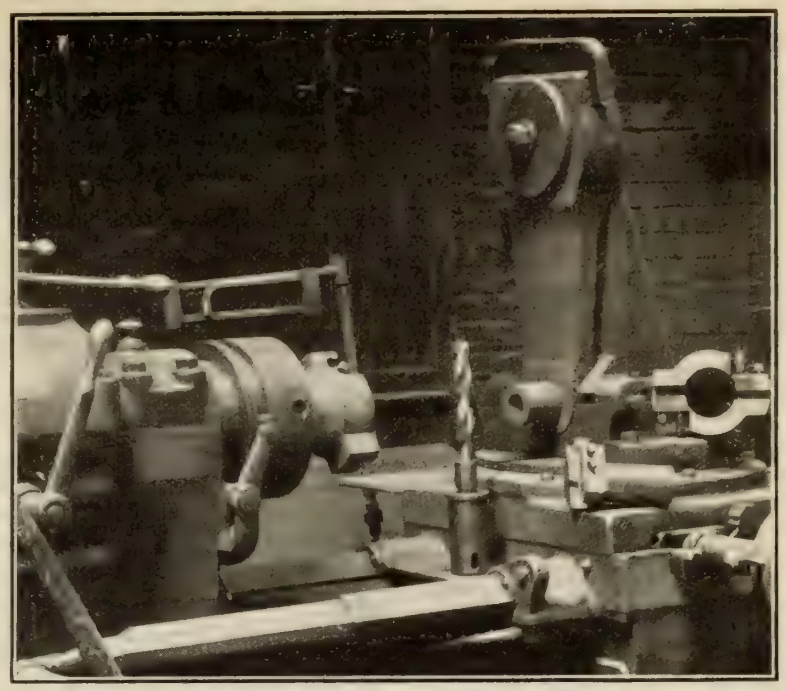
GEAR CUTTING FIXTURE

By W. H. Williams

Having a large amount of small gears to cut, and not being blessed with a dividing head in the shop, which was a small one, we made a fixture as shown in the accompanying illustration. It might be well to mention that the gears to be cut were of two sizes, 60 and 80 teeth; 20 diametral pitch, 1-8 in. face, with a 3-8 in. bore. The gear blanks were punched out on the press, and 12 blanks were placed on a suitable arbor, after the center hole had been drilled. Of course sufficient material was left on the outside to allow a light cut being taken to ensure concentricity.

It will be noted that the head and tailstock of the fixture is one solid casting this being bored at one setting to ensure alignment. The tailstock is tapped 7-8 in. as shown, and a screw inserted. The spindle A, fits into the headstock, and a driving plate was bolted to flange B. A change gear from a lathe was used as an index plate, this fitting on spindle at C.

The indexing device consists of two castings, one bolted to the side of headstock, the other sliding in a groove cut in the first, and held by screw through slot. This slot gives adjustment for different sized gears, and the stop pin is shaped at the end to fit between the teeth, being held in place by a coiled spring. The headstock is of course split to clamp the spindle while cutting.



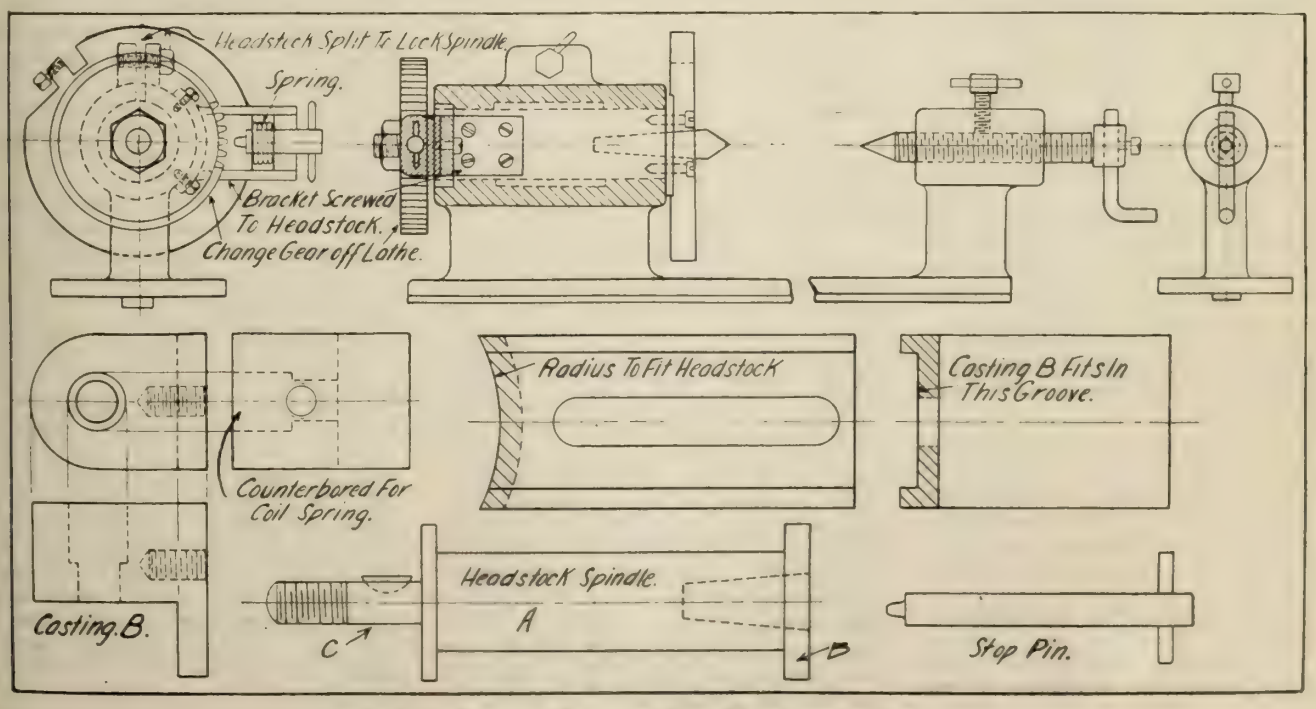
Showing how the Turret Lathe was used to turn, drill and face.

TURRET LATHE IN NEW ROLE

By J. H. Rodgers

An interesting machining operation is shown in the accompanying illustration. The operation consists of turning, drilling and facing the trunnion of eccentric crank for Baker or Walschaert valve gear. A special fixture for holding the work is bolted to the revolving base of the machine turret, which is rigidly secured in a fixed position for this particular job. Vertical alignment is obtained by means of the jig face, and slight adjustment only is required to bring the rough trunnion central with machine spindle.

Four changes of tools are used in performing the complete operation. These are held alternately in the collet chuck, insertion and removal being carried out without stopping the machine. Double cutter box tools are used for roughing and finishing the outer diameter and facing back shoulder; bolt hole is drilled and end machined to proper length by special facing cutter. The complete operation is accomplished in 28 minutes, a great saving over the former method.



Detailed sketch showing the various parts for the gear-cuting fixture.

The Important Question Of Responsibility

Not One Individual But Every Department Is Needed to Keep Plants Operating—Responsibility Depends Upon Duties—Comprehension Is a Quality Vital to Every Business

*By W. J. HISCOX

IT IS not the concern of but one individual, or of even one department, to "keep the shops going." It is the concern of every department, to a greater or a lesser degree, and the sooner this is understood the better it will be for all concerned. There are, of course, departments or individuals primarily responsible, but these do not by any means exhaust the list, and there are many instances to prove that, even though these are doing their part, their efforts are not always attended with success, the reason being that some of the more remotely connected departments have failed to discharge their obligations, and the effect is felt.

Sometimes it is actually the fault of the shops, and by the term "shops" is meant the manufacturing departments. It is obvious that in order to ensure the prosperity of the factory the manufacturing departments must be fully employed, or, in other words, there must be no "waiting time." The shop foremen fully appreciate this, and yet there are times when they themselves are responsible. They will not admit this, of course, and are quite prepared to prove that someone else is at fault.

It is not good business on the part of anyone to endeavour to blame another, or even to rely upon excuse. Many troubles, ostensibly traceable to one individual, could be obviated if another would extend himself. It is so easy to wait until the thing comes along, and if it does not come to disclaim all responsibility. Technically one is right, but in practice wrong; and after all, it is the practical things which count. "I relied upon So-and-so, and he failed me," is not the excuse of the business man, and yet it is heard in most factories. "You are responsible—not I." How paltry it sounds—and is! One foreman blamed the progressman because he did not complete a job to time, on the score that the material was late. "But what effort did you make?" asked the manager, and the foreman could make no reply. "Then I hold you responsible in the highest degree," went on the manager, "for the progressman made an attempt, and you did not."

It is not only indirectly that the foreman is culpable. Often he is the direct cause of the delay. In one factory he had had advance information of work required, this being given to enable him to ascertain that all tools and jigs were available and in good order, and also to enable him to place his requisition for material with the store early enough. But he failed upon both counts. In the first place he sent his requisition for material to the store just at the time that the work should be put in hand, and then blamed the store for the waiting time that had to be given.

He did not appreciate that the storeman required time to execute the order, and that requisitions of other foremen had to be dealt with first. This type of man only thinks of himself and his own requirements, and he gives no thought to the fact that his order is but one of many. He may say with perfect truth that his order could be handled by the store in ten minutes, but the storeman is not waiting for a job, and it may be that an hour must elapse before that specific requisition comes up for treatment.

The Foreman

As far as the tools were concerned he was equally at fault, for he did not trouble to apply for these until they were actually wanted. Then he discovered that they were under repair in the toolroom, or, upon taking them from the tool store, that they needed adjustment. He may advance a number of excuses which in his eyes are quite legitimate. If they were in the toolroom the order was given in plenty of time and if they needed adjustment then they should not have been in the tool store.

All this is very well, and no doubt someone blundered. But because that has happened, it does not free the foreman from responsibility. Had he done his duty, the effect of the blunder would have been obviated, or at least minimised, and his excuse is not valid He should have known before the tools were actually required that they were not available, or that they needed adjustment, and then he could have put in hand another job, and so obviated waiting time. Then he could have lodged his complaint, and the blunderer would have received his just deserts.

Another instance is the issue of wrong material from the store; and where the difference between certain parts is very slight, mistakes must at times occur. Yet that is no reason why the foreman should operate upon the part in question, and, when the job is finished and rejected by the inspector, absolve himself from all blame. As a matter of fact, he is, often defaulting, quite as much to blame as the acknowledged department, especially where his technical knowledge is of greater value than the commercial experience of the storekeeper. It may be that two classes of the same-diameter bright-steel bar—exact and commercial—are kept in store, and that several bars of the commercial quality are inadvertently stocked with the exact. The job in question specifies "exact," and the "out-of-place" bars are sent out. The storekeeper cannot always detect the fine difference between the two, but the foreman can, and here also the skill of the operator should be apparent for he is handling the material and should detect the difference.

If the job is proceeded with, then the foreman incurs grave responsibility, which he should not be allowed to evade. It does not, of course, lessen the responsibility of the storekeeper, but it obviates the worst effect. The material should be at once sent to the inspector, and upon this individual's report the storekeeper is indicted. In like manner, also, the assembling-shop foreman has responsibilities, and because the storekeeper in error sends out a wrong part that does not mean that the foreman has the right to assemble it, assuming this can be done It only needs a little cooperation and a normal sense of duty to obviate a good many troubles, and, after all, it is the foreman who is primarily concerned and who will reap the greatest reward.

The responsibilities of the progressman are so obvious that he has little opportunity of shelving them; still, he will endeavour to do so. Even though the foreman is expected to look ahead, and see that material and tools are available before putting the job into process, it is not always with deliberate intent that he does not do so. He is not infallible, and is therefore liable to mistakes like ordinary mortals, and he does not have a lot of spare time upon his hands. The progressman has responsibilities in this direction, for he knows the work which must be put in hand, and he can prompt the foreman as the time draws near. Some hours before, he can say, "Now, about so-and-so job. Are the tools O.K. and the material applied for?" His good offices are not always received with the gratitude they deserve, but they are usually effective, and the result is his reward.

He, too, can advise the storekeeper for with a miscellaneous collection of requisitions it is necessary to have some idea of their relative urgency. Some foremen err on the side of being premature and apply for material on Tuesday which is not wanted until Friday. Valuable time on Tuesday is thus taken up with an order which must lie for several days, whereas that time could have been applied with greater advantage to a much more urgent (though received later) order. The progressman can assist here, for he knows better than anyone else the relative importance of each requisition.

The storekeeper, in his turn, must not

*From Mechanical World.

be hide-bound, for though he is strictly within his rights in dealing with the requisitions in rotation, there are times when a little deviation from the rule is an advantage. Assuming that the foreman has omitted to apply for the material until it is actually required, it is not helping maters for the storekeeper to stand upon his dignity and to declare in no uncertain voice that the order must take its turn.

He must remember that he, too, is a producer, and if he allows an operator to remain idle for a considerable time when he could have prevented it, then he is not doing his duty, and must take his share of the blame when trouble follows. It is of no use for him to flourish rules and regulations—to say that he must have the agreed-upon notice before he can supply material to any requisition. This will not help him, unless he can prove to the satisfaction of the management that by handling this requisition out of its turn other important orders must have been delayed. And usually he would have some difficulty in proving this.

He may say that this would dislocate his system and rob his department of efficiency, seeing that the foremen would not trouble about placing their requisitions early. He, however, has his remedy, for he can report the delinquent, and he need not be afraid of constant repetition. But, first of all, supply the goods; obviate, or at least minimise, the effects of blundering, and then protest. That is the business-like way.

The Inspector

The inspector is another whose responsiblilities are manifold, and who exerts a tremendous influence upon the shop output, and, also, costs. Abiding by the strict letter of his instructions he may consider himself immune from censure, but such is not the case. Even the management, which insists upon rigid inspection, will criticise the decisions of the inspector, and the wholesale scrapping of work will bring down the vials of wrath not so much upon the head of the foreman responsible for the work, but upon the head of the man who, strictly speaking, has done his duty—the inspector.

It behooves the inspector, therefore, to adopt a common-sense policy—to recognise that business is a grim reality and must not be played with. It is not to say that he must bend to the will of the shops; that work, no matter how bad, must not be rejected. It is the inspector who sets the standard of quality, and good workmanship consistent with the function of the piece must be insisted upon. Wholesale scrapping of work for technical inaccuracies, however, will not enhance his reputation; and, again protest (if one be necessary) must, if possible, be deferred, in order to allow manufacture to proceed.

The indifferent worker arranges that his product will just pass the nspector, that is to say, it is not up to the standard desired, but yet it is not bad enough for rejection. The inspector notes the fact, and is obliged to pass the work, but he takes care to state upon his report that that work is not as it should be. The next job also is indifferent, and again the fact is recorded; but after a times the inspector comes into his own, for he is able to turn a batch of work back again to the operator. In this he has the backing of the management, for his previous forbearance stands him in good stead. He has vindicated himself as an inspector whilst not forgetting his obligations as a producer.

Comprehension Necessary

Comprehension is a quality vital to every business, and must be well to the fore in the composition of every person possessing executive powers. The rate-fixer has responsibilities not less than those of the other individuals mentioned for he, as the others, can either facilitate or retard progress. He may be a stickler for system, and to all intents and purposes understand his job, yet his contribution to the factory output is of the negative variety. And why is this? Simply because he sticks to that which is written, and refuses to deviate by even a hair's breadth. The rate is fixed, but the operator loses money. He refuses an allowance, and the operator leaves. Enter another, but the result is the same. So no progress is made. He may be right in his calculation, but his method of application is wrong. He lacks comprehension.

The list may be further extended and many more instances quoted, but sufficient has been said for our purpose. No man has the right to think solely of himself and his job, for whether he be operator, foreman, inspector, progressman, storekeeper, rate-fixer, draughtsman, or works manager, he is first and foremost a worker, and as such is directly responsible for output. It must not be inferred that the abolition of all rules and regulations is suggested, or that the system should be thrown upon the scrap-heap. That would, of course, make confusion worse confounded, and the last state of affairs worse than the first. But rules and regulations and systems are capable of broad interpretations, and the man who is so wrapped up in his own job that he cannot see its effect upon the other fellow's is not so efficient as he imagines.

He may be able to show a clean slate, and to boast while he is walking upon the firm path, others are floundering in the mire. But what answer can he give when asked how many he has pulled out of the mire; and what can he say to the suggestion that he has pushed a few in? For his own sake he needs be careful, lest in a fit of exasperation one of the flounders pulls him in.

The helping hand is at times necessary, and although perhaps it is slightly soiled by the contact, it is a business proposition. It is of no use to take the stand that "He is responsible—not I." It may serve for a time, but sooner or later the management realises that, although not directly responsible, you could have obviated the bad effect. Then you may expect your just reward.

STEAM LOCOMOTION OF FUTURE

(Continued from page 53)

December 8th issue

Comparing the results obtained at St. Louis with the compound superheated locomotive with those obtained at Altoona with simple superheaters, we find that the compound used 10 per cent. less water than the simple superheated engines at low pistons speeds of 400 ft. per minute, and at 800 ft. per minute the consumption of the compound and the simples were alike. We gather from this that for freight service of a heavy character, moving at low speeds, compound engines, provided they are fitted with superheaters, might, from the point of view of fuel and water economy, profitably be employed. So far as practice in this country is concerned, and we write from this viewpoint, we can foresee certain difficulties of a practical nature, due to our restricted loading gauge, making it difficult for designers to find room for sufficiently large low-presure cylinders. An alternative would be to use a six-cylinder engine having three low-pressure cylinders with their respective high-pressure cylinders superimposed, two sets outside and one set between the frames. with cranks at 120 deg. We make the suggestion being aware of its short-comings; however, heavier train loads in the interest of economical working may yet enforce generally unlooked-for developments in locomotive designing.

Taking what we may call a panoramic view of the world's locomotives and considering their devepoment on the various great lines in the old and new worlds, we think that engineers in this country have been in the van of progress. The multi-cylinder engine has been developed here to a point surpassing that attained elsewhere, and we believe with satisfactory results. For ourselves, while recognising to the full the benefits arising from the use of four cylinders, we are inclinded to favour the three-cylinder engine as being a medium between the simplicity of the two-cylinder and the more complex four-cylinder locomotive for fast passenger service, and we are inclined to favor the three-press services either the three or four-cylinder engine with superheated steam, using perhaps higher temperatures than we know to-day, will be the locomotive of the future. For freight traffic w may in time come to see the compound reappear, and it will have a superheater and will be built when we make up our minds to run heavier freight trains under the control of a continuous brake.

"Things to watch and methods of speeding up filing" will interest everyone connected in any way with the trade. Look for this special feature in the January 5th issue of Canadian Machinery.



DEVELOPMENTS IN SHOP EQUIPMENT



COMBINATION LATHE, GRINDING AND DRILLING MACHINE

The Electric Motor Mfg., Co., Ludington, Mich., have recently developed a machine that is of the combination type and is sold under the trade name of "Utility." The machine is designed to handle a wide range of repair work requiring lathe, drilling and grinding operations. The machine is driven by an electric motor and is intended for bench use. The grinding wheel is mounted on the shaft, while the lathe spindle is driven from the motor shaft by gears.

BENCH DRILLING MACHINE

The Model Specialty Co., New York, have recently placed on the market a portable bench drilling machine weighing only 34 pounds. The machine is intended for accurate work and all-round shop use. The column is high enough to permit objects up to eighteen inches in height to be drilled. The table can be tilted to any angle and locked in position. The spindle is driven directly from a motor, and the head carrying the spindle and the motor, can be located at any point on the column and locked.

HARDNESS TESTING PUNCH

The Case Hardening Service Co., Cleveland, Ohio, have recently placed on the market a punch for quick hardness testing by the Brinell method. A spring hammer in the barrel delivers to a ¼ inch steel ball inside the cap at the bottom, a blow of sufficient force to make a depression of three millimeters diameter or less, according to the hardness of the test piece. The test is accomplished by gripping the knurled barrel of the punch and pressing downward quickly until the spring hammer is released.

FRICTION TAPPING MACHINE

The Geometric Tool Co. of New Haven, Conn., is introducing a tapping device known as the Jarvis F. D. It has a friction drive, that is controlled by the pressure exerted on the machine spindle with which the device is employed. Little pressure is necessary to drive the tool, and the stopping and starting of the tool is obtained independently of the spindle. The device is equipped with a standard chuck. The tapping range is from "0" to ¼ inch. Light holes in tough metal can be tapped.

VERTICAL AUTOMATIC CHUCKING MACHINE

The Vertomatic Manufacturing Co., Reading, Pa., has brought out a Vertical Automatic chucking machine in several re-designed types. The Type A is intended for work requiring a series of from three to five operations at one setting. Type B is for work requiring two or three operations. The two machines are identical in construction except that Type A has six chucks and five active spindles, while Type B has four double chucks and three pairs of spindles. By providing one less spindle than the number of chucks loading and unloading can be accomplished without interfering with the continuous operation of the machine. Type C machine is for work requiring but one operation or two operations performed by a combination tool. Types A and B are indexing machines. The spindles remain stationary while the chucks are fed to the tools independently of each other, at the desired speed and to the proper height, by the use of cams.

On the Type C machine each spindle is mated with a certain chuck and operates on the work placed in that chuck. The chuck and the spindle turrets are locked together and rotated in one direction. As the chucks leave the loading station they run up a continuous cam so that the work is raised to the tool in the spindle. The work is ejected when returned to the loading station. The machines are automatic thoughout.

STANDARD PUNCH AND DIE SETS

The Diament Tool and Manufacturing Co., Newark, N. J., have standardized a number of Punch and Die Sets, and are manufacturing them on a quantity production basis. These standard parts are complete punch and die sets in every respect except the die openings and the holes for inserting punches in the punch-plate. That is to say the following parts are standardized;—punch holder, die blank, stripper plate, punch plates, liner pins, liner pin bushings, and the dowels and screws. Then when a new die is designed its special parts and features can be readily machined. Thus it can be quickly assembled and ready for use. Several designs and styles of punch and die sets have been standardized and anything within a wide range can be made up on short notice and with little special labor.

RULE FOR OXY-ACETYLENE CUTTERS

Mr. K. McDermott, assistant mechanical engineer of the South Chicago Works, Illinois Steel Co., has devised a convenient rule for metal cutters who use the oxy-acetylene blow pipe. It is in the form of a nickel plated hand rule about 12 inches long by 1⅛ inches wide, and ⅛ inch thick. It is so graduated as to indicate the tip sizes of oxygen pressures best suited for cutting steel sections of any thickness up to 7 inches. This rule is graduated on one side for use with the "Oxweld" and on the other side for use with the "Davis-Bournonville" tips. The device is simple and can be easily applied. Tip sizes and pressures are read off directly thus dispensing with reading thickness in inches and fractions, and all references to a cutting table. The device saves time and eliminates waste. The idea is not patented and anyone can easily make a rule of this type adapted for the equipment being used.

ADJUSTABLE REAMER

The Standard Tool and Supply Co., Mason City, Iowa, have recently designed and placed on the market an adjustable reamer known as the "Larson."

It has been developed to ream the bushings of automobile pistons. In use the reamer is inserted through both bushings and then expanded by turning the adjustable nut so as to permit the spring in the reamer at the opposite end to actuate the cutter blade. Proper alignment is secured by reaming both bushings at once. One complete turn of the adjusting nut enlarges the reamer 0.001 inches. The cutter blade is of the double edge type so that it can be rotated in either direction. It can be readily sharpened, replaced or shimmed up.

HEAT TREATING INSTRUMENT

The Gibb Instrument Company, Detroit, Mich., have disposed of the patents and maufacturing rights of the "Crit-Point" instrument, used in hardening steels, to the Illinois Testing Laboraties, Inc. of Chicago, Ill. The instrument has been completely redesigned and is being placed on the market, by the latter firm. The device is made in two types; model 220 P. is a portable unit, which is used by attaching it to a conveniently located electric light socket; model 220 W. is intended for use as a permanently installed instrument in

connection with suitable switch and wire arrangements. This arrangement permits the use of one large instrument on several furnaces. Modifications of the fire-end are possible to permit use with special shaped articles under unusual conditions.

GAUGE PRESSURE REGULATOR

Alexander Milburn & Co. of Baltimore, Md., have placed on the market a pressure regulator intended to control the delivery of acetylene, oxygen, hydrogen, and other gases under high pressure such as are used in welding. The device is said to maintain a constant pre-determined pressure regardless of fluctuations in the initial pressure line and variations in consumption at the torch.

ADJUSTABLE BORING BARS

The Power-Vosberg Co. of Detroit, Mich., have recently placed on the market through their selling agent, The Firmhil Machine Supply Co. of Detroit, Mich., a line of adjustable boring bars made in three styles, the angle adjustable, straight adjustable, and removable types. The bars will bore holes from ⅞ inches diameter to 15 inches diameter. The bars are intended for both rough and finish boring and reaming and can be used on drilling machines, lathes, boring mills and other tools.

ALL-GEARED MILLING MACHINES

The Oesterlin Machine Co. of Cincinnati, Ohio, has placed on the market a line of milling machines of the constant speed, or all-geared type, consisting of six sizes each made in the plain or universal style. The speed mechanism furnishes sixteen geometric speeds through fifteen gears and one shaft, in addition to the spindle and pulley shaft. Speed changes are obtained by "two-position" levers and a "four-position" knob, and may be made without stopping the machine. Automatic lubrication is effected by an ingenious three tank system. The system is practically fool proof and one supply of oil is sufficient for about two months of ordinary service. The driving pulley of each machine is 14 inches diameter and runs at 400 r.p.m. A brake is connected with the belt shifter mechanism, which stops the spindle quickly. The feed box, knee, and table are similar to the cone top of millers built by this firm.

BENCH BROACH PRESS

A power broach press of the bench type has been recently placed on the market by the American Broach and Machine Co. of Ann Arbor, Mich., The machine is designed not only for push broaching operations but also for pressing into place or removing mandrels, bushings, etc. The machine is belt driven by a pulley 1 inch in diameter and taking a 2½ inch belt. Power from the pulley shaft is transmitted through a worm and worm gear and thence to a spur pinion that meshes into a rack on the spindle, or ram. The worm gearing has a ratio of 30 to 1. The worm is arranged to disengage automatically at the end of a predetermined stroke, through the medium of an adjustable collar on the upper end of the ram. The ram then automatically returns to its top position. The machine has a stroke of 14 inches and the bore in the table is 2½ inches in diameter.

SNAP GAUGE MICROMETER

In order to eliminate the necessity of having a large number of snap or limit gauges on hand, the J. T. Slocomb Co., of Providence. R. I. has brought out a duplex micrometer, intended for use as an adjustable limit snap gauge. The gauging surfaces are the anvils and spindles of two micrometers, which are set in the frame of the instrument. This design enables any dimension within the range of the micrometers to be gauged by merely setting one spindle to the "GO" dimension and the other to the "NOT GO" dimension. Provision is made for locking the spindles after thy have been set. A patent covering the instrument has been applied for.

CONNECTING ROD ALIGNING FIXTURE

A fixture for testing the parallelism of holes and the twist in automobile engine rods is now being manufactured and marketed by the Allen Wrench and Tool Co., Providence, R. I. The wrist pin end of the rod is placed in a sliding block that slides in a "V" slide so as to accommodate various lengths of rods. The large end of the rod is fitted with a special bushing and pin and registers against two vertical circular posts. Errors can be seen or can be gauged by feelers. It is possible to gauge a rod on which the piston has been assembled. For general garage use it is necessary to provide two arbors for the large end of the rod, one for Ford cars and one for other makes of cars. A complete set of bushings for the fixture ranges from 1¾ inches to 2½ inches by eighths. It is claimed that inaccuracies of 0.001 can be detected. A pair of bench vise jaws are supplied as auxiliary equipment for use in straightening rods.

POWER CROSS FEED FOR TILTED TURRET LATHES AND SCREW MACHINES

A compact power cross feed to the cut-off slide, has recently been developed for the Nos. 2, 3, 4, 5 and 6 Tilted Turret lathes and screw machines, manufactured by the Wood Turret Machine Co., of Brazil, Ind. This design of power cross slide allows casting the apron or gear box integral with the saddle proper and insures rigidity as well as permanent alignment of these parts. The power is transmitted to feed screw by means of two bevel gears on lower feed shaft meshing with a third gear on a vertical shaft, thence through helical gears to the feed screw.

A single lever control allows of feed engagement in either direction by simply moving through three positions. When the lever is in a vertical position the feeds are disengaged, while throwing lever to the left engages the feed to travel in. Moving lever to right reverses feed causing it to feed outward. Six feed changes ranging from .003 to .023 per rev. of spindle are provided, any one of which is instantly available without stopping machine.

Provision is made to safeguard the feed mechanism against overload or accident by providing a brass shear pin on the lower feed shaft. This pin is easily replaced should it become necessary. The feed nut is made of bronze and is of the solid flanged type which allows it to be held in place by two cap screws. The feed nut being bolted to the back side of saddle allows it to be easily removed without disassembling the other parts. A large dial is fitted on hand wheel which is graduated to .001. Provision is made for clamping this dial at any point.

The feed screw is provided with two bronze bearings in the out board end of slide and which gives an extra long support. An ingenious method of taking up the back lash of feed screw in this bearing, is provided by means of a knurled adjusting nut which is locked by hand wheel. Positive screw stops are mounted front and rear which control the depth of cut when using forming tools.

OIL RECLAIMING OUTFIT

The S. F. Bowser & Co., Inc., of Fort Wayne, Ind., have marketed an outfit that is adapted to reclaiming different kinds of lubricating oils, but especially intended for use on oils used in internal combustion engines. The apparatus is said to restore oil to its original viscosity, flash point, and purity. The outfit is made in two sizes with capacities of 50 and 100 gallons respectively per twenty-four hours.

A SPECIAL MACHINE

A special machine for cross cutting and boring railway sleepers has been supplied by a British firm to oversea's railway. This machine is designed to cut and bore sleepers up to 10 ft., and to cut out the seatings for the rails. A special feature is the manner in which the boring spindles are driven by a series of four endless roller chains running in horizontal paths, each chain being arraged to drive two spindles. This method has been found very advantageous compared with the belt drive formerly employed in this type of machine. It is of course a great convenience to a large railway to have one machine which can rapidly carry out the special operations which railway sleepers require.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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B. G. NEWTON, Manager
J. H. MOORE, Editor
T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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Make the Most of Your Time

THE young man who makes a habit of standing around the streets at night with the gang may see a lot of traffic go past, but there is more passing him than just traffic. Every moment he wastes with the gang in seeming pleasure can never be retrieved. He may, later in life, wish lost time back again, but wishing will never bring back the past. Opportunity may have flown, his youth may be gone, and all he will have left is bitter regret.

Time and time again young men have been warned against loafing. In some cases the warning has been heeded. If any young man has been frittering away his time, not necessarily at the street corner, for there are many ways of wasting time and energy, let him read the story of Jack Neal's advancement on another page of this issue. Where would Mr. Neal have landed if he had not applied himself assiduously to the task at hand. The chief cause of his advancement was that he made it a point to learn more than the average man at his own particular business. It pays to be a leader, and as Mr. Neal says, "The best formula for success is hard work."

We have often emphasized the advantage of being able to read blueprints, and Mr. Neal's experience bears out our statements. In his case it worked wonders. Let every reader of Canadian Machinery make up his mind to cut waste of time and energy to the minimum, making the most of every spare moment. Increase your knowledge, then watch yourself advance.

Didn't Know It Was Loaded

EVERYONE is familiar with, and has smiled in a superior manner at the man who gets shot with a gun that he didn't know was loaded. That there are other things than guns that can contain a deadly charge has been the experience of a man in Ontario during the last few days. His experience has been a terrible one, in that he has lost his right hand, and as the man was an expert mechanic, the meaning of such a loss can be appreciated by all those who work with their hands.

This man was engaged in some repairs on a pump, and during the course of his work, had occasion to remove a nut, perhaps the piston nut itself, or one of the follower bolts. In any case, he had the rod and piston out of the pump, and in order to make the work a little easier, or to make sure of not breaking anything, he took it over to a small blacksmith's forge fire, and put the piston in the fire, holding the rod by the other end. He had only had it there a few seconds, when an explosion occurred, and the piston was torn violently asunder, one piece travelling up the rod in a straight line, and in its course cutting off the hand of the man holding it.

The cause of the accident, of course, was that water had in some manner got into the piston, very probably between the rod and the bore of the piston, or through a porous casting into the piston itself. Its admittance and accumulation would be a slow process, but its raising to boiling point and subsequently to steam was a process of seconds only at the high temperature and comparatively large quantity of heat available in the forge. Once more that terrible force, the force of molecular expansion, was called into being, and the frail metal was shattered and with it a man's hand. We have called attention before in these columns to the energy contained in even small quantities of water which have been raised to high temperatures and pressures, and here is another melancholy and painful example to give warning. Never put anything in a fire to heat unless you are morally sure that there can be no water contained in it, and if there is, that there is ample room for the vapor to find its way out as fast as it is formed. Of course, we know that such an accident is not frequent, and it is to be hoped will never become so, but the danger is always there, and no one has a right to take a chance. If he does not know of the danger, he cannot be blamed, but every man who is engaged on work around engines and boiler rooms should know these things, or have them drawn to his attention by the man who does.

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MARKET DEVELOPMENTS



Finished Steel Market Very Quiet This Week

Production of Steel Ingots in November Was 44 Per Cent.—How Production and Consumption Compare—Metal Markets Somewhat Stronger—Small Tools and Machine Tool Market Quiet Losses Are Less Than One Per Cent.

ALL MARKETS report very little activity this week. Pittsburgh presents some interesting figures on production and consumption. The production of steel ingots in November was at practically the same rate as October, viz., 44 per cent. However, the rate fell to 40 per cent. on December first. There is a slight declining tendency at present, and as a few mills will likely close for the last week or two this month, or the first two weeks in January, we can expect a drop in production at whatever period they close.

The direct consumption of steel in nails, tin plate, many forms of sheets, oil country goods etc., is practically normal, and is greater than in 1910, but the consumption in construction is decidedly light, this making a big hole in consumption in general. The demand in machinery making is also very light.

Montreal reports very little activity in any line. The rail mills are rapidly completing their orders and there are no more in sight. The steel demand is light and the conditions prevailing for the past few weeks have not altered. Machine tools are hardly moving, but portable tools seem to be in fair demand. Non-Ferrous metals are stronger, copper being especially active.

Toronto reports a spotty market. Metals are quite a bit stronger but this is the only bright spot. Copper, tin and lead, are the three strongest items. The steel market reports only a fair demand, while machine tools are very quiet. The supply market is also weak, repair parts being the only thing in demand.

NOVEMBER PRODUCTION OF STEEL INGOTS ABOUT 44 PER CENT. CAPACITY

PITTSBURG.—Production of steel ingots in November was at practically the same rate as October, 44 per cent. of capacity, as indicated by the report of the American Iron and Steel Institute giving the production of the 30 steel companies which made monthly reports.

These are simply averages for the respective months, and a closer analysis can be made. September had shown a rate of 32 per cent. against 30 per cent in August. The figures, confirmed by current information obtained in the trade, indicate that production was rising during October and falling during most of November. Roughly speaking the rate rose from 40 per cent. October 1, to 50 per cent. November 1, and that fell to 40 per cent. December 1, and that is substantially the rate at present. There is no more than a slight declining tendency just now, but a few mills will likely close for the last week or two of this month, or the first couple weeks of January, producing a dip in production at that time. The point is that mills in general have been making a special effort to run for the purpose of providing their workmen with some holiday money.

What everyone is interested in, of course, is how production and consumption compare, with what may reasonably be expected for the future. There has been a good bit of loose thinking on the subject of whether business has been bad or good and how it is likely to be in the next six months. Right now there are predictions that steel business will be "good" by early spring, and other predictions that it will not be "good" before the middle of the year. When put in that form the predictions seem to be opposed, and yet investigation shows they are not so much opposed after all. The difference is not so much in the tonnage demand that men expect, as it is in the tonnage they take as a basis for making "good" business. This divergence arises from the fact that capacity has increased so greatly. In ingots, capacity is now about 52,500,000 gross tons a year. Prior to 1912, the largest production was the 25,200,000 tons made in 1910. Prior to that, 1906 and 1907 were years of great activity all around, and production in each year was about 22,000,000 tons. A 50 per cent. operation now, however, would make 26,000,000 tons. Considering how much construction work, railroad development and general steel consumption there was in 1906, 1907 and 1910, a 26,000,000 ton production in 1922 would look fairly large. On the other hand a 50 per cent. operation would look quite small. It is chiefly on account of this difference that some observers predict that business will be good and some predict that it will be poor. Both are thinking, probably, of about the same tonnage, a rate of production in the first half of next year of between 26,000,000 and 37,000,000 tons, which would be between 50 per cent and 70 per cent of capacity, big one way, small the other way.

A great deal of harm to business is being done by two things, first, the concept that "iron is the barometer of trade" and second, that business cannot be good until freight rates are reduced. Rates in general will hardly be reduced in less than about three months, and they will not be very greatly reduced even then. It is wasting time to wait on the reduction.

As to iron being the barometer of trade, that used to be a good and useful adage, but the difficulty is that men do not think of the total tonnage that is consumed, but of the capacity that may be idle. By a long range comparison it would be a big thing for the United States to make 26,000,000 ton-

of ingots in 1922, but from the erroneous viewpoint there would be the terrible condition of 26,000,000 tons capacity being idle. Population in 1922 will be approximately 19 per cent. greater than in 1910. There is no larger percentage of the population desirous of working (as was shown by the census report recently issued on the gainfully employed) and the individual does not work harder than in 1910. A production of 30,000,000 tons of ingots in 1922, allowing for the increase in population, would mean the same amount of activity in the production, fabrication and utilization of steel as occurred in 1910, a busy year. It can therefore be argued that if more steel is to be made and used men will have to discontinue doing something else, and other industries would have to decay.

Channels of Consumption

The direct consumption of steel, in nails, tin plate, many forms of sheets, oil country goods, etc., is practically normal and is greater than in 1910. The consumption in construction is decidedly light, and that is the chief thing that makes such a hole in consumption in general. Consumption in machinery making is at the moment relatively light but plainly will increase since machinery, tools, etc., are essentials for the common everyday activities of the people. From this viewpoint the country can be decidedly active and prosperous in the first half of 1922 without giving steel producing industry anything like full employment. Automobile factories, foundries and machine shops, mines and factories generally can be very active, and get all the steel they need without the steel industry operating at more than between 50 and 75 per cent. and incidently they may get it cheaper, which certainly will not be to their disadvantage.

The Markets

The finished steel markets generally have been very quiet in the past week, and that is the chief reason for the above digression. The quieter conditions began about the middle of October and the quietness increases as the year-end is approached. Tubular goods are an exception, there having been quite an active demand up to date, there being heavy demand for line pipe, moderately heavy demand for oil country goods generally, and a fair demand for standard pipe. The mills are operating on an average at between 70 and 75 per cent. the best rate shown for any of the finished steel products.

Finished steel prices show scarcely any change at all from week to week. Orders individually are so small that there is little incentive to make further cuts. When demand broadens and buyers are ready to take hold, as to tonnage, in a more liberal way, there will probably be some further price recessions, but these will be slight, not at all comparable with the large declines that were occurring up to last August.

POINTS IN WEEK'S MARKETING NOTES

Steel ingot production in November is about 44 per cent. This is practically the same rate as prevailed in October.

The finished steel markets have been very quiet during the past week. Tubular goods are an exception, for there is still an active demand for line pipe, a moderate demand for oil country goods generally, and a fair demand for standard pipe. Pipe mills are operating on an average between 70 and 75 per cent., this being the best rate of any of the finished steel products.

Pig iron and coke remain dull, with prices open to concessions, if fair sized competitive orders come into the market.

The Canadian Pacific Railway is said to be planning extensive operations for 1922. Details of this programme will not be announced until early in the New Year.

Montreal reports no change in base prices on the steel market. Generally speaking the market is firm, but trading is very light. The rail mills are rapidly completing their orders, and it looks as if they may have a quiet two or three months before them.

The pig iron situation in Montreal has not changed any during the past week. If the proposed hydro-electric development schemes go through, also some other large undertakings, it would mean considerable increased business for foundries throughout the country.

The metal market shows a better tone than for some time past. Copper displays more strength than at any time since the last big slump. If the present demand continues for two or three weeks more, it will mean a general steadying influence all around. Copper keeps well above 17 cents for three grades, and tin still commands 37½ cents. Lead is also going strong.

Standard lines are not selling as well as special supply parts. A Toronto dealer tells an interesting story regarding this unlooked for activity. Manufacturers evidently intend repairing old goods, rather than purchase new articles.

In the past week line pipe has been cut somewhat more deeply, while casing has been cut in some instances. Wire products have very largely slid back to the prices ruling before the advance of September 12, but it is claimed small orders are still commading the advanced prices. This would mean that the market stands at $2.50 to $2.60 for plain wire and $2.75 to $2.90 for nails.

METAL MARKET SHOWS SIGNS OF ACTIVITY

TORONTO.—There is no change in conditions on the local markets with the exception of metals. The metal market is showing continued signs of activity, and copper is especially active. Since the New York market picked up, Canadian business has likewise strengthened, of course this is natural, for we always reflect conditions on both the New York and London markets. Copper is selling around 17½ cents depending on the grade, tin can demand and get 37½ cents, while lead is selling at about 6½ cents. Dealers are of the opinion that the present improved condition is here to stay. If the demand does continue for another two or three weeks, it will have a decided strengthening effect on the whole market. From present outlook dealers will get their wish. In another portion of this issue we publish an article on the relative freight charges on pig iron and scrap metal. Although the conditions stated in this material apply only to the U. S. it will prove interesting reading, for, while the relations are not the same in Canada, there is no question but that the rates on scrap metal are very high. In fact so much so, that it is impossible for dealers to ship scrap for any great distance. One dealer tells this story:

"We had a chance to purchase some scrap," he said, "and the manufacturer wanted us to pay him $2.50 per ton for the material. So far so good, but we found that the freight charges to carry the scrap to the nearest destination was $6.70 per ton, so of course the deal was off." In other words the freight charges would have been almost three times the cost of the metal.

Steel Markets

The continued good weather has been of some use to the steel market, and while business is by no means brisk, some lines are still moving. Sheets are selling at a fair rate, and reinforcing material is also being bought up at a moderate speed. One dealer claims that the busines closed so far this month would tend to make him believe that December will be a better month than November. Prices remain the same nor is there likely to be any change for some time.

Machine Tool Market

As far as machine tools are concerned there is not much activity. A few odd machines are being sold here and there, but nothing to write home about. A peculiar point was brought to light this week while on our tour, regarding the supply market, that is machine tool supplies in general. "You know," started off a certain dealer, "this is the funniest market I have ever experienced. Instead of our standard lines selling strong, it is the specials that are moving, while our standard lines continue to rest peacefully on our shelves."

"Take for example chain blocks," he

continued. "During the last few months we have received orders for (here he mentioned a very large amount) worth of repair parts for chain blocks alone. What holds good in this line, is equally true in other lines. People are simply refusing to buy new goods, but are patching up the old ones.

They think this is a wise policy, but it's the old story of a penny wise and pound foolish, for in many cases they pay almost as much for the repair as they would for a new article. It may seem economy, but to my mind it's mighty foolish practice, forgetting altogether the axe we have to grind, so far as selling them new goods is concerned."

To prove his point, this dealer led the writer to the shipping room, where resting peacefully in a corner was a chain block that had seen better days. It was rusted up, and loose at many points; in fact was over 50 per cent scrap. "Can you imagine anyone sending that thing in for repairs," asked the dealer, and we could only shake our head negatively. "When we finish the repairing of the block, we won't guarantee its safety," concluded our informant, "yet they keep on inspecting elevators, and leave people to patch up chain blocks as they see fit."

This brings up an important point, and one which should not be overlooked. True, firms may be eliminating all unnecessary expenditure, but if deciding on repairs, it should first be ascertained if a new part would not be cheaper in the end, and above all, if the repaired part would be safe for use.

Small Tool Market

Our old stand by, the the small tool market is still a deserter from the ranks. Business is very quiet, and dealers are not over optimistic as to the near future. "We may get a little better business after the close of this year," commented one dealer, "but so long as manufacturers continue to buy for immediate requirements only, the volume closed will not be large."

BUSINESS IS VERY DULL THIS WEEK NOT MUCH DEMAND FOR MACHINE TOOLS

MONTREAL,—December is usually a dull month in the iron and steel industries, even when conditions in general are normal, but under present conditions business is a little duller than usual. At this time of the year programmes and policies for the coming year are usually well considered, and a more or less active start has been taken to put them into being. This year has been unusual in as far as the elections were concerned, and many firms who have more or less extensive dealings with firms in the United States, have hesitated to take any steps in connection with the coming year's business. The reason for this, although not definitely stated, has been one of "Safety First." Not one of these firms seriously thought that the tariff walls would be torn down should certain parties be elected to power at Ottawa. There was, however, just enough concern, to cause them to wait until after the results were announced before starting on the plans for 1922.

Conditions in most business circles were so quiet that such tardiness would not be followed by any serious results. Thus it is today, there is a feeling that something has been passed which presented dangerous features to Canadian business activities in the manufacturing line. The reaction in the form of increased business has not yet been manifested locally, but there is an undercurrent of optimism that cannot be concealed. Prices for the principal steel products remain unchanged. The business moving is practically the same as last week. A slight decrease in volume of business is expected for the next few weeks, as during the Christmas season the steel trade always experiences a quiet period. Nevertheless, although no actual business increases can be reported locally, the decks are being cleared for action in 1922.

The Canadian Pacific Railway is planning fairly extensive operations for the coming year. Mr. Hall, vice-president is now in the Western provinces arranging the programme, details of which will not be announced until early in the New Year. The increased earnings of the National Railways are very gratifying and it is sincerely hoped that these favorable balances can be maintained. In Nova Scotia the small volume of business being handled by the steel companies is resulting in a great deal of hardship and unemployment. It is confidently expected that this condition will be remedied very soon.

The Steel Market

Base prices locally are unchanged this week although there appears to be a few odd lots of steel being offered at prices that would suggest liquidation. Generally speaking, the market is firm. Merchant bars are still unusuall quiet, while there is a small, but steady movement in structural shapes. Sheets continue to move a little more freely than other lines, but the volume of business is still small. The demand for plates is better than one would expect. A considerable amount of tank and stack work seems to be in progress. The rail mills are rapidly completing their orders and there appears to be a quiet two or three months before them. No changes in prices are anticipated. The steel mills claim that the small margin of profit existing at the present price level is not attractive and that when a change in prices occurs it will be an upward revision.

Pig Iron Market

The conditions prevailing for the past few weeks have not been altered by anything in the last week. Some of the larger plants report that inquiries go to show that there will be more or less hydro-electric development in Canada and that other large undertakings are receiving serious consideration. If most of these materialize the foundries will be in receipt of considerable business and the demand for pig iron will be increased. There has been no change in price during the last week and there has been no additional demand.

Machine Tools and Supplies

The machine tool market remains unchanged. A few scattered price reductions are about all there is to report. The small shop man continues to be the most prominent purchaser in many lines. Some of these shops are unusually busy, as the closing down of the larger shops has thrown a great deal of business in the way of the small shop.

Supplies continue to move in about the same volume as before. Reports of sales of special portable tools to garage and repair-men are quite interesting. Many manufacturers are paying particular attention to the development and marketing of special portable or bench tools. It is surprising too, the interest that is being taken in these tools and also the excellent performance of some of them. It would appear that this type of tool is here to remain and will add considerably to the amount of total sales in the machine tool line.

Non-Ferrous Metals

The metals seem to be very firm in price, New York markets are reported as being stiffer than for some time. Locally there has not been much in the way of increased demands. Copper prices are still well above 17 cents for three grades. Tin still commands 37½ cents. Lead is commanding an exceedingly high rate. There is considerable speculation as to when the price of lead will break. It still has the distinction of being the only metal that is above the 1914 price.

London Markets are a little stiffer this week but the increasing rate of sterling exchange also enters into the calculation and offsets matters somewhat.

Scrap Metal

It is so long since there has been any activity in this market that scrap dealers have been almost forgotten. There must be a very small supply of scrap iron in the yards of the foundries and it would seem reasonable to expect that there would be a slightly increased demand in the near future although it is not expected that there will be any real revival before the spring business of 1922 opens up.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shaues, Pitssburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross Montreal	Toronto
Lake copper	$17 75	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	37 50	37 00
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 25
Aluminum	27 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 38	14 71	17 77
½ in.	6 50	8 03	7 95	9 48
	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ¾" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross to
Bessemer billets	$43 5
Open-hearth billets	43 5
O.H. sheet bars	39 0
Forging billets	48 5
Wire rods	48 0

NAILS AND SPIKES

Wire nails, base	$4 2
Cut nails, base	4 8
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, singe bbls.	1 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B. W. G.	7 75	
Flerur-de-Lis, 28 B.W.G.	7 25	
Morbal's Best, No 28		
Colbornes Crown, No. 28		
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for E.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	15%
Standard	15 and 10%
Cut leather lacing, No. 1	2 00
Leather in side	2 40 3 00

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	$4 50
Polishing wheels, bull-neck	2 00
Emery in kegs, Turkish	8¾
Pumice, ground	06
Emery glue	30
Tripoli composition	9½
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	12½	Popular	.10
Standard	.11	Keen	9
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White	20	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$ .25
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.23
Ammonium, chloride	.22
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.30
Arsenic, white	.18
Copper, carbonate, annhy.	.35
Copper, sulphate	.10
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	16½
Nickel carbonate	.30
Nickel sulphate	.17½
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	1.15
Silver nitrate (per oz.)	1.10
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.39
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Canadian Brill Co. has supplied the Winnipeg Electric Railway with five one-man safety cars.

Plans are being prepared for ore concentrators and bunkers to cost $1,000,000 for the Britannia Mining and Smelting Company, Britannia Beach. B. C.

The ratepayers of Hull, Quebec, passed a bylaw authorizing the expenditure of $289,700 for the following improvements: aqueduct $83,700; sewers $85,500; paving $80,500; viaduct $40,000.

Galt reports that the textile and shoe industries are busy, but the foundries are running below average. In spite of the latter, there is little unemployment.

Kingston, Ontario has another new industry under way. This is the Kingston Factories Ltd. which has installed machinery and will start on the manufacture of overalls, shirts, etc. About 75 persons are to be employed.

Belleville, Ontario reports that contracts for construction on new building of The Ontario School for the district, have boomed business with several planing mills and one of them is employing a night shift.

Edmonton, N. B.—Mr. J. E. Michand states that lumbering business in Madawaska is picking up and that quite a few jobbing contracts have been taken out the last few days.

American branch industries at Sarnia, are running practically at normal. The Imperial Oil Co. is continuing to employ three shifts of men at 8 hours each. Conditions at this plant are looking up and officials report the future outlook as bright.

Surveys are being made for an electric light and power distribution system in Kerwood, London, Oxford Centre, and Muntey, all situated in the province of Ontario. The respective costs will be $38,000, $125,000, $40,000 and $35,000.

Elliott & Whiteal', Galt, manufacturers of small tools, report some improvement in demand from the motor car industry. Changes in certain part designs are, in a measure, responsible for this, and also a tendency toward preparedness for Spring business.

The Roelofson Elevator Co., Galt, have completed the installation of several new freight elevators in the recently constructed wing of the Lang Tanning Company, Kitchener.

The Frontenac Floor and Wall Tile Co., Kingston, Ont., are erecting a grinding plant for Feldspar for the manufacture of floor and wall tile. Formerly they have had to export the rough feldspar for grinding and import the crushed rock.

Major Anthes, president of the Anthes Foundry, Toronto, Ont., has just returned from a two months' business trip to Western Canada. He reports there is business to be had for those who go after it.

Esquimalt, B. C., reports that a contract for piling at Cofferdam for drydock costing $4,300,000 for the Dominion Government, Department Public Works is placed with MacDonald, Watson and Wither, 520 Sayward Building Victoria, B. C.

St. John, N. B. — Announcement is made that Wm. W. Quinton, assistant superintendent of Nashua mills of the Nashua Manufacturing Co., has resigned to accept the position of agent of the Hansaboe Manufacturing Company in Valley Falls. (R.I.)

The Canadian Government has signed a contract with the Burrard Dock Co., for a large floating dry dock for which the Burrard Co. are to receive a subsidy of 4 per cent. in two and a half million dollars for 35 years.

Sydney, N. S.—The marine railway and dock of the Sydney Foundry and Machine Co., are very busy at present. At the main docks two C. G. M. M. steamers are undergoing extensive repairs. The marine railway is taxed to capacity, many schooners waiting their turn to be placed on the slip.

If the present plans of the London division of the Canadian Pacific Railway are carried out next year, eighty miles of new 100 pound rails will be laid on the company's lines between Toronto and London. Appropriations for this new track-work have been drawn up and submitted to the head office of the company at Montreal for approval.

Annapolis, N. S.—A contract has been let this week by the firm of Wright and Joudrey of Annapolis, for the installation of 150 H. P. Hydro Electric plant. The turbine will be supplied by the Morgan Smith Co., New York; the generator and switch board and all electrical apparatus will be installed by the Canadian Westinghouse Co.

The British Empire Steel Corporation are to erect a large wharf on the site of the old reserve coal pier at Sydney where the company's freight and stores of all kinds will be consigned. The intention is to have all the supplies and freight required by the corporation shipped by water to Sydney during the navigation season.

New Glasgow, N. S.—English capital to the extent of £5,000,000 has been pledged to finance the development of oil shale fields in Pictou County. This is the aftermath of a conference in New York of the holding company and representatives of British oil magnates and the petroleum executive of the British Government.

St. John, N. B.—Joseph W. Norcross, vice-president and managing director of the Canada Steamship Lines, Ltd., arrived here and spent the day in conference with Thomas Nagle of the firm of Nagle & Wigmore, agents for the Canada S. S. lines. Mr. Norcross said that as wages and freights come down, the shipping outlook improves. His company will have considerably more business here this winter than last season.

The Ruggles Motor Truck Co., London, Ontario, announce that its working force is 50 per cent. stronger than a month ago, business having shown a decided change for the better during the past two weeks. The Dominion Government has placed a contract with the firm for eleven trucks for mail service and an order for thirty trucks has been received from England. In addition the demand for trucks from local firms is again noticed, the combined results being that the factory is working at full blast.

There are no signs of a slump in the vicinity of St. Catharines, Ont. The Crocker-Wheeler plant, which has been taken over by an English Company expects to run full time after Christmas, and it is said they have a large contract to get out. It is also understood that the McKinnon Industries is employing about 700 men now on part time.

It is interesting to note that we have in Canada 1,255 mills of which 400 are commercial. The capital invested in these is over $76,000,000. It is also reported that during the last ten months the construction companies in Canada have entered upon 17,824 projects, costing $204,375,000. Of these 17,824, over 3,000 were industrial buildings, costing approximately $92,000,000.

Additional contracts have been let for the erection of the market building at Windsor, Ont., to cost $150,000.

The F. B. Coombe Furniture Co., Kincardine, Ont., are in the market for additional wood-working machinery.

The contract for the erection of Sherbrooke's new City Hall has been let to the Sherbrooke Construction Co. The estimated cost is $75,000.

Tools and Stampings, Toronto, has been incorporated with $50,000 capital to manufacture machinery, tools, dies, etc.

The Central Steel Products, Toronto, has been incorporated to manufacture metal products with $40,000 capital stock.

The Hastings Manufacturing Co., Toronto, Ont., has been incorporated to manufacture toys, hardware, household appliances, etc., with $40,000 capital stock.

The National Tire and Tire Apparatus, Toronto, has been incorporated to manufacture motor car accessories, etc., with $100,000 capital stock.

The Trudel Gasoline Saver Co., Montreal, Quebec, has been incorporated to manufacture machinery, automobile equipment, etc., with $100,000 capital stock.

The ratepayers of St. Thomas, Ont., have passed a by-law authorizing the erection of the Elgin Memorial Hospital which will cost approximately $165,000.

The Acton Canning Co., Acton, Ont., are in the market for grinding equipments, vats, etc., for proposed leach house which was recently destroyed by fire.

Mr. E. Grandier, of the Teasdall Hosiery Co., London, Ont., are in the market for hosiery-making machinery for their Port Elgin plant.

Fire losses in Canada during the week ending November 16th, 1921, are estimated in the Monetary Times, at $287,850, compared with $215,500 the previous week.

There is some talk about a new hotel being erected in Sault Ste. Marie, Ont., to cost about $600,000. The matter so far has been placed bfore the local board of trade. They have looked favorably upon it and will bring the scheme to the attention of the City Council.

The Kinleith Paper Co., St. Catharines, Ont., are in the market for a 24 inch lathe with a 15 foot bed. This concern is contemplating building a new paper-making machine for its own use, and should this occur additional equipment will be required.

Mr. W. N. Manning of the Sherlock-Manning Piano and Organ Co., London, Ontario, states that his firm is only ten carloads of pianos short of last year's business, having shown a remarkable recovery during the past month. He says "Its just like old times in the Western provinces and in the east it is better than ever before. We are getting more orders for pianos in Prince Edward Island than at any period in our history."

Amherst, N. S.—The plant of the Robb Engineering works is being closed down. All the boiler patterns of the latest type are being shipped to the Dominion Bridge works at Montreal. Their general manager, Mr. G. E. Newill, is also being transferred to Montreal.

The Continental Electric Co., 505 King St. E., Toronto, recently incorporated to manufacture suction cleaners, etc., has commenced manufacturing operations. It is the intention of the company to increase the capacity of its plant by installing additional equipment in the near future.

A contract for the faced brick for the new Mount Royal Hotel, Montreal, Que., has been let to Webster & Son. Further contracts involving $2,250,000 will be let within three months. These include the supplying of such materials as granite, wood frames, elevators, ornamental iron, and tile fireproofing.

C. N. Kirkpatrick, sales manager of Landis Machine Co., Waynesboro, Pa., visited their Canadian representative, the Canadian Fairbanks-Morse Co., last week. Mr. Kirkpatrick stated to Canadian Machinery that their business on the whole has been satisfactory, and that the outlook for next year was encouraging.

Mr. C. F. Meyer, assistant secretary of the Landis Machine Co., Waynesboro, Pa., has returned from a year's trip around the world. Mr. Meyer's itinerary included India, Java, China, Japan and the Hawaiian Islands. Mr. J.M. McNeal, sales engineer, of the same company has returned after a year and three months in England and the continent.

We understand that one of the largest industries in Oshawa, Ontario took back about thirty men last week and it is expected that more will be taken on early in the New Year. Local manufacturers, wholesalers, retailers and business men generally are to be asked to take part in the campaign just launched to revive business and give every man a job.

Another indication of activity in Brockville is the James Smart branch of the Canada Foundries and Forgings and the Wolthausen Hat Corp. The Smart firm is now working 40 hours a week instead of 24 hours as was the case from last June until September; while the Hat Corporation is on full time instead of two or three days a week as was the rule last winter.

Figures indicating construction activity for the Dominion of Canada for the month of November amount to $16,639,800 as compared with $15,399,200 in November 1920. The total projects making up this item of 16,639,800 are numbered at 1,884. 1,600 of these projects are from the Provinces of Ontario and Quebec combined. Ontario having 1,072 and Quebec having 528. The construction total for the month of November in Ontario totalled $11,725,000 and Quebec $3,276,100.

Building has been active in Sault Ste. Marie during the past season, construction to a total value of about $800,000 having been carried out. The big item in this expenditure is the new Court House, which is now nearing completion. This structure will cost about $400,000 when completed. A start has just been made on the $250,000 Technical school and the proposed addition to the High School there will cost $125,000.

The Alfred Herbert, Ltd., Coventry, England, announces that after December 31st, 1921, its New York office will be closed. All communications should be sent direct to Coventry, or to such branches or affiliated companies as the case demands. Mr. E. D. Mitchell who has been manager of the New York office will return to England the early part of the year and take up duties at the home office. Canadian Machinery readers will no doubt keep in mind that the above company have a branch office at Toronto, Ont., under the supervision of Mr. J. C. Blair.

The Dominion Steel Corporation have the specifications ready for a large up-to-date and modern machine shop, to be erected in Sydney. The building will be of steel and brick and the most modern and efficient machines are to be installed. The company has in view the centralization of all necessary machine work and repairs for their railways, collieries and steel plants. The shop when completed will be one of the largest and most up-to-date in Eastern Canada. It is said on good authority that work on the erection of the new shop will commence at an early date.

The Grand Trunk Railway has placed an order covering its rail requirements for 1922. Business was closed last week for 29,000 tons of rails, of which the Dominion Iron & Steel received 15,000 tons for production, at its Sydney plant, and Algoma Steel Corporation 14,000 tons at Sault Ste. Marie. The Grand Trunk rail orders, added to the C. N. R. recent placing of 40,000 tons in equal shares with the Sydney and Sault mills, bring the total for the two systems to 69,000 tons, which should keep the producers fairly well occupied for several months.

A report from Brockville, Ontario says that industries have taken on a new lease of life in the past two weeks, and labor conditions show gradual improvement over the recent summer months. They are also experiencing an industrial boom which should increase its population by several hundred during the next few months. The recent arrival of the Eugene F. Phillips Electrical Company of Montreal has strengthened industral circles in that city. It is understood that operations in connection with this firm will be commenced not later than March 8th, 1922, on the erection of a total of 15 buildings which ought to be completed by the first week of next November. All told the firm is to employ 500 persons.

"Things to watch and methods of speeding up filing" has been written with care for Canadian Machinery of January 5th issue. Look for it.

Preparations are now in hand for the erection of an eleven storey office building at the corner of Bay and Temperance Street, Toronto, by the General Accident and Assurance Co. of Canada. The building when completed will cost a half million dollars, and with the land included, the total cost will be close to a million dollars. The contract has been let to the W. M. Sutherland Co. of Toronto and they have bound themselves to have the new structure completed and ready for occupation November 1st, 1922.

Something like an industrial boom has hit Pembroke, with the beginning of operations by Maguire, Patterson and a new canning factory in Frankford. Match Co., the latter being the Canadian branch of the Diamond Match Co., of the United States. The first named concern is of English parentage and is supplying splints to the match company. About 200 hands are employed at present, but it is stated that when both industries are operating at full blast, some 2,000 hands will be required. There is scarcity of houses at present in Pembroke and considerable building is planned for the coming spring.

Work has begun on the erection of a new canning factory in Frankford. The canning industry in Frankford has been for years a strong industrial asset, and the destruction of the factory by fire last summer was a serious set-back. The intention is to erect a bigger and better plant to take the place of the old one. Evacuation is well under way and is giving employment to quite a number of men. No definite mention is made as to what canning firm this is, but we imagine it will be The Frankford Canning and Preserving Co.

Improvement in the labor situation is indicated in the latest reports available covering the whole of Canada. For two weeks ending October 22nd, employment was greater than at any time since the middle of last January. This encouraging fact is shown by the latest reports of the employment service of Canada, covering the operations of 5,504 firms. The index figures show 90.4 as compared with 89.9 for the preceding two weeks. The return from 5,504 firms showed there was an aggregate payroll of 692,184 persons, an increase of 5,971 since the previous two weeks. There were additions to that to the extent of 8,075 reported in 23 industrial groups, while contractions occurred in 14 groups involving 2,104 persons.

Mr. O. H. Anderson, of the National Steel Tire Corporation, Hamilton, Ont., says his company have an order for 1,000 cars to be repaired for the Lehigh Valley Railway. There are tentative orders on hand for repairs to 500 cars for the Canadian National Railway system, and 2,000 for the Grand Trunk. This would mean work for employees throughout the winter. Mr. Anderson spoke favorably of the car equipment industry in general and said that the repair of all cars now in operation upon the Canadian railway lines would keep all car repair shops in Canada busy for two years to come.

There is considerable activity in the lumbering camps this year, but at rates of wages that are in some cases, less than half of those of last year. Reports from Pembroke, on the Ottawa river, indicate that while $75 a month and board was about the average rate last year for bushmen, the wage this year runs from $25 to $35 a month and board. Moreover, unemployment is such that in eastern sections men have gone into the woods to work for wages only, hoping that changes in the working force may secure for them a place on the payroll. Much lumber has recently been sold to American buyers, but at prices that represent a loss on the original cost at high prices. Present conditions indicate that lumber will continue to be marketed at low levels next year and thus building operations should benefit by the encouragement thus developing.

OBITUARY

John McClary, founder of the McClary Mfg. Co., the largest stove plant in the British Empire, and probably the oldest active business man in Canada, died at his home in London on Sunday, 11th inst., after an illness of only one day. Mr. McClary was born on a farm near London on January 2, 1829, and with the exception of a short time in California during the gold rush of 1849, he spent his entire life in and about London. He served an apprenticeship at the tinsmithing trade, and at an early age, entered into partnership with his brother Oliver, starting the business which developed into the McClary Mfg. Co., of today. He is survived by two daughters Mrs. Theresa Gunn, whose husband, E. A. Gunn, now deceased was formerly secretary of McClary Co., and Mrs. Gartshore, wife of Lt.-Col. W. M. Gartshore, manager of the company.

STILL YOUNG AT 81

Fifty-five years in the manufacture of lumbering tools, has given to Thomas Pink, Pembroke, head of the Thomas Pink Co., a memory that is rich in reminiscences of the early days in the lumbering industry on the Ottawa river. To him, it does not seem so long ago that rafts of squared timber, with their cabins and crews aboard, floated down from the adjacent forests on their way to Ottawa, Montreal and Quebec. Then, as now, Eddy, Booth, Gillies and MacLachlan were prominent names on the river. To-day the passing of a drive of loose logs means nothing in the shape of excitement, while in the memorable days that are gone, the towns and villages en route were policed by volunteer companies, who in the majority of cases, were more than a match for the huskies who were inclined to tear loose and paint the town red. Mr. Pink today is young at 81. That is, he is in close touch with every detail of his business, is probably known personally to all his customers and has seen his industry thrive from small to large proportions as the result of the significance that attaches to his name on peevy, pike or canthook. He was born in Kent, England, and, early in life, came with his parents to Perth, Ont. In addition to his regular line, Mr. Pink operates one of the largest public garages in Eastern Ontario.

PRESIDENT OF A.S.M.E. ELECTED—PLANS LAID

Dean Dexter S. Kimball of the College of Engineering of Cornell University has been elected as president of the American Society of Mechanical Engineers. Dean Kimball succeeds Edwin S. Carman of Cleveland, and will serve for one year. He heads an organization of 15,000 members with active professional divisions and local sections in every principal industrial centre in the country.

Other officers elected were: Vice-presidents, Col. Edward A. Deeds of Dayton, Ohio; Robert Sibley of San Francisco and Louis E. Strothman of Milwaukee; managers, Sherwood F Jeter of Hartford, Conn.; Horace P. Liversidge of Philadelphia; Hollis P. Porter of Tulsa, Okla.; and Walter S. Finlay of New York; treasurer, William H. Wiley, of New York; secretary, Calvin W. Rice of New York.

With the election of Dean Kimball the society set in motion two important movements, one looking to world engineering unity and the other to remedy what engineers say are deplorable conditions in the United States Patent Office, menacing American industry and invention. In the campaign for better Patent Office conditions the society will work with other national engineering organizations.

Sir Robert Hadfield of London has addressed a communication to Calvin W. Rice, urging the formation of an Anglo-Saxon Engineering Council of the World. Steps are being taken by American engineers to co-operate with British engineers in the formation of a new national association. France and Italy will be asked to co-operate.

Ambrose Swasey of Cleveland said that the engineer and scientist, now the most important factors in war, purpose to devote their energies to the maintenance of world peace. The idea of an international union of engineers, he said, arose during the war and took concrete form last summer, when a deputation of American engineers went abroad to confer the John Fritz gold medal upon Sir Robert Hadfield of London and Eugene Schneider of Paris, head of the famous Creusot Works.

British engineers led by Sir Robert are

already moving to form a federation of engineers of the British Empire similar to the American Engineering Council, organized about a year ago under the leadership of Herbert Hoover, and by means of which American engineers are being welded into a single union.

INCREASED USE OF OIL FUEL BY SHIPS

Lloyd's annual report 1920-21, on shipping, refers to the many adverse conditions which have combined to the disadvantage of the shipbuilding industry. As far as the Register itself is concerned, this is illustrated by the statement that the new tonnage classed during the year ended June 30, 1921, only amounted to 911 vessels, of 3,245,-130 tons gross—equal to a reduction of 25 per cent. on those for the previous twelve months. It is noted, however, that whereas only one vessel exceeding 10,000 tons was classified in 1919-20, no fewer than ten such vessels were classed during the past year.

A special feature of the present report is the account given of the remarkable increase in the use of oil fuel to replace coal, as illustrated by the following comparative figures recorded in the Society's register book:—

Vessels burning oil fuel
gross tons

July, 1914.....	1,310,209
July, 1919.....	5,336,678
July, 1920.....	9,359,334
July, 1921.....	12,796,635

and it is stated that the position indicates that industrial conditions generally during and subsequent to the war have given tremendous impetus to this important economic movement.

Some impression of the industrial significance of the change will be obtained when it is realized that the steamers now in existence which are fitted for oil fuel would represent a consumption of coal approaching 20,-000,000 tons per annum, or about 8.7 per cent. of the quantity of coal brought to the surface in the United Kingdom during 1920. Apart from the question of the relative cost of coal and oil as fuel, continues trade commissioner Harrison Watson, there is undoubtedly, the case of vessels using the latter, an all-round economy of labor, bunker space, accommodation for crew, and time in port; factors which have an important bearing on running costs, more especially in the case of large passenger vessels.

This movement partly accounts for the remarkable increase in the demand for oil tankers, of which 112 of 614,-464 tons gross, or over 18 per cent. of the total tonnage classed, were built in the past year, and the growth of this type is exemplified by the following statistics:—

Tankers (steamers and motors)
gross tons

July, 1914.....	1,478,988
July, 1919.....	2,929,113
July, 1920.....	3,354,314
July, 1921.....	4,418,688

The total number of vessels built during the year and fitted with oil engines was thirty-four of 101,608 tons, twelve of which were ships of large size totalling 83,739 tons gross. All these thirty-four vessels were fitted with oil engines using heavy oil, with the exception of three of 536 tons fitted with paraffin motors.

Production and Uses of Lime

SPEAKING on the production of lime in the United States, Commerce Monthly says that although the production in 1920 was greater than 1919 the supply was insufficient to meet the steadily increasing demand, due in most cases to the shortage in transportation and labor. Approximately 140 different industries in the U. S. use lime in some form. Production in 1920 exceeded that of 1919 by about 240,000 tons and was more than 94,000 tons greater than the average production during the five years 1910 to 1914. As in most industries, due to the increased cost of materials and labor in 1919 and 1920, this expansion in output has been accompanied by a considerable increase in price. However, the slackening of demand and the liquidation in fuel and labor during the current year have caused a marked decrease in production costs and selling prices.

Limestone, from which the greater part of the lime produced is derived, is widely distributed throughout the United States, in varying degrees of purity. The amount of impurities in the raw material, such as silica, iron and alumina, determines the value of lime for its various uses. Quicklime is obtained by burning limestone under slow but constant heat sufficient to dissociate the carbonic acid gas from the stone, leaving the commercial product. Kilns may be intermittent or continuous. Intermittent kilns are used only by small producers as they must be cooled and re-heated each time they are charged. Continuous kilns are constructed at regular intervals, and the kiln recharged with limestone from above.

Used By Building Trades

The building trade consumed about 37 per cent. of the total lime produced in 1920. The decrease noted in the consumption of lime in the construction industries since 1916 reflects the shortage in house-building of the last four years. The largest consumption of lime in the building trade is in the building of homes, and if this type of construction had continued at the pre-war rate it is estimated that such consumption would have increased instead of decreased. The quantity of lime consumed in 1920 by the paper industry was the greatest on record, being 32 per cent. above the average pre-war consumption by that industry and about 9 per cent. greater than the consumption in 1919.

Hydrated lime is that which has been slaked under standardized conditions and expert supervision. A specific amount of quicklime is mixed iwth a certain quantity of water so as to produce a perfectly slaked lime which does not require slaking when used in making mortar. Hydrated lime serves most of the purposes for which quicklime is used and its prepared and finely divided condition provides a more economical and thorough distribution of the product with a minimum of waste.

Production in 1920 was more than double the average annual pre-war production, and the value of the hydrated lime produced in 1920 was the highest on record and more than five times the value of the average annual pre-war production. While the quantity of lime hydrated is only about one-fourth of the total production of lime, the relative increase in the production of hydrated lime since 1915 has been greater than the increase in production of quicklime. The number of plants reporting operation has steadily increased, and there were 98 plants in operation in 1920 as compared with an average of 67 during the five years 1910 to 1914.

Where lumplime is used, lime dust and small particles of lime derived from the burning process are hydrated. Some plants hydrate the entire output—all types of hydrators provide for mechanical mixing and for conserving the heat of the chemical reaction in sufficient degree to hydrate effectively without burning.

The older methods used in burning limestone were those in which the flame and fuel used came in direct contact with the limestone. Numerous small plants were used, especially in Pennsylvania where it has been the custom for farmers to burn the lime for their own use and to sell in small quantities to their neighbors. In 1916 there were in operation in the United States 778 plants which burned 4,073,000 tons of lime. Recently on account of high cost of fuel and labor there has been a tendency to concentrate the industry into larger production units. In 1920 a total of 3,476,-000 tons of lime was burned in 515 plants. Continuous vertical shaft kilns are now the standard. These are upright cylindrical furnaces consisting of iron or brick shells of various sizes lined with fire brick. Suitably insulated rotary kilns are used extensively in burning lime to be hydrated. The number of field kilns is being rapidly reduced and the more efficient and effective types of continuous kilns are being substituted.

More than 99.8 per cent. of the domestic consumption of lime is produced in

the United States, and nine-tenths of the imported lime comes from Canada. A small quantity of lime of a special grade is imported from Europe. Exports of lime from the United States have not exceeded one per cent. of the total production, and the greater part of the exports is sent to Canada.

Lime deteriorates when stored and any decrease in demand necessitates a reduction in the supply produced. Complete statistics of the quantity of lime consumed in 1921 are not available. However the National Lime Association estimates the quantity of lime consumed to date at about 80 per cent. of the quantity consumed during the corresponding period of 1920. It is probable that the improvement during the last quarter of 1921 in the various industries requiring lime as a raw material will be reflected in the final report of production and consumption during this year.

SHOULD FREIGHT RATES ON SCRAP BE REDUCED? COMPARATIVE FIGURES

INVESTIGATION of rates on "scrap iron" as compared with those on "pig iron" has raised the question whether the former are properly relative or excessive compared with the latter. Since scrap iron is now produced and used at a rate of 20,000,000 to 35,000,000 tons per year, depending on general business conditions, it is important, say Briggs & Turvias, Inc., Chicago, that we determine whether it is paying more than its share of freight. In this the producer, the consumer and the carrier are interested, as it effects their financial well-being.

Speaking further on the subject they say: "It is frankly admitted that a definite relationship exists between scrap iron and pig and when the price of one is relatively higher than the other, the proportion used is altered to fit the case, cheap scrap replacing pig iron and cheap pig iron replacing scrap. The freight rates paid on these, therefore, are of importance, as one suffers or gains compared with the other, if rates are out of line.

"If we compare pig iron and scrap iron rates between producing and consuming points," they continue, "it is surprising that in most cases scrap pays the higher rate. The contrary opinion has been held generally. The scrap rates are not only higher, but the differences are large in percentage. For instance, from Birmingham to Cincinnati, pig iron is favored to the extent of $1.245 per ton, or 28 per cent. From Chicago to Moline, the difference is $0.70 per ton, or 35 per cent. From Cleveland to Toledo, pig iron is favored $0.42 per ton or 17 per cent."

The basis for freight rates, according to their comments, ordinarily takes into account the market value of the commodities. Unless this were done, a carload of tea would yield no more revenue than a carload of pig iron. The same basis is used in levying taxes and duties. As a result, they remark, it would seem that scrap should move at a lower price than pig iron since its selling price always is lower. Three reasons indicate the justice of lower rates on scrap compared with pig iron. Scrap is considerably inferior, physically and chemically. Scrap always sells lower than pig iron; in the case of some grades as much as 75 per cent. lower; the loss in melting scrap exceeds that of pig iron by at least 3.1 and as a result, the scrap consumer pays freight on something which is a total loss. Thus, if scrap and pig iron each carry a freight rate of $1.00 per ton, this would cost the consumer $0.25 more on every dollar of freight on scrap compared with pig iron.

This would indicate that scrap rates should not be more than 80 per cent. of those on pig iron based on the melting loss alone, while the difference in claim figures on scrap iron and pig iron.

"Inasmuch as the tonnage and mileage of scrap is much greater than that of pig iron, this commodity should be entitled to much consideration," they continue, "while steel plants consume much of pig iron production of country at the point where it is produced, scrap, invariably, requires railroad transportation. In this carrying much of the scrap iron is handled twice—into a yard for preparation and again to the consumer. This material has not had privileges similar to the fabrication-in-transit and milling-in-transit accorded to structural steel and wheat. At present, it is impossible to move scrap any distance, as the rate for carrying is too close to the selling price to permit long hauls. In many instances, rates range from $6.00 to $12.00 per ton.

"In view of the large tonnage, long hauls and double hauls, it would seem wise for carriers to encourage shipment of scrap by placing rates low enough relative to pig iron to cause free movement."

Editor's Note: — The comparisons stated in the above article are very interesting, but should not be quoted as strictly applying to Canada. A prominent dealer in scrap metals, discussing the matter with Canadian Machinery says that there exists in Canada a very high freight rate on scrap metals, so high in fact as to prohibit the shipment of scrap for any great distance. To prove his point he tells the following story: "We had an opportunity to purchase some scrap a short time ago, and the manufacturer gave us a price of $2.50 per ton for the material. This was all right so far as it went, but the freight charge to the nearest destination would have been $6.70 a ton, which of course made the deal an impossible one, if any profit was to be realized. With the present existing carrying charges, dealers, or in fact anyone, cannot afford to ship scrap from outlying districts to any consuming locality."

NEW CATALOGUE

The Tastern Machine Srew Coroporation of New Haven, Conn., have just issued a very complete catalogue describing their H. & G. die head product. In fact the book is more than a catalogue as it contains many pages of information valuable to the screw machine operator. There are many illustrations which serve to clearly illustrate many points of an obscure nature. The catalogue describes Die Heads known as their type A, C, & D. The die heads are all hardened and ground, the chaser slots being ground to within one one-thousandth of an inch. The chasers are all operated by cams having a positive bearing directly over the cutting edge. The cams themselves are solidly supported by the body of the head thus rendering the tipping of the chasers impossible. The dies are opened by straight acting springs. All chaser sets are perfectly interchangeable. It is claimed that the head is one of the most compact for its capacity, of any on the market. The diameters of thread in the dies is the same at both ends.

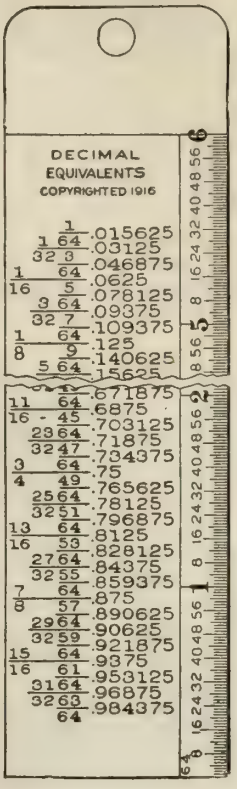
Style A is designed to be used on automatic screw machines like the Cone, Gridley, National Acme and New Britain, and for threading machines and bolt cutters in which the die head rotates. Style C is for turret lathes, hand screw machines and similar designs of machines in which the die head does not rotate. Style D is specially designed for the Brown & Sharpe Automatics, but can be used on other machines cutting small work. It is claimed by the manufacturer that this type of head, recently placed on the market, is not only increasing production, but improves the finish and accuracy of the product. The catalogue also illustrates the H. & G. Chaser grinder, which has been developed by this firm to meet the demand among users of H. & G. die heads for a grinder that is readily operated by unskilled labor and grinds chaser correctly without undue waste of chaser stock.

WILL SPEND A MILLION

In spite of the difficulties which hinder the development of collieries in Great Britain one large colliery company has decided to spend over one million pounds on extending electrical working in its various mines. The main power house is to be extended until it becomes the largest private electric power station in the country. One of the resulting changes in the pits will be the complete electrification of all plant which can be suitably operated by electric power. A considerable reduction in working costs will be effected.

Have You Tried This Contest Yet?

The editors want to make Canadian Machinery as newsy as possible. Every week three or four pages of interesting and valuable news appear in our Industrial News Section, but we know there is a great deal more information to be obtained, the difficulty being to bring it to light. This is where we feel our readers can help us. Read the conditions stated below, then decide to help us **NOW.**



A word about the prizes. These scales are 6 in. long. They are made from finest quality steel. One side is marked in 32nds, the other side in 64ths. A table of decimal equivalents is stamped on the one side, while a table of tap drill sizes is placed on the reverse side. Each scale is enclosed in a suitable case and every reader should strive to obtain one. Send in your item **NOW.**

What You Have To Do

As stated above, we are anxious to make our Industrial News Section still more valuable. Our readers can help us wonderfully in this respect, sending in each week, short items relating to industrial activities in Canada. These items **must** be real news and **must** not be clipped from other papers. A study of our present Industrial News Section will help readers to distinguish what constitutes a real news item and for their guidance we offer the following suggestions:

Let us have items dealing with the formation of new companies; reorganization of old companies; new factories to be erected; plant or factory extensions; changes in personnel of firms; appointments or promotions; contracts about to be placed; equipment or machinery required, or new equipment or machinery about to be marketed.

In every case the editor is to be the judge as to the value of any item received and he is at liberty to use or reject any material. A prize will be given to the readers sending in the best item, or items, each week and to make it interesting we will give two scales as prizes every issue. Make up your mind to secure one of these scales. They are well worth having. Obey the impulse, send in your item **NOW.** See page 28 for the winner of the December 8th contest.

— Important Note —

Readers should arrange to send their items so that they will reach the Toronto office early Monday morning of each week at the very latest. Of course, they should be forwarded before this if possible, but our forms close early Tuesday morning each week, and no matter can be used after that time. Should an item arrive too late for publication in one issue, if considered worth while it will be held over for another week, still being eligible for a prize.

PATENT ATTORNEYS

PATENTS
Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd
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BERTRAMS LIMITED
SCIENNES EDINBURGH
Rubber Mill Machinery

ASBESTOS BELTING
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What can we do for YOU?

Through these columns thousands of dollars of equipment are disposed of each year. If you are not using Canadian Machinery now, let us tell you what others have done—are doing.

CANADIAN MACHINERY
Classified Advertising Section
143 University Ave., Toronto

FROM PATTERN-MAKER TO GENERAL MANAGER

FROM pattern maker to time keeper, foreman, superintendent, then general manager, is the story of the advancement of Jack Neal, of the Northern Foundries Company, Sault Ste. Marie. The story of how Mr. Neal got his advancement is probably duplicated by dozens of other factory men throughout the country, although each one may give a different explanation. Most men are modest, however, nearly all big men are, when they point to their rise in the world of finance, commerce or industry. Jack Neal is the same Jack Neal who came here 20 years ago to work for F. H. Clergue, who put the Sault on the map as a steel manufacturing centre of Canada. Neal came to the Sault, willing to work, with a good knowledge of pattern making which he had acquired at Carleton Junction.

"The only formula I know of to get on is real hard work," said Mr. Neal the other day in relating how he started out. "As a pattern maker I found that I had an advantage, in that blue prints were easy for me to read, and I soon learned the importance of capitalizing this knowledge outside of my own trade."

Mr. Neal confessed that he spent many nights getting through a correspondence course in mechanical engineering . He would not deny that he had a natural aptitude, which stood him in good stead, but he was firmly of the opinion that any young man requires more than natural ability if he is to achieve executive capacity in any industry to-day. Competition is too keen, even in the shops, for any man to depend on the store of his own knowledge, or his ability to grasp principles at first hand.

"Take any young man out in the foundry there," said Mr. Neal, "and he can not tell you what a blue print means unless he has the casting beside him, although he may be very practical, and expert in his work. I studied what I thought would fit in with my pattern making, and I try to keep abreast of new ideas every month in the technical publications of the trade. Iron working appeals to me, but 20 years ago, after a long day, it was hard work and required application to carry through a technical course in mechanical work at night."

Joining with a couple of other shopmates, Mr. Neal started a machine repair shop in the Sault. He was made timekeeper, but his general knowledge of the shop was regarded as too valuable, and he ultimately became superintendent. The Northern Foundries was born out of the repair shop, when the war came along, and like many other factories with nothing to do, it was a case of turning to munitions. Neal turned out the first 4.5 mark 7 shell to be finished in Canada without bushing or nose, and his prints were sent to Ottawa, as a pattern for other plants throughout the Dominion.

To-day, the Northern Foundries employs 100 men, and is manufacturing centrifugal pumps, steam hoists and steering gear, all used in the mining districts in the North. Jack Neal is the general manager, and he knows the cost of every casting turned out, whether in the brass or iron part of the foundry. He has jumped from war to peace time production safely, and his plant represents $250,000 of Sault capital.

A NEW KIND OF COAL

A report is existent that there is a new suggestion as to fuel—a new kind of coal. The idea comes from Norway and is the result of experiments carried out in a plant at Greaker, Norway, where an improved process has been employed to produce sulphite coal as a by-product from the manufacture of wood pulp. A ton of wood pulp, says the Scientific Engineer, yields 9 to 10 cubic metres of sulphite lye, of which 95 per cent. form other processes. If a new process is generally adopted it is estimated that it will be possible to produce annually sulphite coal equivalent to 800,000 tons of imported coal. Considerable quantities of cheap alcohol are produced from the wood pulp lye before it is made into coal. An essential feature of the new process is high concentration of the lye before removed from the autoclaves.

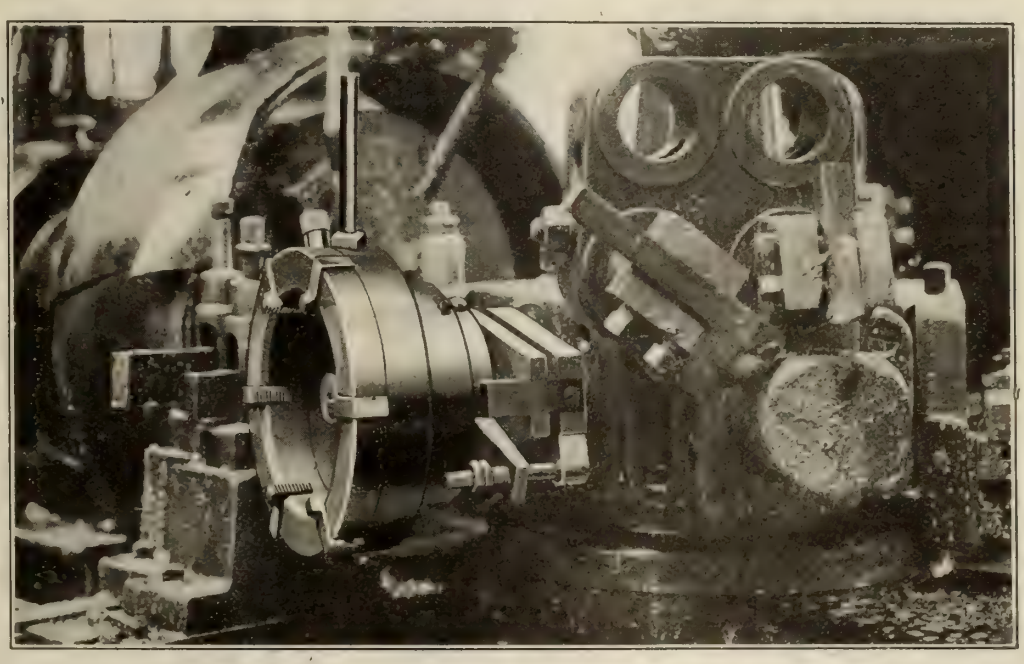
WILL FIND NEW USES

The U.S. Bureau of Mines, in a recent report, points out that the percentage of waste at slate quarries is very high. In order to reduce such waste they have undertaken the problem of discovering new and enlarged outlets for the waste material.

Many products such as paper, rubber, road asphalt, floor coverings, paints, etc., require as one of their important constituents a considerable percentage of finely pulverized inert mineral matter to give "body" to obtain the desired consistency, or to supply the necessary wearing or other qualities demanded. Such materials are known as "fillers." Eleven manufacturers of mechanical rubber goods found that slate flour was a satisfactory filler for such products as disks, sheet packing, molded shoe heels and soles, hard rubber battery jars, carriage tires, garden hose, clutch facings and similar products. Slate flour was used successfully as a substitute for whiting, clay, ground barytes and aluminum flake. A manufacturer of rubber footware found that products in which slate was used compared favorably with those made from regular compounds in tensile elongation and accelerated or natural aging.

Right on the Lead

A Big Job And A Big Die Head to Cut The Thread



In less than one minute's time the big 5⅜-inch Geometric Die Head cuts the thread on the bearing plate of ball-bearing journal jacks, and then releases automatically and makes way for the next tool.

The Foreman of Tool Supply in that Shop says he knows of no other tool that will do the work as they require it done like a GEOMETRIC.

Geometric Screw-cutting Tools help the man at the Lathe and at the Screw Machine give the best possible showing on a day's work. These tools are built to fit the work—to handle it in the easiest manner and produce threads that are true in every particular.

100 PER CENT. SATISFACTION

IS OBTAINED BY THE USE OF A GEOMETRIC.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S.

Classified Opportunities

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

FOR SALE

FOR SALE—1, 5, 7½ AND 10 H.P., 550 VOLT, and 3, 8, 15 and 20 H.P., 220 Volt, 25 Cycle, Motors; good condition. Canadian Linderman Co., Limited, Woodstock, Ont. (C20M.)

LOW PRESSURE HORIZONTAL STEAM ENgine 12 x 9 Deane Pump and Receiver. Cheap. Canadian Linderman Co., Ltd., Woodstock, Ont. (c24m)

SAWMILLS — PORTABLE MOUNTED AND unmounted; also portable engines on wheels, all sizes. Box 797G., Canadian Machinery.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

SITUATION WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 795 Canadian Machinery. (c23m)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

WE ARE ANXIOUS TO SECURE THE FOLlowing:
3 spinning lathes, 28" swing, 6 ft. bed; 3 buffing spindles; 2 foot presses with deep throat for rivetting; 1 automatic rivetting machine with deep throat, 25 to 30 h.p. motor, alternating current, 550 volt; Rotary shear; 1 double action toggle press 12 to 16" stroke, 30 in. between uprights. Quick action requested. Box 797T, Canadian Machinery.

MACHINE WORK WANTED

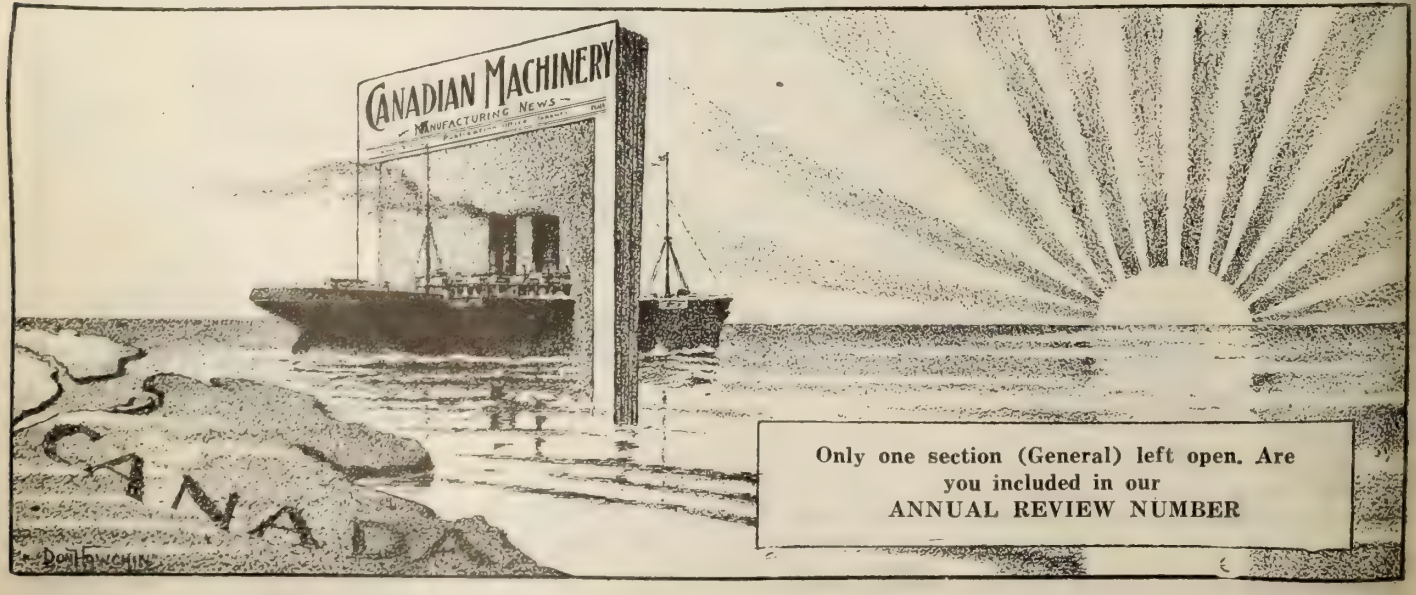
MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

HELP WANTED

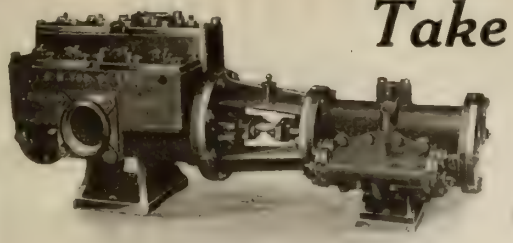
WANTED AT ONCE — THOROUGHLY COMpetent mechanic of good character and judgment, to take charge of production in a modern plant manufacturing automatic screw machine products. Must be thoroughly conversant with up-to-the-minute methods of producing on automatics and finishing by secondary operations both high-grade and commercial products, with a complete knowledge of tools, and tool designs best adapted to get these results. Must be able to train and handle help, enthusing them by personal leadership and energy so that efficiency can be constantly maintained. To a thorough mechanic who has a capacity for geting things done, this is a real opportunity. In applying state age, nationality, experience, and lowest salary expected as a start. Plant is up-to-the-minute in modern equipment. The Galt Machine Screw Co., Limited, Galt, Ontario, Canada.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)



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The Hepburn is the only Self-Draining Steam Pump Made in Canada.

See if it isn't behind the times. Find out if it isn't proving a big expense through leakage, continual adjustments and repairs. If such is the case your solution is in getting

A NEW HEPBURN PUMP

This efficient pump requires very little attention; there are no tappets or levers to give trouble; the valves are very accessible and the long strokes assure a decided steam economy.

Write us for a complete list of features as well as particulars of Vertical Engines, Power Presses, Cranes and other Machine Shop Equipment. Information will be freely given.

JOHN T. HEPBURN, Limited ENGINEERS AND IRON FOUNDERS **18-60 Van Horne St., TORONTO, CANADA**

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS, *LIMITED*
OWEN SOUND, ONTARIO
ESTABLIS HED 1860

HAVE YOU A CASTING PROBLEM? IS IT SIZE, WEIGHT, OR SPECIAL RIGGING?

We Can Make the Piece for You

as we are organized and equipped for the production of large, complicated foundry work of all kinds.

We will also do the machining, if desired. Our equipment for machining large work is the most complete in Canada, and we handle fly wheels and circular castings up to 35 feet diameter.

If you will submit your blue prints and specifications, we will gladly quote figures.

DOMINION ENGINEERING WORKS LIMITED
MONTREAL CANADA

THE MORSE CHAIN CO.

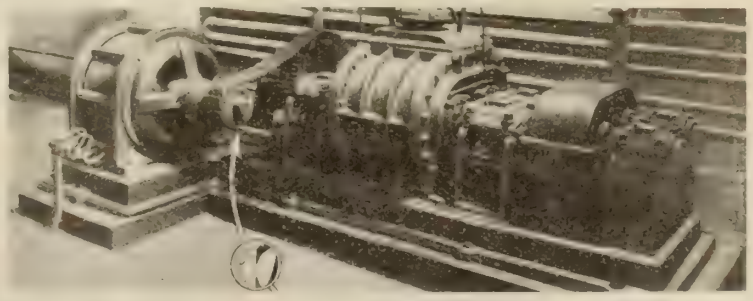
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of **Morse Rocker Joint Silent Chain** has never been seriously questioned.

They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)
Canadian Agents
Montreal - - Toronto



25 H.P. Morse Silent Chain to Positive Blower.

Racks & Pinions





Cut Teeth

We can cut racks up to 45 feet long

Gear Data for Your Note Book
Cut this out, more coming later

Comparison of Diametral and Circular Pitches
from Hamilton Gear & Machine Co., Toronto

Diametral Pitch.	Circular Pitch.	Circular Pitch.	Diametral Pitch.
1	3.1416 in.	4 in.	0.785
1¼	2.513	3½	0.898
1½	2.049	3	1.047
1¾	1.795	2¾	1.142
2	1.571	2½	1.257
2½	1.257	2¼	1.396
3	1.047	2	1.571
3½	0.898	1¾	1.795
4	0.785	1½	2.094
5	0.628	1¼	2.513
6	0.524	1	3.142
8	0.393	⅞	3.590
10	0.314	¾	4.189
12	0.262	⅝	5.026
14	0.224	½	6.283

Write for Quotations

Hamilton Gear & Machine Co.

76 Van Horne St. - Toronto

Elimination of waste effort is the secret of complete efficiency--in a filing job as elsewhere.

A file that has lost its keenness wastes a workman's effort and time, and so costs more than a new file.

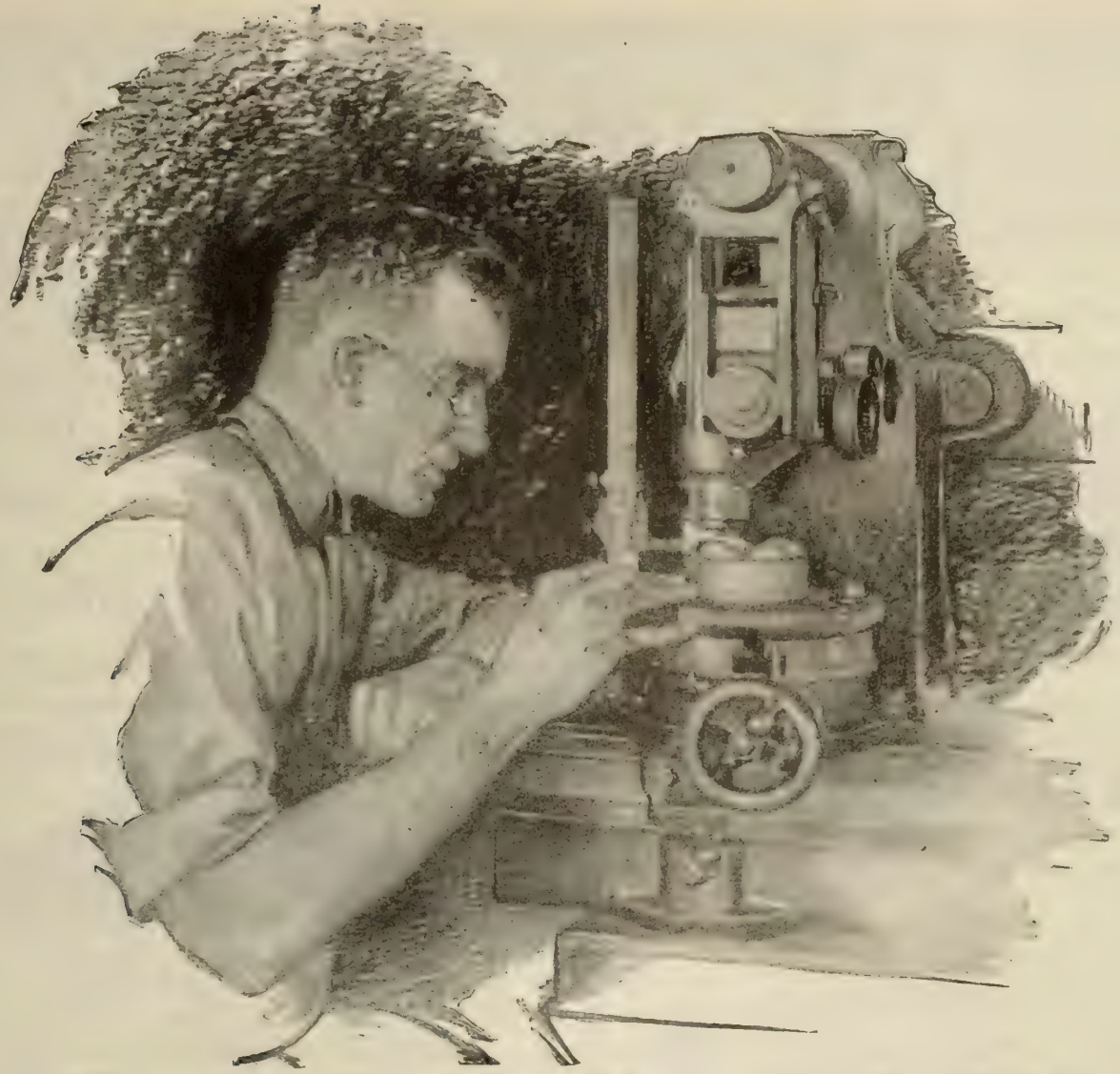
Keep a new file handy to replace the worn one, and for long-lasting efficiency specify one of these brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by:

Nicholson File Company

Port Hope - Ontario



Invariably Dependable

"Good enough" quality and "near enough" accuracy are poor policy—either in making tools or using them.

Men who work metal within close limits know that the quality and accuracy of Starrett Tools are invariably dependable.

2100 of these dependable tools are described and illustrated in the new Starrett Catalog No. 22 "3" Copy sent free on request.

THE L. S. STARRETT CO.

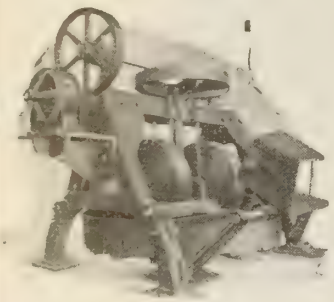
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

42-265

Starrett Tools

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Canadian Steel Foundries Need Frost Improved Sand Mills



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Unloading Device
Motor or Belt Drive

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Jigs, Fixtures, Gauges

SPECIAL MACHINE TOOLS
SPECIAL MACHINERY

General Machine Work and Repairs

Write

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LIMITED
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ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.

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HIGH SPEED STEEL

Tool Steel for Every Purpose
Twist Drills, Music Wire, Steel Balls

Pilot Steel & Tool Co., Ltd.
332 St. James. - - - Montreal

Torrington MACHINE SCREWS

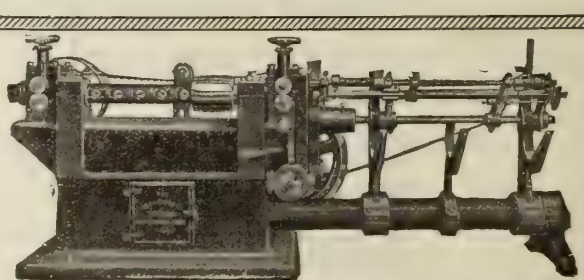
Side Knob and Lock Cap Screws



Let us quote you our prices on your next order. Our quality and service are sure to please you.



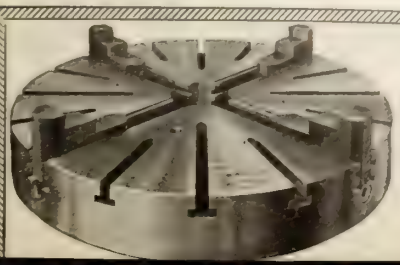
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UPPER BEDFORD, QUEBEC



THE WIRE IS PERFECTLY STRAIGHT

and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

The F. B. SHUSTER COMPANY, New Haven, Conn.
Formerly John Adt & Son. Established 1866.
Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.



IRON BODY INDEPENDENT CHUCKS

They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

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IMPORTERS OF
INDUSTRIAL DIAMONDS
Goods Submitted on Memorandum if Desired
JOHN W. GORDON, Manager
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MANUFACTURERS OF
DIAMOND POINTED TOOLS
All Mountings Fully Guaranteed
Office and Factory:
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Gear Cutting Machines
Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
THE D. E. WHITON MACHINE CO.
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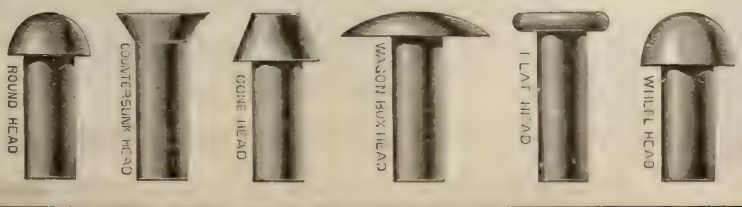
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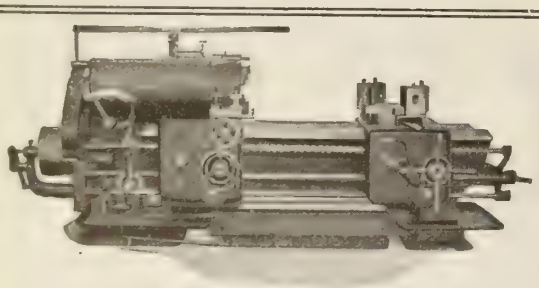


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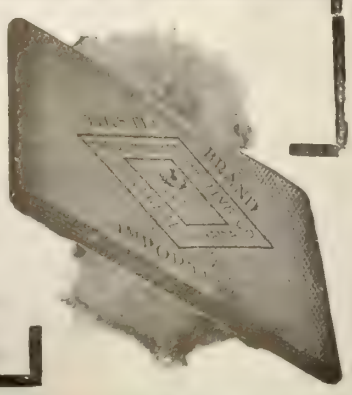
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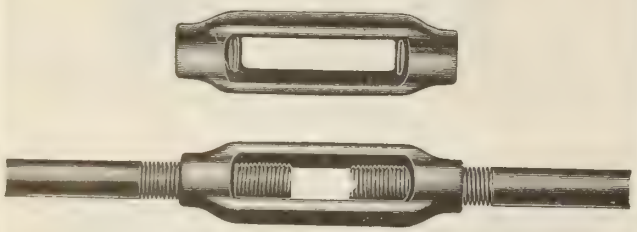


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Petrie, Ltd., H. W., Toronto, Ont.
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Oakley Chemical Co., New York, N.Y.

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Petrie, Ltd., H. W., Toronto, Ont.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., B. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., E., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S. New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd Montreal
Fellows Gear Shaper Co., Springfield, Vt
Petrie, Ltd., H. W., Toronto, Ont
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg Co., Providence, R I
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N Y
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa
Modern Tool Co., Erie, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
[illegible] Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
[illegible] Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
m
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Williams Machinery & Supply Co., A. R Montreal, Que

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont
Atkins & Co., Inc., E. C., Indianapolis.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont
International Nickel Co. of Can., Ltd Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, En
Burke Machine Tool Co., Conneaut Ohio.
Ford-Smith Machine Co., Hamilton, On
Hendey Machine Co., Torrington, Con
Kearney & Trecker Co., Milwaukee, W
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R
Burke Machine Tool Co., Conneaut Ohio
Can. Fairbanks-Morse Co., Ltd., Montre

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Lt Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Oh

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, O
Pratt & Whitney Co., of Canada, Lt Dundas, Ont.
United States Machine Tool Co., C cinnati, Ohio.

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal Q
Ford-Smith Machine Co., Hamilton, Ont
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.
Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que
Jardine & Co., A. B., Hespeler, Ont
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont
Can. Fairbanks-Morse Co. Ltd. Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa
Fisher Motor Co., Ltd., Orillia, Ont

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich
Can. Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot
Brown, Boggs & Co., Ltd., Hamilton, Ont
Terry & Co., John C., Birmingham, Eng.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa
Can. Fairbanks-Morse Ltd., Montreal, Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montréal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Stewart & Co., Duncan, Glasgow, Scot

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can
Can. Blower & Forge Co., Ltd., Kitchener
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Ltd., Montreal Q
Hepburn Ltd., John T., Toronto, Ont

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn
Taylor Instrument Co., Toronto, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Gisholt Machine Co., Madison, Wis

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robuster Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

BUYERS' DIRECTORY

Saws, Band
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Beller.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton,

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

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Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

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Algoma Steel Corp., Ltd., Sault Ste Marie, Ont
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

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Armstrong Bros. Tool Co., Chicago, Ill
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa

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Standard Tube & Fence Co., Ltd., Woodstock, Ont.

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Can. Steel Foundries, Montreal, Que.

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Williams & Co., J. H., Brooklyn, N.Y.

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Atkins & Co., Inc., E. C., Indianapolis, I.

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Can. Steel Foundries, Montreal, Que.

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Northern Electric Co., Montreal, Que.

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Bristol Co., Waterbury, Conn.

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Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Starrett Co., L. S., Athol, Mass.

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Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
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Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.

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Kennedy & Sons, Wm., Owen Sound, Ont

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Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
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Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

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Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio
Geometric Tool Co., New Haven, Conn
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont

Tool Holders
Armstrong Bros. Tool Co., Chicago, I
Bilton Machine Co., Bridgeport, Conn
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

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Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn
National Machine Tool Co., Racine, Wis
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom Steel Products Co., Brantford, Ont
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Tyres,
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
[illegible] Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

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The Canadian Fairbanks-Morse Co Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire, Black Tempered, Music Phosphor Bronze and Premier
[illegible] Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

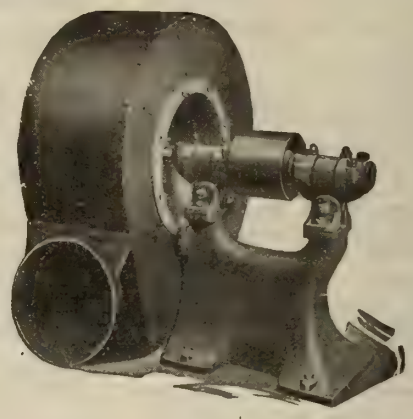
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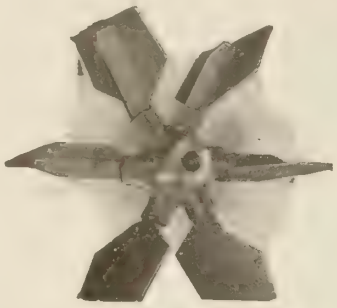
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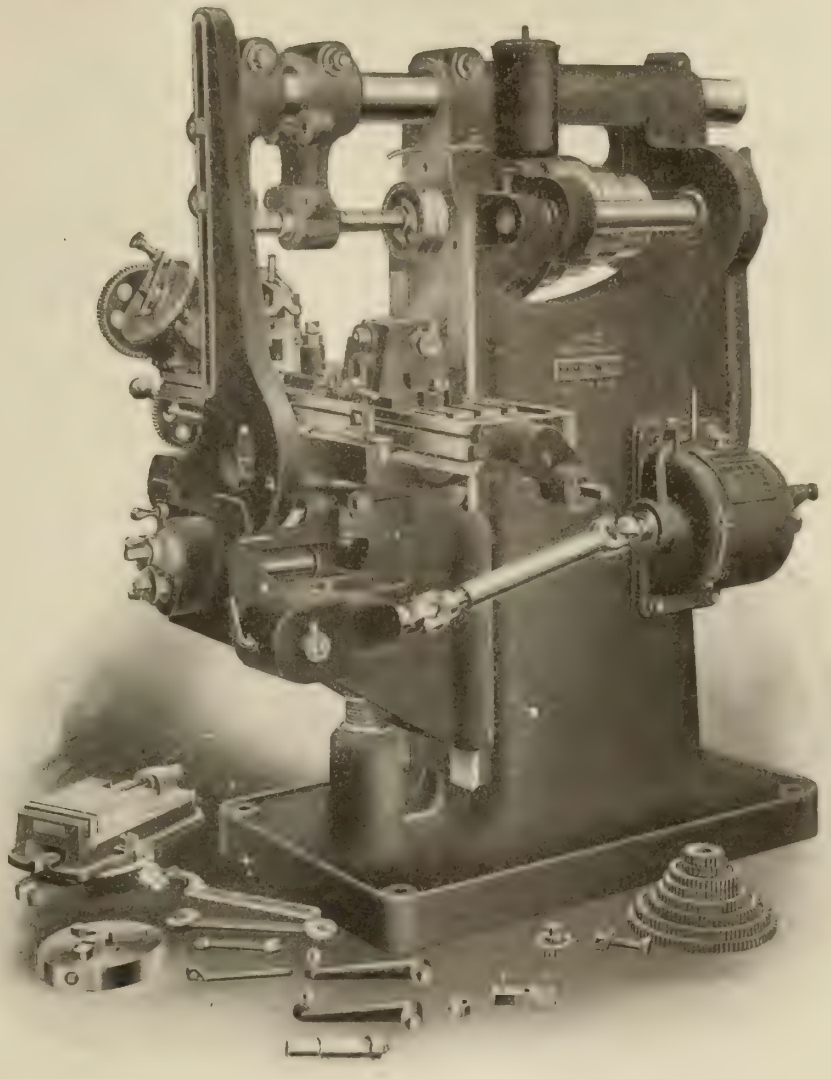
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BLOWPIPES-REGULATORS
FILLING RODS - FLUXES
ACCESSORIES

THE LIQUID AIR Co

SOCIÉTÉ L'AIR LIQUIDE

FACTORIES FOR SERVICE

HALIFAX, THREE RIVERS, MONTREAL, TORONTO,
LONDON, SUDBURY, WINNIPEG, CALGARY, VANCOUVER.

OPERATED IN CONJUNCTION WITH A CONTINENT WIDE NET-WORK OF DISTRIBUTION STATIONS



"Liquid Air" Oxygen Means a Saving in Transportation

With a network of Factories not only planned but in actual operation, and a number of Distribution Stations situated at all large centres all over Canada, Purchasers of Oxygen can obtain their supplies at a point very near to the point of consumption. This comp'etely obviates heavy freight charges on cylinders and assures an immediate supply at any time within a few hours and often minutes after the orders are placed.

All cylinders conform to the specifications of the Canadian Railroad Board and are made to ensure safety without unnecessary weight. When purchasing "Liquid Air" Oxygen you not only save on freight, but in very many cases the cost of cylinder rental is eliminated.



CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVI., No. 25 | Published by the MacLean Publishing Company, Limited, Toronto, Ont. | Dec. 22, 1921 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Greeting

To Our Customers, Friends
and all the People
of Canada—

We Wish You a Merry
Merry Christmas
And a Happy and
Prosperous New Year

VANADIUM-ALLOYS STEEL CO.
LATHROBE, PA.

Manufacturers of

"Red Cut Superior"

The Nationally Known First Quality
HIGH SPEED STEEL

SMALL TOOLS

Pratt & Whitney Adjustable Blade Reamers

These reamers have eccentric relief and can be set to size without regrinding. They are unexcelled for design and simplicity and ease of adjustment.

The eccentrically relieved blades are stronger than others, do not chatter, and produce a smoother hole. The hand, shell and fluted chucking reamers have interchangeable nuts, screws and wrenches. The bottom of a hole can readily be faced.

By a simple adjustment of the blades the reamer can easily be set to size, without regrinding.

Prompt service is assured at our nearest store, where P. & W. Small Tools are carried in stock for immediate delivery. Place your order there to-day.

PRATT & WHITNEY CO.
OF CANADA, LIMITED

Works: Dundas, Ontario

MONTREAL
723 Drummond Bldg.

TORONTO
32 Front St. W.

WINNIPEG
1205 McArthur Bldg.

WINDSOR
Davis Building

VANCOUVER
B. C. Equipment Co

HALIFAX
Roy Building



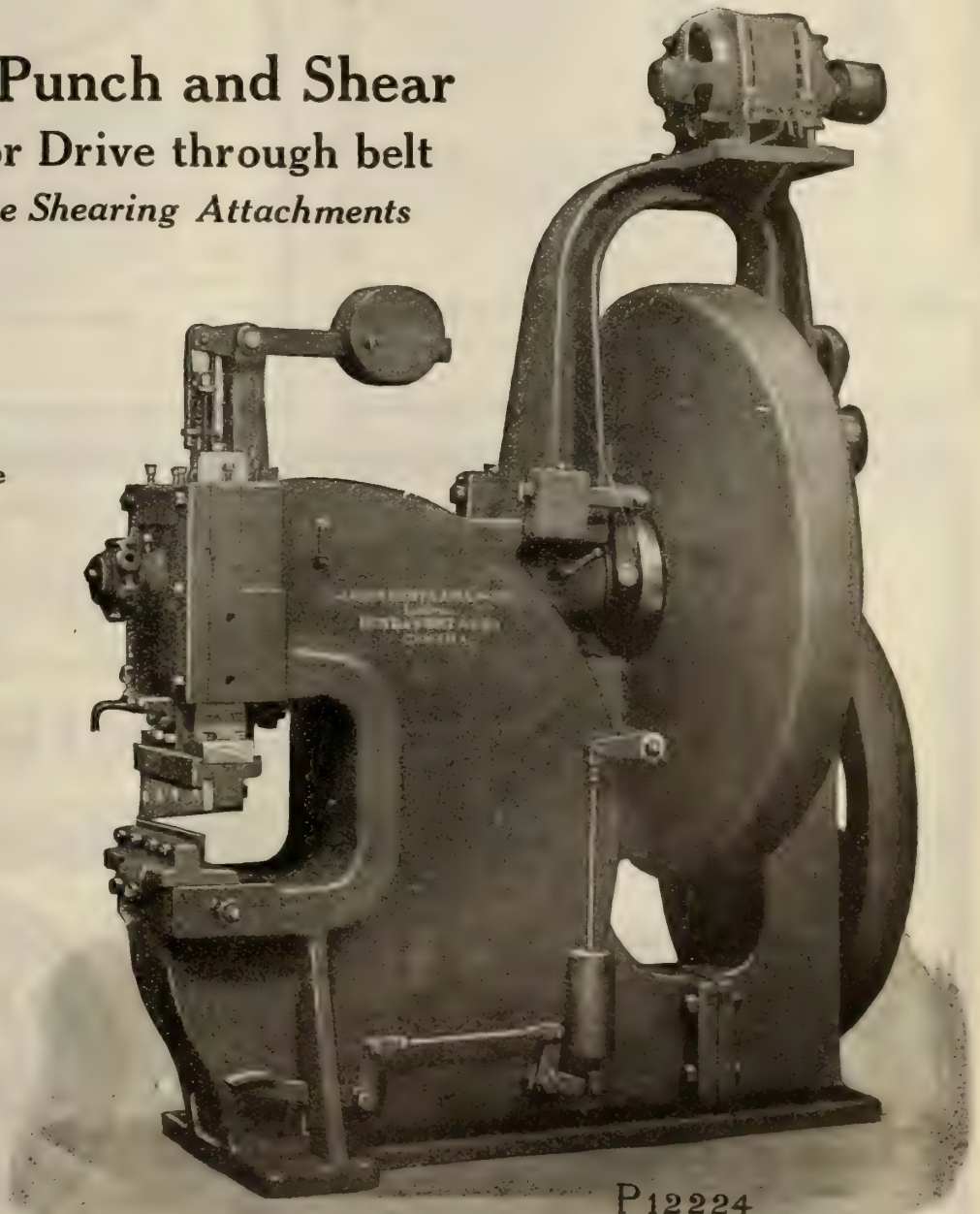
The BERTRAM Page

MACHINE TOOLS

No. 4 Single Punch and Shear

12" Throat Motor Drive through belt

Fitted with Plate Shearing Attachments



CAPACITY

To punch 1" hole through 1" Plate
To shear 1" Plates
To " 6"x1" Flat Bars
To " 1¾" Round Bars
To " 4x4x⅜" Angles

The John Bertram & Sons Co., Ltd.
DUNDAS ONTARIO

MONTREAL
723 Drummond Bldg.

TORONTO
32 Front Street, West

VANCOUVER
609 Bank of Ottawa Bldg.

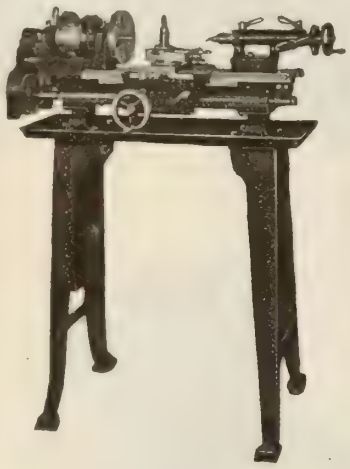
WALKERVILLE
103½ Sandwich St.

WINNIPEG
1205 McArthur Bldg.

HALIFAX
Roy Building

"DALTON SIX"

"The Small Lathe for the Big Job"



Type B-4

—

Actual Swing 7¼ inches

Made with 30" and 36" Length of Bed

—

Write for Bulletin BC-650

Also Manufacturers of Type B-6 Lathes

Dalton Manufacturing Corporation
Sound Beach, Connecticut, U. S. A.
Cable Address "ALEDAL Stamford"



Why Buy So Many Tools?

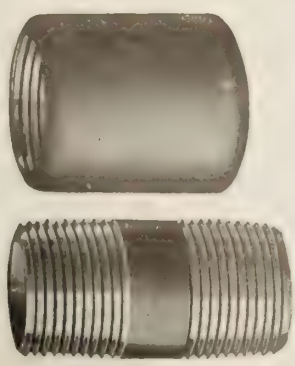
Why buy inferior tools of short duration when genuine ARMSTRONG TOOLS are just as easy to obtain. The longer life and greater usefulness of ARMSTRONG TOOLS means money in your pocket.

Write for free catalogue.

ARMSTRONG BROS. TOOL CO
"The Tool Holder People"
306 N. Francisco Ave. Chicago U. S. A.

WROUGHT PIPE
COUPLINGS and NIPPLES





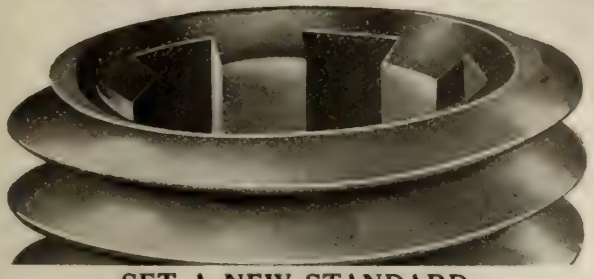
Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

Supplied in black, or galvanized.

THE STEEL COMPANY OF CANADA LIMITED

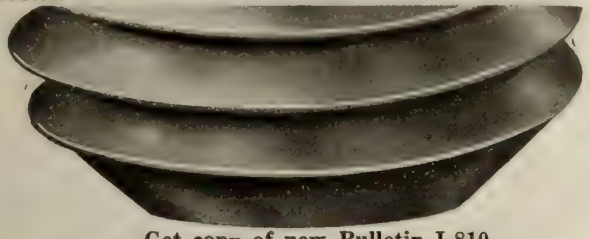
HAMILTON MONTREAL

TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE
PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.



Get copy of new Bulletin I-810
THE BRISTOL COMPANY
Waterbury, Conn., U. S. A.

THREE WINNERS!
COVERS ALL BEARING NEEDS



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



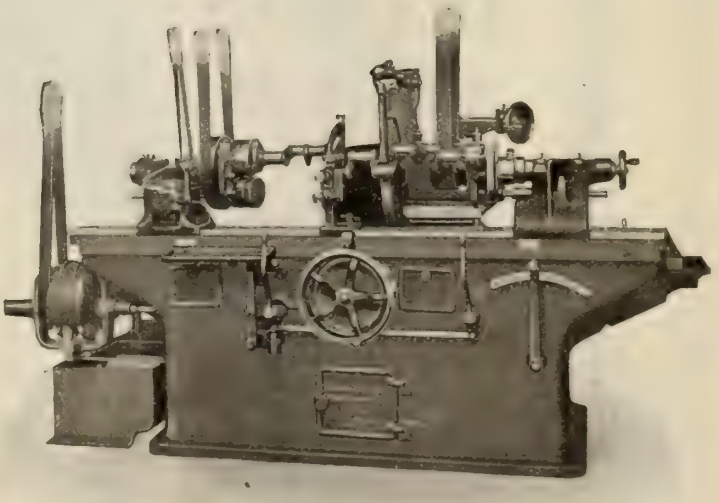
Matchless

Suitable For Slow-Moving Bearings
Write For Prices

THE CANADA METAL CO., LIMITED
TORONTO WINNIPEG HAMILTON VANCOUVER MONTREAL

LANDIS

NO. 4-A SPECIAL GRINDING MACHINE



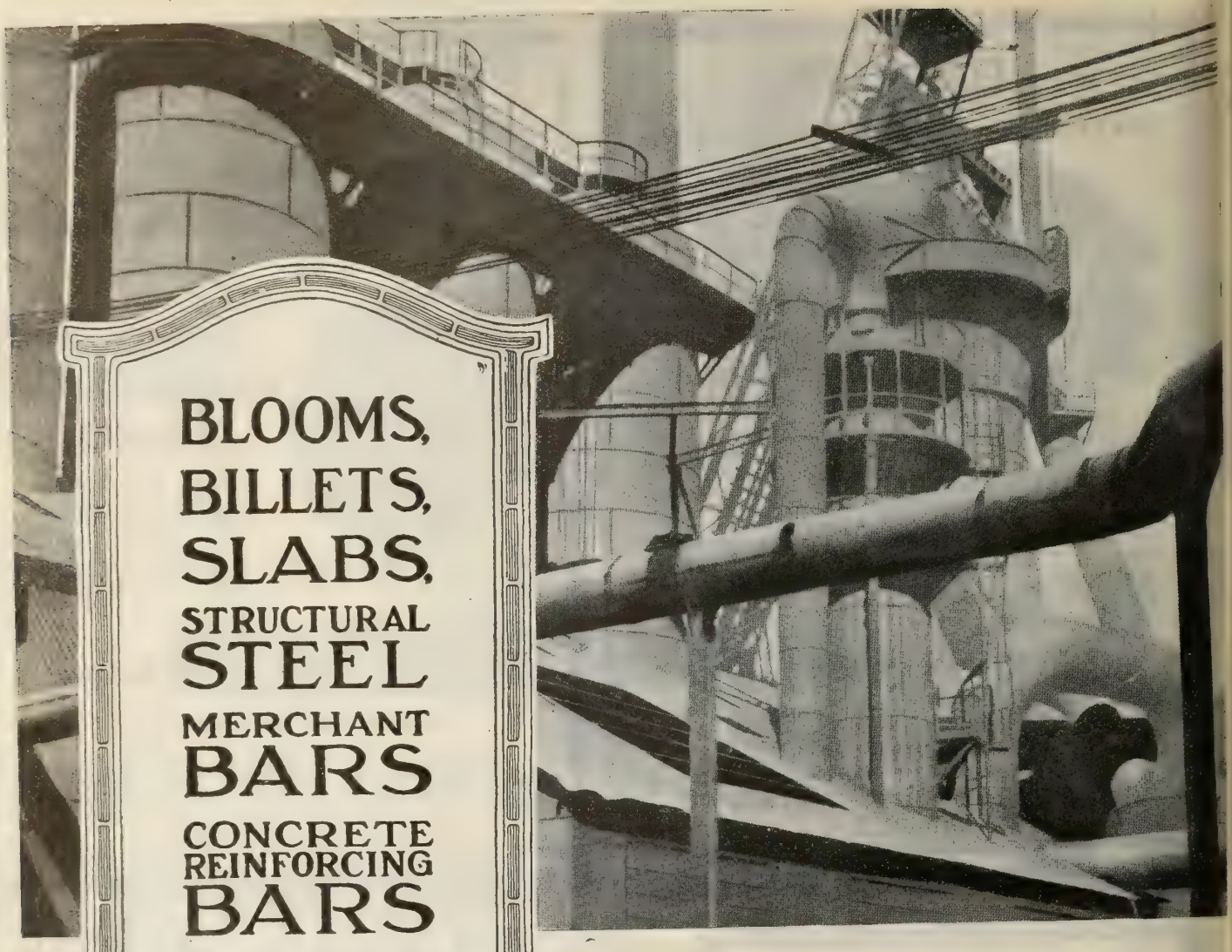
Thousands of grinding jobs are going begging in the automotive repair fields to-day—simply because repair men are not catering to the demand.

Ground parts give real service. The car owner gets full value and the shortened time on the repair work gives a quick delivery of his car for which service he willingly pays.

A Landis No. 4-A Special Grinding Machine is daily earning big returns in a great many repair shops and garages and with even a small amount of repair work, a Landis gives you a good profit. The machine is particularly adapted for all classes of repair work such as regrinding crankshafts, pistons, piston pins, valves, transmission gears, in fact any repair job for automotive engines.

Let us send you complete detailed information.

LANDIS TOOL CO., Waynesboro, Pa.
NEW YORK OFFICE: 51 CHAMBERS ST.



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BILLETS,
SLABS,
STRUCTURAL
STEEL
MERCHANT
BARS
CONCRETE
REINFORCING
BARS
IRON, BRASS
AND BRONZE
CASTINGS

STEEL RAILS
Open Hearth Quality
(All Sections from 12 lbs.
to 100 lbs. per yard)

SPLICE BARS
STEEL
TIE PLATES
PIG IRON
BASIC FOUNDRY
MALLEABLE
SULPHATE OF
AMMONIA

OPEN HEARTH ALLOY STEEL

CHROME-VANADIUM CHROME-NICKEL NICK

All of these steels we supply in
HOT ROLLED BARS

SULPHURIC ACID *NITRE CA*

Order from us and you'll get both quality and prompt service.
A trial is convincing

MARK OF ALGOMA O.H. QUALITY

ALGOMA STEEL CORPORATION, LTD.

SAULT STE. MARIE, ONTARIO
SALES OFFICES:
Montreal: 606 McGill Building
Toronto: Bank of Hamilton Building

NAMCO

CAP & SET SCREWS



STANDARD

S.A.E., U.S.S. & "V" Cap Screws, U.S.S. Set Screws, S.A.E. Plain and Castellated Nuts, U.S.S. and "V" Semi-Finished Nuts, Studs

SPECIAL

Screw Machine Product up to 2¼" diameter to sample or blueprint made up promptly. Hardened and ground product to specifications.

THE
NATIONAL ACME COMPANY
MONTREAL, P.Q.

AN IMPORTANT QUESTION

For the Advertiser to Answer

Is the Publication Soliciting Your Business a Member of the Canadian National Newspapers and Periodicals Association?

YOU would never engage a man on an important piece of work until you gained a thorough knowledge of his qualifications. It would not be wise. You first of all require a clear record of his character and ability, in addition to a statement of his aims and aspirations. When you are in possession of this information you have a real basis for judging his fitness to serve you.

It is just as important that you should know the character, ability and aspirations of the publication in which you desire to carry your business message.

You should know if the paper is circulating and has an influence among those men who are responsible for results—the men who buy, or influence the buying, of machinery, tools, power and any other equipment or merchandise which you may sell.

Facts are essential. When you are in possession of the facts you can make every dollar spent for advertising a judicious investment. To enable the advertiser to make such judicious investment is the purpose of Canadian National Newspapers and Periodicals Association. From this Association the advertiser may secure complete information concerning the character and aims of the leading Canadian publications. The facts are fully presented for your consideration—and they are presented RIGHT.

CANADIAN MACHINERY

is a member of the Canadian National Newspapers and Periodicals Association, along with the following publications which constitute the Association's Technical Newspapers Section:

Canadian Engineer
Canadian Foundryman
Canadian Machinery
Canadian Manufacturer
Canadian Railway and Marine World
Construction
Contract Record and Engineering Review
Dominion Dental Journal
Electrical Dealer & Contractor
Electrical News
Marine Engineering of Canada
Municipal World
Power House
Sanitary Engineer

Canadian National Newspapers & Periodicals Association

70 Lombard St., Toronto

BANFIELD

Have you some article you want to place on the market but not the equipment to manufacture it? We can probably help you.

Metal Stamping, Drawing, Finishing and Assembling. Light machine work such as Gears, Pinions, etc. Prices cheerfully quoted.

W. H. BANFIELD & SONS, LIMITED

370-386 Pape Ave. - - Toronto

STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open - Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
New Glasgow, N.S.

Sales Offices:
Western Room 14 Windsor Hotel
MONTREAL

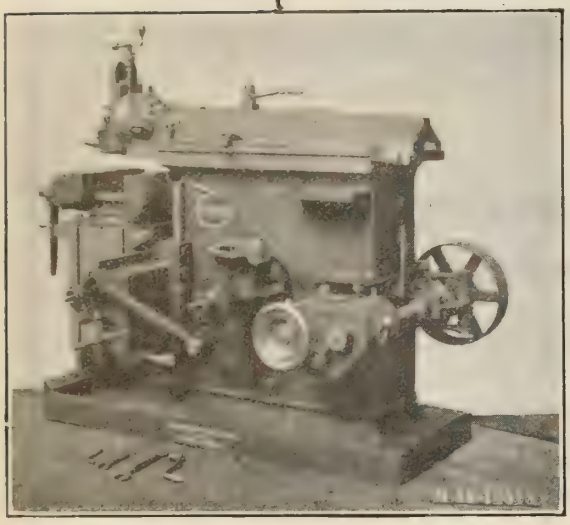
Steel Ingots
by the
HARMET
Liquid Process



THE JOHNSON FRICTION CLUTCH

The Bertram Crank Shaper is started and stopped with a Johnson Clutch





John Bertram & Sons, Ltd., Dundas, Ontario, are building a shaper that is designed *right* from the practical standpoint of the user. Countershaft and tight and loose pulleys have been abolished in favor of friction clutch control—control that is immediate, and placed right under the operator's hand.

And Bertram has wisely selected the Johnson Clutch.

On a shaper, especially, convenient control is a valuable feature. But a good clutch is an essential on any machine —and there is none that will equal the Johnson.

Write for our Yellow Catalog.

Canadian Agents:

Williams & Wilson, Ltd., 84 Inspector St., Montreal.
Canadian Fairbanks-Morse, Ltd., Montreal, Toronto, Winnipeg.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

Clean Gasoline—Easily Available



Write for Illustrated Booklet C-13

The gradual return to 100% production and the change from a seller's to a buyer's market demands that manufacturers reduce their overhead to a minimum.

An important step in this direction is the installation in your plant of Bowser Piston-Type Measuring Pumps for storing and handling gasoline.

Bowser Equipment will save you time and labor by giving you an easily available supply, no matter where the gasoline is needed. Bowser Pumps guarantee to manufacturers clean, dry gasoline and afford an accurate check on all disbursements. Bowser accuracy eliminates spillage in transfer and the perfected construction makes evaporation impossible.

There is a Bowser Piston-Type Measuring Pump to meet your every requirement.

Bowser Equipment is MADE IN CANADA by
S. F. BOWSER CO., LTD., 1368 Fraser Ave., Toronto, Ont.

BOWSER
ESTABLISHED 1885
PISTON-TYPE MEASURING PUMPS



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

Heavy Foundry and Machine Work for Machine Builders

Our Foundry Equipment enables us to handle work up to 75 tons per piece in Grey Iron or Semi-steel, mixtures to suit your requirements, clean castings of uniform quality and prompt deliveries.

Machining when required. Boring and turning capacity to 35 ft. diameter, 18 ft. high.

Your inquiries with blueprints and specifications will have prompt attention.

Dominion Engineering Works, Limited

Telephone Melrose 700.

MONTREAL, CANADA

Cable Address: "Domworks, Montreal."

R. F. MATHER, Western Representative, London Bldg., Vancouver, B.C.

M-38)

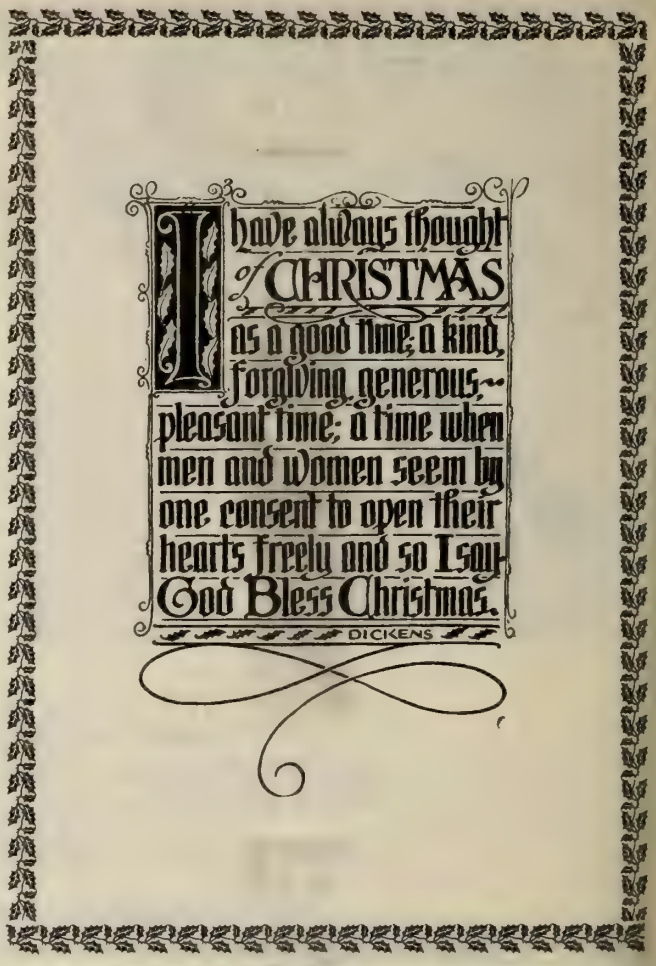
Labor cost is the big item in a filing job. Money is saved in the long run by discarding a file that has got the least bit dull and buying a new one, because a dull file means two or more strokes where one should do the work. The following brands will be found to give maximum service before showing wear:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

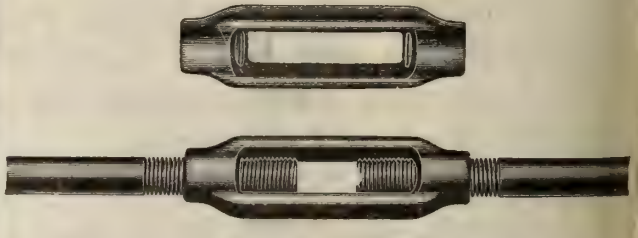
Nicholson File Company

Port Hope - Ontario



CANADA FOUNDRIES & FORGINGS LIMITED

Drop Forged Steel



SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

THE WILLIAM KENNEDY & SONS,
LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

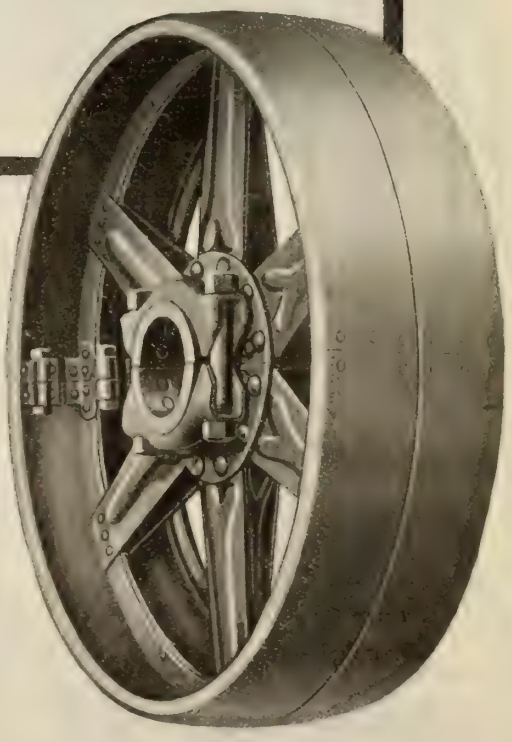


Pulleys that Transmit Maximum Power

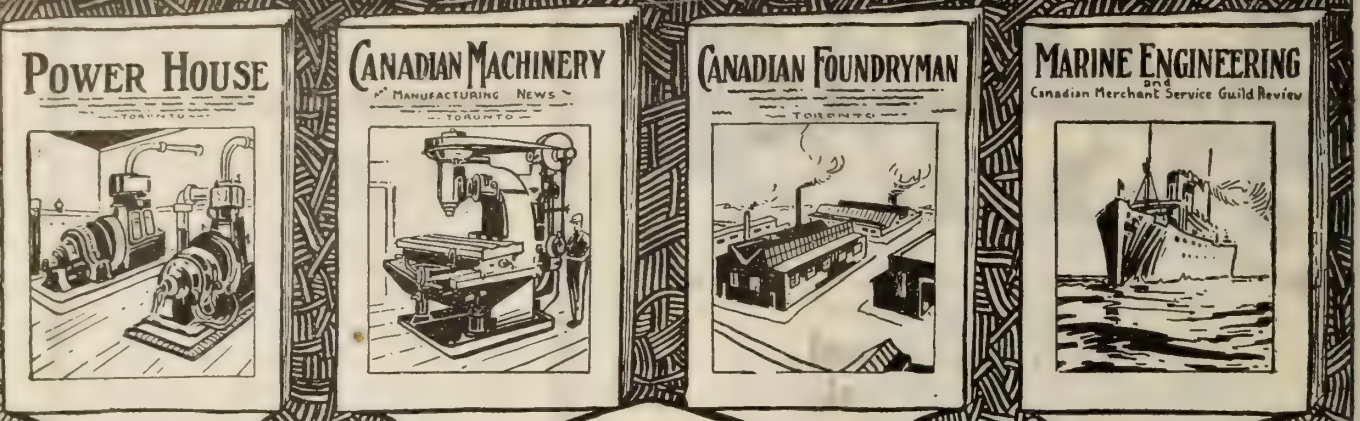
"AMERICAN" Pulleys transmit maximum power because their co-efficient of friction is high. Carefully balanced, they prevent vibration. Light in weight, they reduce friction on the bearings and increase the available power for production. Stronger than cast iron or wood, they are more durable and stand shock and overload better.

A booklet, "Getting Maximum Pulley Efficiency," shows in detail just how much such points can really amount to, and will be sent upon receipt of your address.

The American Pulley Company
Philadelphia, Pa.



AMERICAN
STEEL SPLIT
PULLEYS



For

Self-Promotion And Sales Promotion

Are you interested in any of these fields—power—metal working —marine? As a manufacturer, or purchasing agent, as a superintendent or foreman, as an ambitious mechanic or engineer?

Use These Publications

They will keep you strictly up-to-date in all branches of mechanical engineering. Edited by practical men. Cheerful, inviting, instructive, authoritative.

POWER HOUSE

Twice a month—$2.00 per year.
Serves the power plant engineer—Steam, Electric, Refrigeration, Hydraulic.

CANADIAN MACHINERY

Weekly—$4.00 per year.
Covers the metal working field—serving shop executives, purchasing agents and owners. First-class mechanical paper and market paper combined.

CANADIAN FOUNDRYMAN

Monthly—$2.00 per year.
A paper for the foundry owner, superintendent and foreman. Claimed by its readers to be unexcelled.

MARINE ENGINEERING

Monthly—$2.00 per year.
Interprets marine engineering in its broadest sense, serving the shipbuilders, navigation companies and their officers. (The editor holds an extra first-class B.O.T. certificate.)

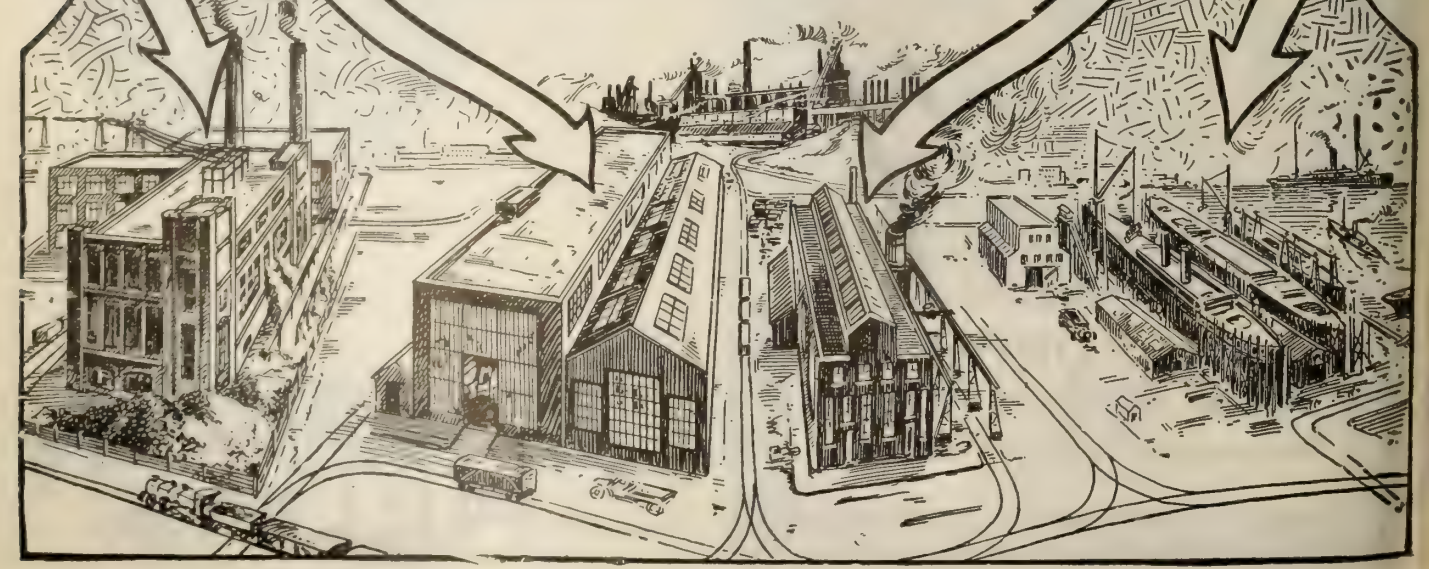
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THE MACLEAN PUBLISHING CO., LIMITED

143-153 UNIVERSITY AVE., TORONTO

A company whose idea of service has made it the largest concern of its kind in the British Empire.
Thirty years' experience and dozens of practical men in your own line, stand ready to serve you. Let them! Subscribe for your paper to-day.

Men with selling problems will find a profitable tip in the statement made by a prominent manufacturer recently, "I use MacLean Publications because I am satisfied that papers with such a high standard of editorial excellence, MUST have an influential following."



Bilton

GEAR MILLERS

WHEN you think of cutting small gears of every description, associate the name of **"Bilton."**

Bilton Automatic Gear Millers conform to almost every phase of small milling work. Their speed, positive and accurate indexing, and easy control make them economy tools on work such as cutting spurs, bevel metres, taps, cylinders, angle gears, and many other operations.

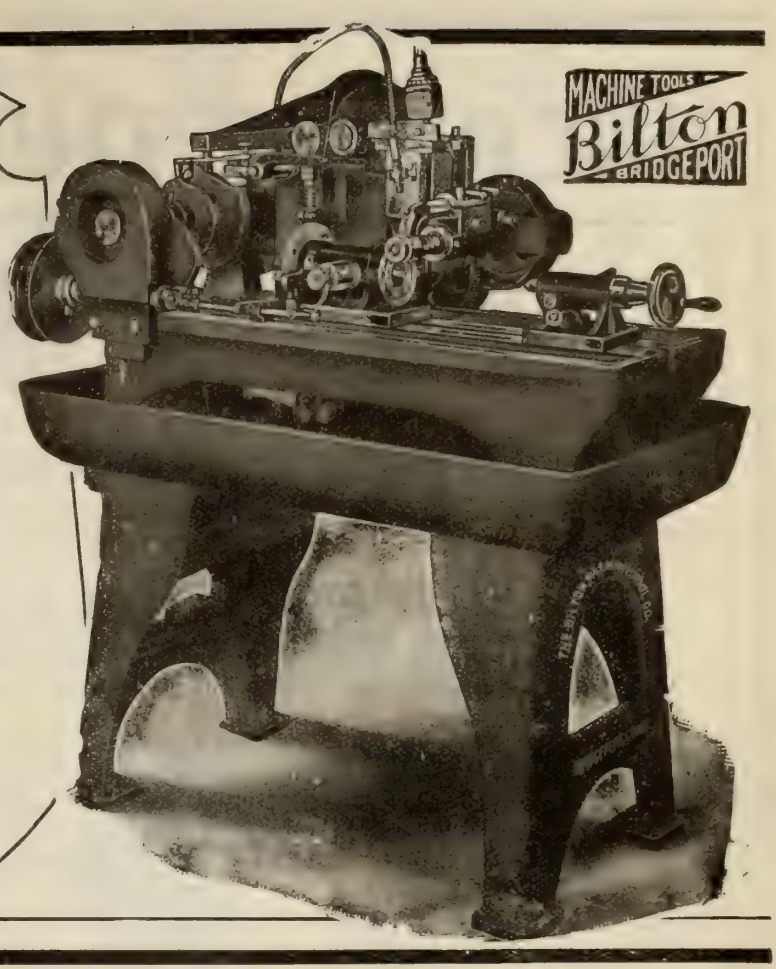
Big business everywhere is adopting the Bilton for high production on accurate work.

May we send you our catalogue?

Bilton Machine Tool Company

Bridgeport, Conn., U.S.A.

Foreign Agents:
Alfred Herbert, Ltd., Chas. Churchill & Co., Ltd.
M. Mett Engineering Co.

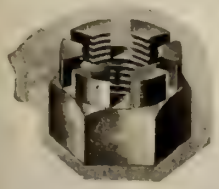




ACCURACY

Just now all jobbers should have a complete stock of SAE Cap Screws, Plain and Castellated Nuts and Taper Pins to meet the automobile repair trade requirements.

Your rush orders filled promptly by



The Galt Machine Screw Co., Limited

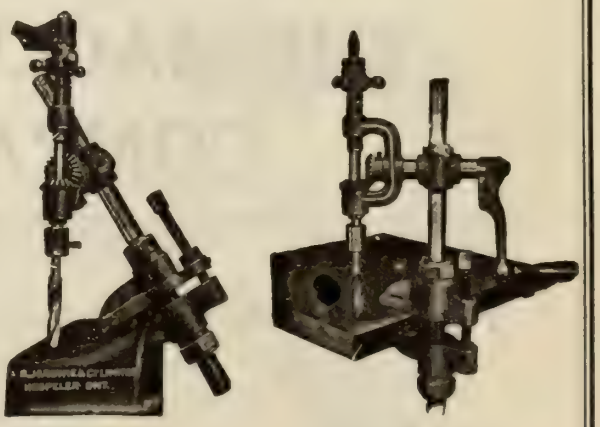
GALT, ONTARIO

Eastern Representatives:
Messrs. F. BACON & COMPANY
131 St. Paul Street West, Montreal, Que.

Western Representative:
Mr. D. PHILIP
133 Portage Avenue Winnipeg, Man.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A.B. JARDINE & CO., Limited

HESPELER, ONTARIO

INCREASE THE CAPACITY OF YOUR MERCHANT

There are two kinds of business policies of the merchandising field to-day.

The first believes the goods are sold when they have been sold to the merchant. Having bought the goods it is up to him to sell them and to get rid of them the best way he can.

The other thinks of merchants in terms of their capacity to sell his goods to the ultimate consumer, and having sold them to keep them sold and keep them coming back for more. The former very often finds new competitors coming into the field, and taking away a great deal of the business he has come to expect should be his.

The second approaches his merchant on a man to man basis. He encourages him to build. He shows him clearly and carefully what he is doing to help him create a market for the products he is distributing. Through the business newspapers the merchant reads, he shows him the turnover possibilities in his line. In fact, he shows him how to make more money for himself, and incidentally make more for the wholesaler or manufacturer.

The second and most successful type of business realizes that training does not stop when he has trained and sold his own selling force on the goods he is merchandising. He realizes that this is only a beginning, that the great force of retail merchants who finally dispose of his goods to the ultimate consumer must be trained, must have knowledge, must have information, so they in turn can prove and sell the ultimate consumer.

The one great way to reach the merchants who are selling your goods is through the MacLean Trade newspapers, which merchants are reading every day and every week of the business year. They are reading them for new ideas, methods, for merchandising plans, for schemes to make more money. Now as never before they are studying the market pages and price quotations of every issue. Firms who are taking advantage of this avenue to better business are finding results far in advance of their expectations.

THE MACLEAN PUBLISHING COMPANY LIMITED

TORONTO MONTREAL WINNIPEG VANCOUVER

Publishers of the following specialized trade and technical newspapers

Trade Newspapers

Weekly

Druggists' Weekly
Hardware and Metal
Canadian Grocer

Monthly

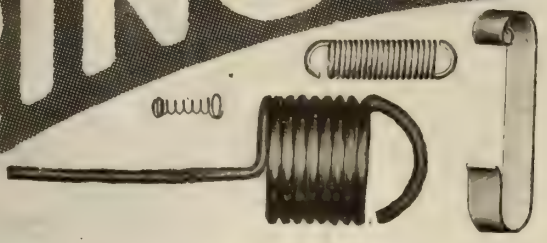
Dry Goods Review
Men's Wear Review
Sanitary Engineer (Semi-Monthly)
Bookseller and Stationer

Financial

The Financial Post

SPRINGS

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO



ALL STYLES and SIZES

Spiral Springs, Hook Springs, Common, Coil Springs, Flat Springs—in fact we can supply any design you may desire. Get our prices before placing your next order. Expert advice gladly submitted on request.



THE WALLACE BARNES CO., LIMITED, Main St. W., Hamilton

ELK BRANDS FIRE BRICK

Our Brands:
"Elkco"
"Elkco" Special
"Elk Steel"
"St. Marys"
"Keystone"
"M.D. Elk"
"Rotex"
"Elk Dust"
"Keystone Dust"
"Rotex Dust"

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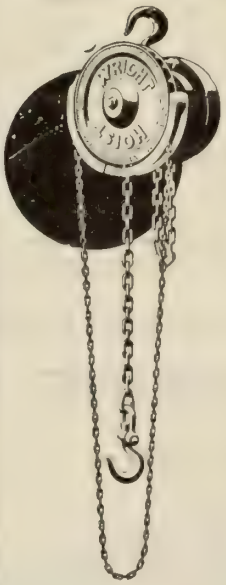
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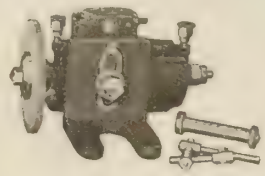
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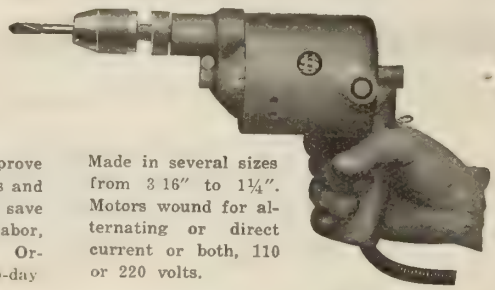
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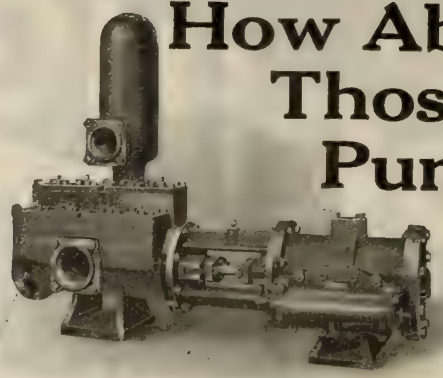
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MANUFACTURING NEWS

VOL. XXVI No. 25 DECEMBER 22nd, 1921

Various Jigs Used in Making Marine Engines

Milling, Drilling and Boring Operations on Cylinders—Machining Top Pads and Intake Ports—Drilling Valve Stem Holes—Drilling Exhaust and Intake Manifold Flanges.

By ROBERT MAWSON

THE manufacture of marine engines entails considerable organization work before they can be made at a productive rate. Without going into the preliminary work involved, we shall discuss some of the fixtures used in manufacturing a 4 cycle vertical six cylinder marine engine, having a 6¼ in. bore and a 7¾ in stroke, and developing a horse power of 250 at 1500 r.p.m.

Milling Operations

Fig. 3 shows the set up for one of the milling operations. The casting is pushed back into the fixture against a stop at the rear, and rests on the height locating pins A. The screw poppet B is raised against the surface shown, this holding the casting against machining stresses. The straps C hold the cylinder in place. The base of casting is machined with inserted cutter D, and the exhaust ports and water jacket flange milled with another cutter E, also of the inserted blade type. Both faces are milled at one time, and once the cutters are set correctly, all cylinders machined will have their machined surfaces in the same relative position, as the locating medium is a fixed surface.

Fig. 4 illustrates the next milling operation, this being the machining of top pads and intake ports, also water jacket flange.

The casting is placed on machined base of fixture, resting on steel pads at A, being fastened down by means of hook bolts, one of which may be seen at B. The edge of the casting rests on pads C, and two tapered straps D are tightened to hold the cylinder securely against the machining stresses. It will be noticed that fixture is made on an angle, the purpose of this being that the pads on the top along line E, will be in a vertical plane.

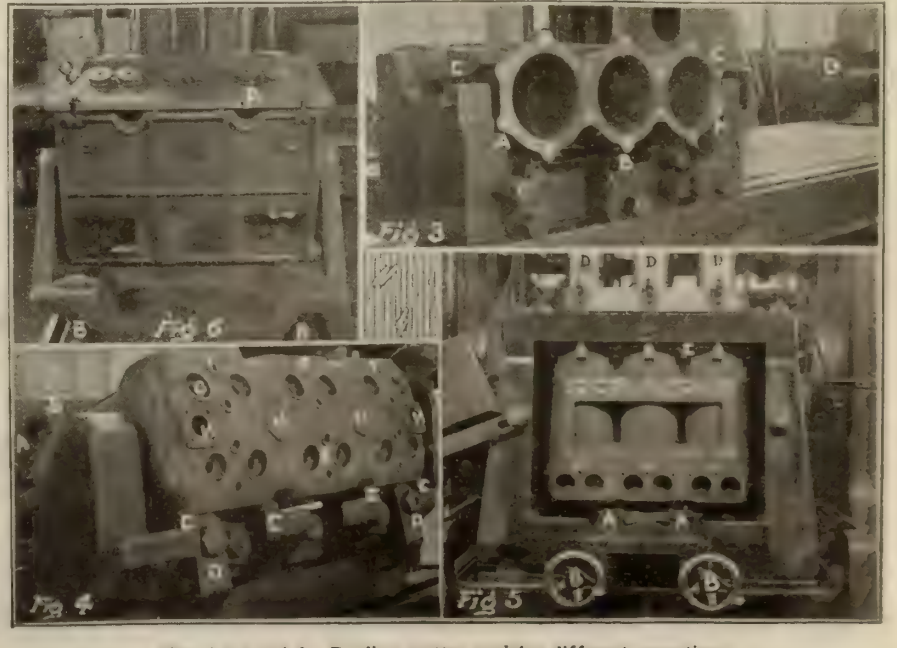
The inserted cutter for machining water jacket flange at F is placed on an angle so that the surface milled will be horizontal in relation to the cylinder bores. The reason for this may be noted by referring to the design of the milling fixture. The pads along line E are also machined at the same time with another inserted tooth cutter, correctly set to obtain the proper position on the cylinder.

The casting is then reversed and the edge at F placed in contact with stops C, being held in a manner similar to that already described. The pads along the line G are now machined, these being in a vertical plane owing to the angular design of the fixture. The pads at H are machined in a separate operation, the cylinder being placed on its machined base. As these pads are in a similar plane to the base no special fixture is necessary.

The operation of boring the cylinder is shown in Fig. 5. The casting is placed on steel ways A, being pushed back against a stop at rear of fixture. The two hand wheels B are then operated which raise the ways, and also the cylinder, until two dowels enter holes in the base which have been previously drilled and reamed. The three cutter heads are now fed down, and the holes bored to 6¼ inches.

The jig used when drilling the valve stem holes in cylinder is illustrated in Fig. 6. The casting is placed as shown, being located by means of two dowels that fit into holes previously drilled and reamed in the base flange. The casting is then fastened in the jig with straps to hold it securely, and the cover A placed in position, this being fastened with the swinging bolts shown. The fixture is oscillated over to one of the angular positions, as the holes to be drilled are at an angle, as may be noted by referring to the design of the cylinder.

Six holes are drilled and reamed to ⅝ inch. The oscillating member of jig is then placed into the other setting; another jig plate substituted; then six more holes drilled, these being of the same size already noted. An interesting feature of this jig is the provision made



Figs. 3-4-5 and 6. Reading matter explains different operations.

to slide it back for the drilling, circular tracks B being attached to the base of fixture and rollers fitted to jig so that the fixture may be conveyed backward and forward with the least friction and energy on the part of operator. Various stops and screws are used to fasten against casting thus assisting in holding it against the machining stresses. These may be observed by referring to the illustration.

Fig. 7 shows the jig used to drill the exhaust and intake manifold flanges on cylinder. The casting is located by means of two dowels which fit into reamed holes in the base of the cylinder, similar to the last jig. Straps are then tightened to this, holding the piece securely in the jig. The casting and tool are then placed into position shown, being located with the latches A, which are provided with machined stems that fit into steel bushings in bosses B of the main jig, also in steel bushings in the bosses C of the oscillating member of the tool. Steel plungers D operated with knob screws E then brought against the surface of the sliding member of the jig in order to hold it securely with the locating latch pins in position. The exhaust manifold flange holes are then machined, the drills being guided through the steel bushings in the horizontal member F of the jig.

The locating latches are now withdrawn and the oscillating member of the jig swung around 180 degrees, when the surface F will be at the lower side, or where the wall G is shown in the illustration. The intake manifold flange is then machined in a similar manner to that noted for the other flange, the oscillating member of the jig being located and held by means of the latch-pins which fit into the bushings in b sses H and C.

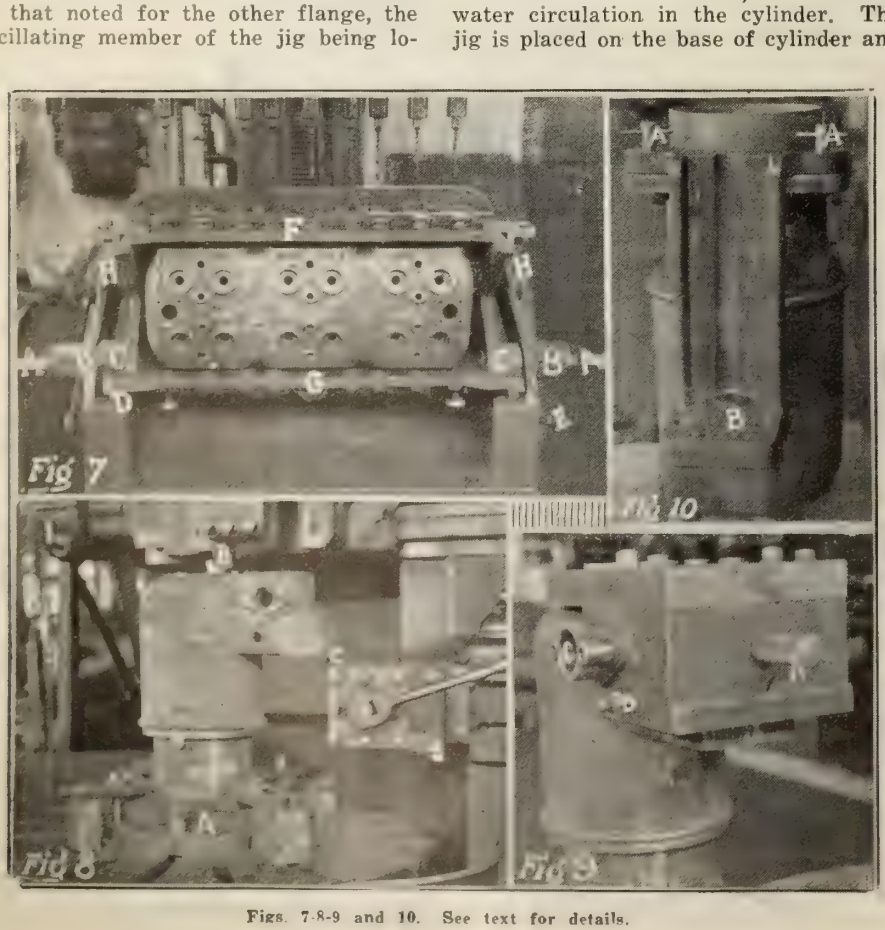
Machining Cylinders

Fig. 8 shows the machining of top of cylinder, and under surface of intake and exhaust port flange on a vertical turret lathe. The casting is located on machine by means of plate A, which is provided with a machined register that fits the inside bore of the cylinder, this having been previously machined.

The casting is then held down on the register plate, also the machine table, with the four clamps as shown. The top of cylinder is turned with tool B, and the under surface of intake and exhaust port flange machined with tool C, each turning tool being held in tool posts of machine in the usual manner.

The jig at Fig. 9 is used when drilling the various holes on upper end of the cylinder. The tool is placed onto the casting and located with the knurled handle pin A, this fitting into a cored hole in the cylinder. A screw at the rear is afterwards tightened, this action forcing the jig back against fixed stop B. The cylinder and jig is then placed on its side and a 1¾ inch hole drilled and reamed through bushing C. Holes are also drilled through the small bushings on each side of C, the latter holes being afterwards tapped ½ inch. The jig and casting is then paced in position illustrated and six 3-8, four 7-16 and one 11-16 inch holes machined, bushings being provided to guide the drills. Fig. 10 shows jig used when drilling holes for the exhaust manifold, also for the water circulation in the cylinder. The jig is placed on the base of cylinder and located by means of two pins A, which fit into reamed holes previously machined. With the tool in position shown five 5-16 inch holes are drilled for the water circulation, and two 17-32 inch holes for the exhaust manifold.

Many other fixtures of interest are needed to complete these engines, but sufficient have been shown for the present.



Figs. 7-8-9 and 10. See text for details.

ELECTRIC COOKING ON RAILWAY TRAINS

There was inaugurated recently on one of England's main lines a unique service, that of electric cooking for the dining cars. The train thus unusually equipped possesses many exceptional features. It consists of five coaches which are run on six bogies only, these bogies being placed underneath the junction of two carriages, thus linking up the carriages on what is kn wn as the articulated system. This arrangement gives very easy running and makes it possible to shorten the connections between the carriages. In the kitchen all the cooking is done electrically. The equipment includes a water boiler, a grill, a steaming oven, a roasting oven, vegetable boilers, steaming pans, hot plates, hot cupboards, fish fryers, kettles, etc. This kitchen is capable of furnishing meals for 78 persons at one sitting, and over one hundred dinners have been cooked and served on one trip. The electrical energy for the cookers is obtained from two dynamos driven through belts from the axles of the carriage. These generators work in conjunction with a battery of 80 cells, carried in boxes below the under frames. In addition to the cooking apparatus, there is a hot water tank of 44 gallons capacity, which is heated up at terminal stations by connecting with the station electricity supply. The apparatus, which has been in service for some time, has been giving complete satisfaction.

GREASING DEVICE

A British firm has brought out a device which makes the grease filling on motor cars a simple, clean process, or at least as clean as it possibly can be. The device is fitted to the tin containing the lubricant, and has a screw with a nut which takes the form of a leather-packed piston of the diameter of the tin.

As the handle attached to the device is turned, this piston is forced down upon the grease, which is thus squeezed out of a hole in the bottom of the tin into the base of the device. From this, in turn, it emerges through a spout from which syringes, lubricators, etc., can be filled. In addition to avoiding the soiling of hands, this simple invention has the advantage of keeping the grease free from grit and dust which gathers in tins which have to be frequently opened.

Handling Material by Compressed Air

A Considerable Amount of Time is Wasted Each Day in Industrial Plants—This Condition Can be Largely Overcome by Up-to-date Lifting Machinery Being Installed.

By F. A. McLEAN

THE PROCESS of handling and placing material is one of the greatest time killers in a modern industrial plant, and in most cases it is a condition that is easily remedied. Each time an employee calls a fellow workman away from his machine, bench or task, to help him in lifting or placing material, the firm who employs them is losing money. By the use of proper hoisting and lifting appliances it is possible to overcome this waste and keep the men at work on the tasks which they are paid to do. Hand operated chain hoists, while of considerable assistance in doing away with this trouble, are not always desirable for the reason that no matter how easy it may be to operate them, they are dependent on human energy for their power, and as the day progresses, the workman through fatigue is not able to work at as high speed as he did in the earlier hours of the day, and with some of the cheaper hoists there is the possibility of the man straining himself by trying to raise too heavy a load.

The use of a power operated hoist enables the workman to maintain the same speed throughout the day, so that the matter rests on the selecting of the type of hoist best suited for the work to be done. Steam hoists due to their bulk are out of the question for interior use, so that a choice must be made between compressed air and electric hoists.

Pneumatic hoists may be divided into two general classes, the direct acting or straight lift type in which the load is raised by air under pressure acting directly on a piston with rod and hook to which the load is attached, and the rotary geared motor driven types in which a number of reciprocating cylinders and pistons, an engine of the square piston type, or a motor containing vanes or blades is used to transmit a rotary motion to the hoisting drum. Hoists of the motor driven types are capable of much longer lifts than the straight lift types and require less head room.



A direct lift hoist of the air balanced type

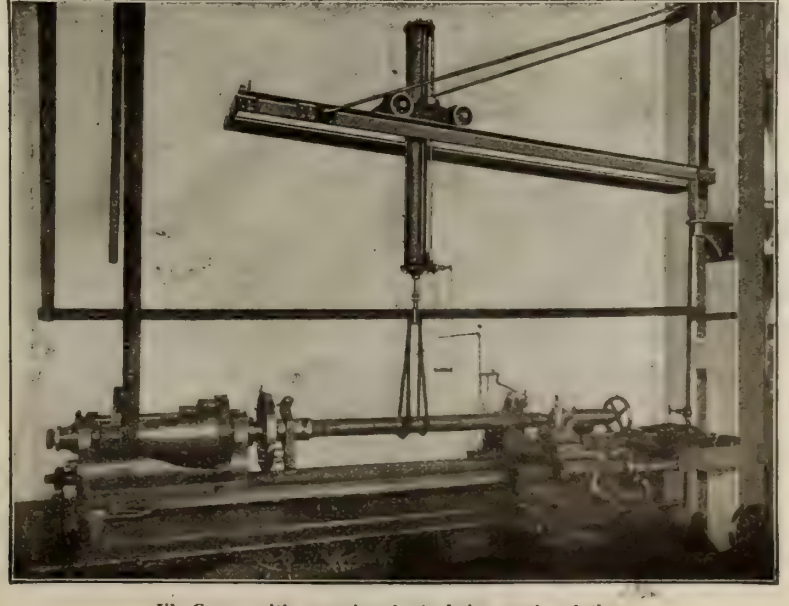
The straight lift air hoist is probably the simplest and cheapest type obtainable, consisting essentially of a cylinder containing a single acting piston and rod which passes through a stuffing box in the lower cylinder head and terminates in a hook to which the load is attached. The valve which controls the admission of air to the under side of the piston is operated by a double-ended lever to which pendent cords or chains are attached. In the earlier forms of direct lift hoist, dirt and moisture were sometimes drawn into the upper part of the cylinder from the atmosphere by the suction created by the down stroke of the piston, thus limiting the usefulness of the hoist in dusty places or where the air was laden with chemical fumes. This trouble was overcome by different makers in various ways and the modern direct lift air hoist is practically a reciprocating air motor well adapted to use in industrial plants of all descriptions.

Single Acting Air Hoists

In the single acting type, the exhaust of air passes from the lower, to the upper part of the cylinder and live air is used only on the lifting stroke. To raise the hook, the admission valve is opened and the air passes from the receiver to the lower part of the cylinder, raising the piston. When the load has reached the desired height the cord is released, the admission valve closes, and the load remains stationary. To lower the load, the exhaust valve is opened by pulling the other cord which allows the air to pass from the lower part of the cylinder through the exhaust valve into the upper part of the cylinder. As the air is thus exhausted to the upper part of the cylinder, the piston and load descend by their own weight. On the next upward stroke the air above the piston is exhausted into the atmosphere. This style of hoist is suitable for use in places where a quick acting type is required, such as in lifting machinery, operating elevators or furnace doors, hoisting castings and in stores and shipping roms for handling supplies and finished products.

The air balanced hoist differs from the single acting type principally in the construction of the valve mechanism, which is similar with the exception of a third cylinder which acts as a check valve and holds the load from falling in case the hose becomes detached, bursts, or if for any other reason the air pressure is suddenly cut off. In this type the lower part of the cylinder is always open to the air pressure which passes

*Author is connected with the Canadian Ingersoll Rand Co., at Sherbrooke, Quebec.



Jib Crane with trunnioned air hoist serving lathe.

through the check valve before entering the cylinder. To lower the hook the air is admitted to the upper part of the cylinder and allowing the piston and load to fall by their own weight with the assistance of the unbalanced pressure on the upper part of the piston. To raise the hook, the air in the upper part of the cylinder is allowed to exhaust into the atmosphere, and the piston is raised by the air pressure below.

Any possible leakage which may occur around the piston will have no effect on the height of the load as it will be automatically compensated for by the air in the receiver. The pressure above and below the piston keeps the load absolutely steady, there being no sudden movement, or jerking of the piston, and the load is lowered quickly owing to the unbalanced pressure on the piston when the exhaust valve is opened. The steadiness and accuracy of control of this hoist make it suitable for use in such work as may be handled by the single acting type, and in addition, it may be used in placing parts of machinery, in erecting and repair work, handling jigs, serving machine tools, drawing patterns, etc., as the load may be raised or lowered a fraction of an inch at a time and placed with precision, as there is no fluctuation of the piston.

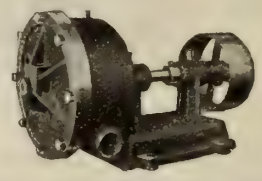
An unique check valve used on this hoist allows the load to be raised, after which the hose may be disconnected and the hoist moved rapidly on a trolley to another part of the mill and the load lowered into the place desired, without the slightest lowering of the load during transit. The valve is easily adjusted and affords a wide range of speeds. As no air is drawn in from the outside in either the class A or B hoist during operation, there is no chance for moisture or dust to enter and their use is permissible in places where dust or strong chemical fumes abound which would prohibit the use of the old-fashioned type.

Capacities of Straight Lift Hoists

Obviously the capacity of a given hoist will depend on the air pressure on which it is operated and the following table shows the lifting capacity of seven standard sizes of Hoists at various air pressures:

Diam. in Inches	For Shortest Length over all Add to Lift 60 Ft.	Capacity in Pounds Air Pressure Ins.	80	100
3	1-2	360	480	600
4	1-2	640	850	1070
5	1-5	1000	1360	1670
6	1-6	1450	1920	2400
8	1-4¼	2560	3400	4300
10	1-8⅞	4000	5350	6700
12	1-11⅛	5750	7700	9600

A disadvantage of the direct lift hoist is the head room required, and to overcome this difficulty and render it possible to secure the benefit of the economies offered by this type of hoist, it is often possible to place the cylinder in a horizontal position, and use a rope or chain to get a vertical lift. When used in this way it is possible to secure a double lift without increasing the length of the piston stroke, and as the high air pressure used for hoisting acts only in the upper part of the cylinder



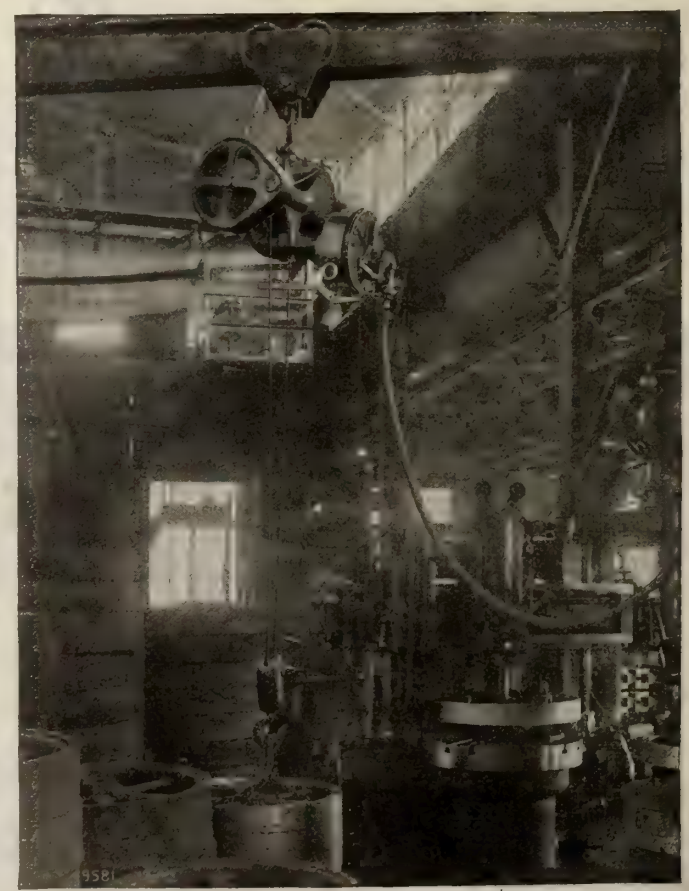
This type of air motor is often used for powerizing cranes, tumbling barrels, etc.

and hence not on the stuffing box, the likelihood of stuffing box leakages is done away with. A double-acting type must be used in order to force the piston back to the head of the cylinder when there is no load on the hoist, but as the pressure required to do this is slight, there will be very little strain on the stuffing box.

The mobility of the straight lift air hoist is somewhat limited by the length of its hose, which may also be said of the small electric hoists which do not



An Air-Operated Jib Crane Used For Unloading Waggons, Cars, etc.

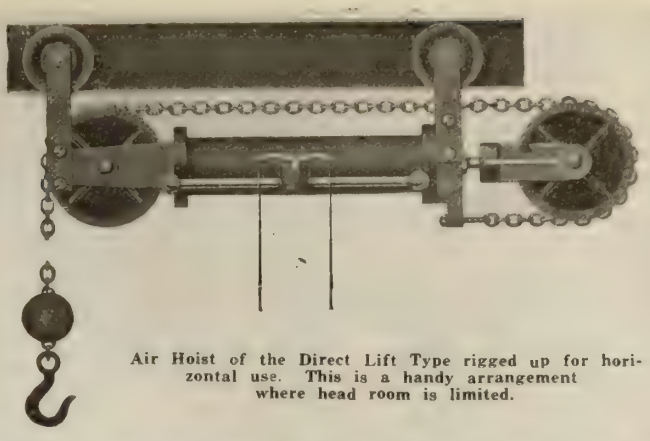


Showing How Air Motor Hoists Can Be Depended Upon For Quick Handling of Material.

employ trolley wires, but depend on flexible cords for their connection to the power supply. For use on trolleys of medium length and where the lifts are short and frequent, however, it has no equal and will, in many cases, readily save its cost in a very short time.

Cost of Operating Direct Lift Hoists

In commenting on the cost of hoisting with compressed air, Mr. Frank Richards, technical editor of Compressed Air Magazine, estimates that with electricity at 2 cents per k. w. hour and at a gauge pressure of 100 pounds, compressed air costs about 5 cents per 1,000 cubic feet of air, and basing his determinations on this, the rated lifting capacity of various sized straight hoists, their free air consumption per four foot lift at 90 pounds pressure and providing a margin of 30% to cover such contingencies as taking up the slack in the rope, the means of attaching the load, etc., has compiled the following table of costs per 4 foot lift and per 100 4 foot lifts:



Air Hoist of the Direct Lift Type rigged up for horizontal use. This is a handy arrangement where head room is limited.

TABLE OF HOISTING COSTS

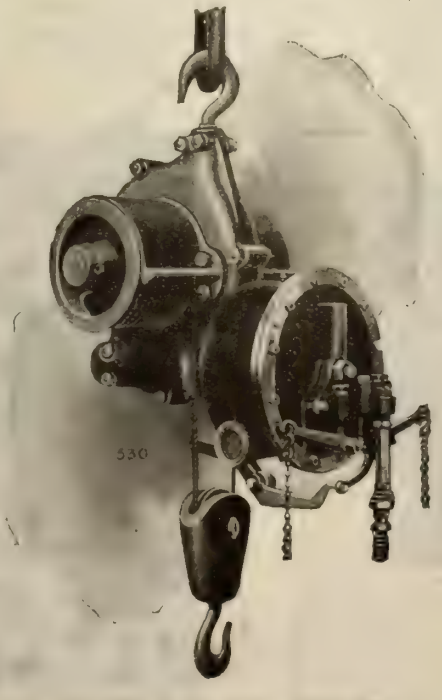
Diam. of Cyl.	Effective Area Of Piston	Maximum Weight Lifted	Cu. Ft. of Free Air per 4-ft Lift.	Cost of Air Per lift	Cost of Air per 100 Lifts
3	8.87	618	1-67	$.000084	$.0084
4	12.22	1.099	2-97	.000149	.0149
5	19.09	1.718	4.64	.000232	.0232
6	27.49	2.444	6.68	.000334	.0334
7	37.42	3.367	9.09	.000455	.0455
8	48.87	4.398	11.88	.000594	.0594
9	61.85	5.566	15.03	.000752	.0752
10	76.36	6.872	18.56	.000928	.0928
11	92.39	8.315	22.46	.001123	.1123
12	109.96	9.896	26.73	.001337	.1337

The direct lift hoist being the simplest and earliest type of air hoist developed, is yet more widely used than the improved motor driven type although the latter was designed to overcome some of the objectionable features of the former, such as limited length of lift and the head room required.

The power unit of a well known hoist of this type, is a small three cylinder reciprocating engine or motor similar in design to those used on earlier types of pneumatic drills and reamers. The crank remains stationary and the cylinders revolve around it on a somewhat similar principle to the well known Gnome and Le Rhone engines which have proved so successful in the development of the modern areoplane.

The air admission and exhaust is controlled by ports in the stationary crank shaft, thereby eliminating valves and their necessary gearing.

The motor is geared to the hoisting drum in the small sizes by means of a worm and work wheel; and by the addition of spud gears in the larger sizes. This method of contruction does away with the necessity for brakes to hold the load steadily in any position. The valve is so arranged that it will close automatically when the pendent operating cords are released, and being of the reversing type it readily allows the motor to be run in either direction. An automatic stop is provided which closes the valve when the load has been raised to the maximum height, and prevents the hook from being run up too far, should the operator forget to release the valve cord, which sometimes occurred in the earlier types of hoists with more or less disastrous results.



An Air Hoist of The Motor Driven Type.

The three radial cylinders used in this motor are cast in one piece and revolve about the crank. They are provided with a tapered bronze bushing which is adjusted for wear by simply driving on its larger end. As the thrust of the pistons is always outward and pressure is always exerted between the pistons and the cylinder heads, the cylinders are forced to a tight seat on the crank and leakage of live air is practically impossible, which with the exceptionally short ports used, reduces the air consumption to a minimum. This hoist is provided with phosphor bronze bearings throughout and lubrication is provided for by partially filling the motor casing with oil which is flooded over all of the working parts when the hoist is in operation. As the hoist is provided with an outside exhaust, and there is no air pressure in the casing, there is no tendency for oil to be blown or forced from the casing, drying off the bearings and shortening the life of the hoist. A swivel hook which turns on ball bearings allows the load to be turned in any direction without twisting the hoisting ropes, and to remain in the desired position without swinging back, which is of value when delicate adjustments of the load are desirable.

Operating Costs

One of the principal advantages of this type of hoist is its steadiness in operation and its absolute freedom from vibration, made possible by the balanced motor, which with the worm gear drive transmits a steady motion to the hoisting drum. This results in a uniform lift with no jerks, jars or vibration. These hoists are obtainable in five sizes as shown in the adjoining tables, one of which also shows the approximate operating costs based on air at 5 cents per 1000 cubic feet delivered to the hoists at 80 pounds pressure. This is considered to be a sufficiently conservative figure to allow for any drop in pressure due to transmission losses, and air consumed in taking up slack in the rope before the hoisting actually commences. In many cases this figure would be too high, but these figures may be taken as representing average conditions.

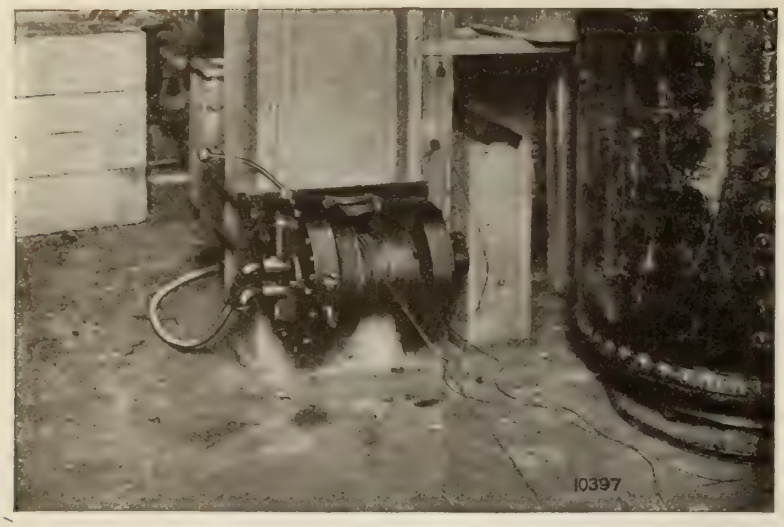


Fig. 6—Showing hoist used for skidding boxes and bales in a warehouse. It is estimated that using this hoist saves the wages of six or eight men.

From a glance at this table, it is apparent that a load of one ton, can be lifted to a height of one foot, one hundred times for only one and four tenths cents, or to a height of ten feet, ten times, for the same cost.

to adjust on the machine by block and tackle, for instance: Put on rope 40 secs.; Lift to Radial Drill 28 secs.; Adjust casting on machine 22 secs.; Remove rope and swing away hoist 20 secs. Total 1 min., 5 secs.

COST OF HOISTING WITH SUCH H)ISTS

Hoist No.	Cu. Ft. Free Air Per Min. at 80 Lbs. Pressure	Cu. Ft. Free Air per foot of lift	Cost of Air Per Foot of Lift	Cost of Air per 100 one ft. Lifts
1	45	1.41	$.00007	$.007
2	45	2.81	.00014	.014
4	45	5.62	.00028	.028
7	80	10.00	.00050	.050
10	80	11.43	.00057	.057

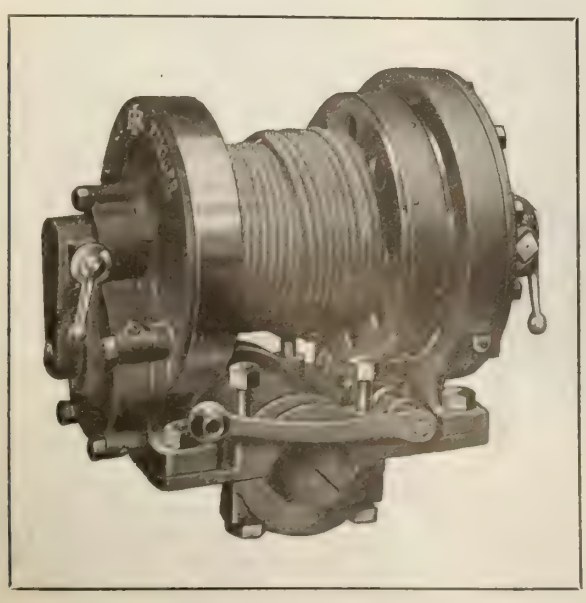
Motor Hoists of the type spoken of above, are particularly well suited to serving machine tools, as the following time study of an actual operation in a large Canadian machine shop will show. The casting in this case weighed about 2000 pounds and would have been slow

The makers of the above mentioned hoist, also make a 2¾ H. P. stationary air motor of the same general construction which may be used to "powerize" existing hand-operated hoists and cranes, or to drive any machinery requiring power within its capacity.

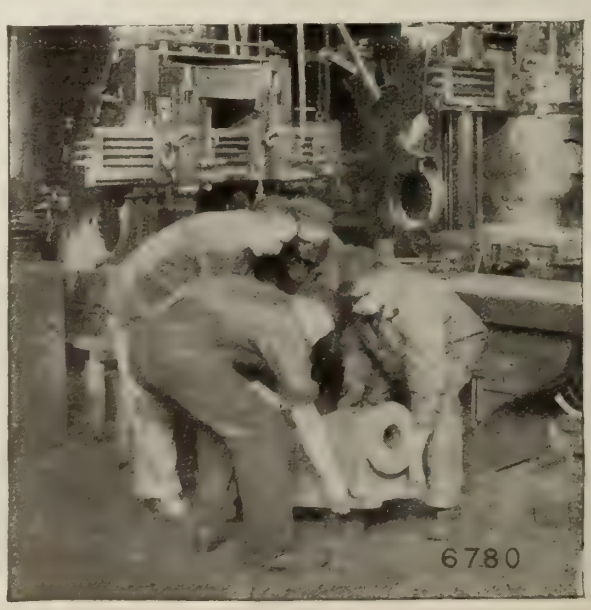
Due to the manner of suspension and their short range, certain types of air hoists are not adapted to pulling up or hauling loads in a horizontal position, and while they are probably the most suitable for general use in the machine shop and industrial plant, and are unexcelled for short straight lifts of not more than twenty feet, and for transferring material from one building to another, etc., there will often occur many situations in which a highly portable hoist of rugged construction and longer lift could be used to better advantage; such as for hoisting ashes in the power plant, switching small cars, snaking or skidding timbers, moving trucks and packages in the warehouse, pulling logs from a log pond or in front of a saw, taking down and erecting piping, shafting, machinery, powerizing derricks and cranes, jib and general hauling and lifting in constructing and maintenance work.

For work of this class a hoist of the type shown at Fig. 6 will often quickly save its cost, as it is light in weight, easily set up and taken down and may be mounted in any position, overhead, on the floor, bolted to a flat timber, or circular column 4½ inches in diameter as may be most convenient. It can be operated by unskilled help and will reduce the cost of many hoisting jobs now being done by hand.

The motive power is provided by an engine of the square piston type, which gives four power impulses per revolution, making the hoist very steady in operation, and as there are no dead centres, it may be started in any position. The engine is readily reversed and is controlled by a small lever on one end of the drum housing. When this lever is pulled forward the load is raised and when it is thrown backward the load is lowered. The reverse may be used as an auxiliary to the regular brake if desired. When the throttle lever is released, it is returned automatically to central position cutting off the air and stopping the hoist. This



Showing brake, clutch and throttle levers of hoist.



This sort of thing wastes time and pays no dividends.

CAPACITIES OF MOTOR HOISTS MENTIONED IN ARTICLE

Size No.	Cap. in lbs.	Ft. lift. per min. 80 lbs. pressure	max. lift feet	Size & Leng. wire rope ins. x ft. &	Size Motor	cu. ft. free air	net wt. lbs	size of hose
1	1000	32	20	¼ x 42′ 10″	4	45	270	¾″
2	2000	16	20	¼ x 42′ 10″	4	45	270	¾″
4	4000	8	20	5/16 x 42′ 10″	4	45	395	¾″
7	7000	8	20	3/8″ x 96′ 6″	10	80	785	¾″
10	10000	7	20	3/8″ x 96′ 6″	10	80	785	¾″

COST OF LIFTING WITH HOISTS SPOKEN OF ABOVE

Hoist No.	Cu. ft. free Air per Min. at 80 lbs pressure	Cu. ft. Free Air per foot of lift	Cost of Air per feet of lift	Cost of Air per 100 one ft. lifts
1	45	1.41	$.00007	$.007
2	45	2.81	.00014	.014
4	45	5.62	.00028	.028
7	80	10.00	.00050	.050
10	80	11.43	.00057	.057

control is very sensitive and the hoisting speed may be varied at will.

Power is transmitted to the drum by means of a clutch and gears, which are controlled by a clutch lever located on the end of the drum housing opposite the throttle. Cords may be attached to the control levers if desired and the hoist operated from a distance. The gears are cut from steel and run in an oil bath which also lubricates the various bearings. The engine is lubricated by oil from a reservoir in the cylinder casting, and the drum bearings are supplied from a large oil cavity in the centre of the drum which only requires an occasional filling.

The brake which is of the band type lined with "Raybestos" is actuated by a long lever attached to the base of the hoist and operates through the medium of a double screw on which are cut right and left hand threads. With this arrangement the brake will stay in any position in which it is put, either on or off, without the use of ratchets or toggles. The brake is adjustable for wear and the brake lever may be placed in the position most convenient for use in cramped or close quarters, for use in which this hoist is particularly suitable, owing to absence of exposed moving parts or projections which might injure the operator. As the drum is mounted independently of the engine shaft, wear and friction from the brake band load are eliminated. A useful feature is the clutch mechanism, as it enables one man to successfully operate the hoist for haulage work, as he can leave the hoist and carry the rope to the desired point, whereas, in hoists not equipped with this clutch, it is necessary to pay the rope out under power, necessitating the services of two men, one to run the hoist and the other to carry the rope.

These hoists are obtainable in two styles for wire or manilla rope and are supplied for operation on either steam or air. Larger valve clearances are allowed and a lubricator and drain cock are supplied when it is desired to operate the hoist on steam. Both styles develop 2½ horse power and the drum capacity runs from 700 feet of ¼ inch or 450 of 5/16 inch wire rope in certain sizes to 300 feet of ⅞ inch manilla rope in the other styles. The lifting capacity varies from 1000 pounds and the other style handles 600 pounds at 85 feet per minute, or smaller leads at higher speeds, on a steam or air pressure of 80 pounds.

There are only 600 working minutes in each 10 hour day and if a man and machine are forced to stand idle for 6 minutes 20 times a day, their efficiency is reduced by 20% through the enforced idleness of the machine. By the proper selection and location of air hoists this loss can be reduced or done away with, floor space otherwise encumbered, kept clear for new work, and the time for passing a job from one stage of production to another materially reduced.

Figured on the basis of cost of installation, maintenance and power consumption, air hoists to my mind cost less per year and will stand up to their original capacity and last as long, or perhaps longer, than any other type of power hoist at present available.

Haulage capacity of hoist shown at Fig. 6 on various inclines.

This table, shown here, is based on 40 pounds per ton rolling friction and also that of the maximum load on hoist, the pull on the rope will be 1000 lbs. and the air or steam pressure 90 to 100 pounds.

Haulage Capacity of Hoist Shown at Fig. 6 On Various Inclines

Rise Per 100′	Angle of Incline		Load Including Car
0 ft.	0 deg.	0 Min.	50.000 Lbs.
1 ft.	0 deg.	34 Min.	33.330 Lbs.
2 ft.	1 deg.	9 Min.	25.000 Lbs.
3 ft.	1 deg.	43 Min.	20.000 Lbs.
4 ft.	2 deg.	17 Min.	16.670 Lbs.
5 ft.	2 deg.	52 Min.	14.290 Lbs.
10 ft.	5 deg.	43 Min.	8.330 Lbs.
15 ft.	8 deg.	32 Min.	5.950 Lbs.
20 ft.	11 deg.	18 Min.	4.630 Lbs.
25 ft.	14 deg.	03 Min.	3.780 Lbs.
30 ft.	16 deg.	42 Min.	3.260 Lbs.
35 ft.	19 deg.	18 Min.	2.850 Lbs.
40 ft.	21 deg.	49 Min.	2.250 Lbs.
45 ft.	24 deg.	14 Min.	2.320 Lbs.
50 ft.	26 deg.	34 Min.	2.140 Lbs.
55 ft.	28 deg.	49 Min.	2.550 Lbs.
60 ft.	30 deg.	58 Min.	1.870 Lbs.
65 ft.	33 deg.	02 Min.	1.770 Lbs.
70 ft.	35 deg.	00 Min.	1.681 Lbs.
75 ft.	36 deg.	53 Min.	1.610 Lbs.
80 ft.	38 deg.	40 Min.	1.550 Lbs.
85 ft.	40 deg.	22 Min.	1.500 Lbs.
90 ft.	42 deg.	00 Min.	1.450 Lbs.
95 ft.	43 deg.	32 Min.	1.410 Lbs.
100 ft.	45 deg.	00 Min.	1.370 Lbs.
110 ft.	47 deg.	44 Min.	1.320 Lbs.
120 ft.	50 deg.	12 Min.	1.270 Lbs.
130 ft.	52 deg.	26 Min.	1.230 Lbs.
140 ft.	54 deg.	28 Min.	1.200 Lbs.
150 ft.	56 deg.	19 Min.	1.170 Lbs.
160 ft.	58 deg.	00 Min.	1.150 Lbs.
170 ft.	59 deg.	33 Min.	1.130 Lbs.
180 ft.	60 deg.	57 Min.	1.120 Lbs.
190 ft.	62 deg.	15 Min.	1.100 Lbs.
200 ft.	63 deg.	27 Min.	1.080 Lbs.

A new cable service across the Mediterranean is soon to be established, connecting the ports of Marseille and Philippeville, according to a recent report from Algiers. The entire cost is estimated at 7,280,000 francs, and contains an item of 180,000 francs for equipment. The Algerian budget for 1922 already provides for meeting half the expense of construction.

Problems In Connection with Leather Belting

Technical Research in Leather Belting Industry Has Progressed Rapidly—Many Points Must be Watched—Stretch—Creep—Its Cause—Elasticity—Effect of Humidity—All Are Important.

By J. EDGAR RHOADS

TECHNICAL research for manufacturing industries has grown at an enormous rate within the past decade or two and competent men, capable of investigating in an original way problems bearing on the methods of production, raw materials or properties and uses of finished products, have been in greater call than in former time. Industrial concerns have in many cases attracted specialists from pure research which they were conducting in universities to work upon technical problems.

The policy of some universities and a few other institutions of setting up Fellowships for investigation of problems of a manufacturer or group of manufacturers has much to commend it, and has led to notable improvement, not only in new lines of business, but in some of the old ones. As an instance of this, the baking industry, and the manufacture of various plastics from flour such as macaroni, have after centuries of practical experience learned through careful research some of the fundamentals that have to be followed in order to get the most satisfactory product and in order to save raw material used. As an instance, one of the large baking concerns has found that proper treatment of their water, used in the dough, has resulted in an economy of upwards of one hundred thousand dollars a year. With the water treated in the proper way, less flour is required to give a certain yield of bread.

The Mazda lamp is a splendid illustration of a great national economy, resulting from careful search for a more satisfactory form of filament than the old carbon one. The electric companies have been spending tens of thousands of dollars per annum in research departments devoted to improving product usually in a way to actually save money for their customers. It is important, of course, that all of this work should not entirely supersede the pure research of the scientest in the university, and usually the two branches go hand in hand and probably this will be found to be more true in the future than in the past.

As the coal reserves of the world have become reduced through extensive mining operations, engineers have found out how to make coal go much further than they ever did before, through improved control of combustion, more efficient boilers, protection of heat value in the form of steam through insulation and super-heating and other economies resulting from recovery and use of exhaust steam. The steam engine itself has been greatly improved until now by the use of the latest forms of uniflow engines, it is possible to get a mechanical horse power with probably less than half as much coal as was required not so many years ago.

*Read before the National Association of Leather Belting Manufacturers, Philadelphia, Pa., November 16th, 1921.

Use Of Roller and Ball Bearings

After the energy has been turned into mechanical power, the use of roller and ball-bearings on high speed shafts have reduced friction load and we know that the electrical transmission of power, now soon likely to be possible up to perhaps a million volts, has made practicable the carrying of power in this form for what were unheard of distances only a short time ago. The tendency towards individual drives upon every machine, however, seems to have been largely or at least somewhat checked, due to the fact that earlier promises of economy have not been entirely lived up to by experience, and the group system of driving with belts and counter shafts over a comparatively small area seems likely to become more generally adopted, which of course, tends to lessen the number of large belts in use in proportion to power transmitted.

The use of leather belting for power transmission has been common for decades, but until very recent times, comparatively little has been done in the way of a scientific investigation of it. Possibly because as a method it is so exceedingly simple and efficient. Even within perhaps twenty years, the millwright was supreme in this work and the trained mechanical engineer had given little thought to the matter. The latter was perhaps loath to undertake careful investigation of the subject as a comparatively superficial investigation showed that there were many and rather serious complications involved in making scientific tests in the various factors which go to make up belt drives, and some of these factors were quite difficult to control. No methods of investigation of accurate measurement had as yet been worked out, in fact, a few of the points involved as yet are almost untouched. It is one of those cases where it is important to really begin at the bottom and make a thorough study, if reliable conclusions are to be reached. The fact that many of the earlier investigators ignored some of the important factors, has led their successors into great trouble and mistakes. This situation, however, should not cause us to hesitate in carefully investigating the scientific side of our industry with an idea of putting it upon a really solid engineering basis and giving us the feeling that we have scientific knowledge comparable with that existing in some other lines of highly developed manufacturing work. Let us consider some of the items which are involved in such a study.

Common Causes of Trouble

The experienced belt-maker would probably say that the two most frequent sources of trouble are belts stretching and running crooked, the latter usually with high speed drives where single belts are most likely to be used. It is evident that there are a number of things which may affect the stretch of a belt, such as the kind of hide used, tannage, method of currying—that is, the percentage and distribution of grease in the leather itself, and the thoroughness of stretching given to the leather before it is made into a belt. The hide of spongy fibre or consistency is likely to make leather that is more stretchy. It is well-known that certain tannages, probably those which do not well fill the inter-fibular spaces, make leather which is made more apt to stretch than that which is dead tanned. Belts running crooked, when not due to abuse, are certainly sometimes caused by the springing of the piece of leather, after it is stripped to width, which is probably related somewhat to the factors influencing stretch just previously noted. With leather which is not very thoroughly tanned there seems to be a tendency for one edge of the strip to draw up more than the other after it has been stretched, and thereby pulling crooked. Aside from the annoyance to the user by having to frequently tighten the belt, the tendency to stretch causes a rapid reduction in the tension, and unless the co-efficient of friction is unusually good, there results a rapid diminution in the effective tension and the work which the belt will do.

While a moderate amount of stretch is perhaps not a serious matter, the importance of this being removed as soon as possible, so that an effective tension high enough to carry the load satisfactorily may be maintained is of great importance. As far back as the days of Frederick Taylor considerable work was done in determining what was the proper tension to install a belt. He arrived at figures which were certainly conservative and practicable. I think there is not much doubt that if the belt users of the country had been willing to adopt his recommendations in this respect, they would have had greater economy with belting than has been the case. However, the tendency has been to load closer to limit and to settle upon a tension which could be maintained steadily, but which would give a maximum of power transmission. It would not be surprising to see higher tensions still

adopted with improved methods of manufacture and better types of bearings.

Closely allied with the question of stretch is that of creep and its cause, and elasticity, which we have for a long time thought one of the most valuable properties of the leather belt, and one which differentiated it sharply from most of the substitutes available. Some of the work on this has been done by Mr. Jones and Professor Sawdon, which has thrown rather more light on earlier work and theories in connection with the subject. They have shown that the leather belt is not perfectly elastic in that it comes back immediately after the removal of tension, but that there is a time lag which may have some bearing upon the problem of transmission of power. Just what this is will probably vary a little with different leathers, but from the practical standpoint of power transmission it seems pretty clear that it will account for perhaps the first three quarters of one per cent. or one per cent. of what we read as slip in our power transmission curves, and it would seem reasonable that there is room for further improvement in reducing this a little more in a way which will increase slightly the efficiency of the leather belt.

The Wide Variation

The wide variation in the observed co-efficient of friction readings on a belt when it is just new and that obtained after it has been in use some time shows clearly the importance of a proper finish on the surface. One interesting feature which had not been carefully studied until perhaps of recent times is in the observation that the co-efficient of friction changes quite noticeably at different speeds of slip on a given piece of leather, though the coefficient of friction does not apparently change in any considerable way at different tensions. It is obvious that in a running belt the effective tension, which is the difference between the tension on the tight side and the slack side, is limited very definitely by the co-efficient of friction obtained at a given speed of operation and of slip. This problem seems to be one of the very fertile fields for further work.

So far I have not mentioned the often spoken of factor of tensile strength, though it is apt to be one of the main things alluded to in leather belting specifications. I have not mentioned it because the factor of safety in a good leather belt is high, often "5 to 1" to "10 to 1", and it is a very rare thing to hear of a belt tearing because of the load applied to it unless some accident has occurred.

Another very important factor in the capacity of a given belt to transmit power is speed, and while considerable work has been done on this subject, there is still a good deal to learn. It has only been a few years since a prominent leather belting manufacturer stated that he considered it good practice to run leather belts for woodworking machinery at speeds in the neighborhood of 9000 ft. per minute. Other makers disagree with him. Dr. E. D. Wilson, in presenting data on the subject published in 1919, (and on which the tables published are based) has shown that at this speed a double belt will transmit practically no power and a single very little indeed.

There is no available machinery for actually making such tests at these high speeds, and general experience in which little scientific data is available seems to indicate that the greatest efficiency is obtained at speeds of 4000 to 5000 ft. per minute. So far as I am aware, none of the data submitted take into consideration the effect of grease, and of the varying coefficients of friction at the high speed of slip which would be obtained at any such speed as 9000 ft. per minute. We do know, of course that the centrifugal force increases very fast on higher speeds, tending to throw the belts away from the pulleys, and it is likely that scientific work on this subject when it is done thoroughly, will, as is so often the case, bear out practical shop experience, at least in large measure, and recommend the limitation of speed to a more reasonable figure.

Humidity And Its Effect

Some years ago the subject of humidity and its effect upon leather belts was investigated, but whether or not due consideration was given to the variation in the modern methods of currying from the old hand stuffing, and whether the tests were made on a large number of belts, or only on a few of one make, I am not aware. It does seem, however, pretty clear that the presence of large amounts of humidity lower the effectiveness of a leather belt, but it is also likely that proper treatment will do something to lessen this tendency.

During the past few years the use of compressors and machines with a wide variation in loads has rather increased, and motor driven compressors with a binder pulley or tightener have become very much more common. This type of drive has received comparatively little careful investigation, though it has been known to work quite well with proper installation and sufficient belt capacity. It does, however, seem quite clear that it is necessary to have more belt for a load of this kind based upon the power required from the motor than for an ordinary steady pull; some say twice as much is needed, but I believe this is still another subject requiring careful test under well controlled conditions.

Closely allied with this is the question of arc of contact, the effect of increasing or decreasing this in the load which a belt will carry, and also the most effective way to arrange drives where there is a small driver and a large driver or vice versa.

The subject of center distance was investigated somewhat during this past year at Purdue University, but time prevented final or the most thorough kind of test. The mill-wright has known for a long time that increasing the center distance was a great help, and that with a well designed drive, the position of the catenary formed by the slack side on top was a great help in steadying the belt, particularly on sloping drives where belts were running at angles with the floor. Here there are such varieties of conditions available that much work is necessary to get standardized competure worked out. The same would probably be true of quarter and half turned or cross belts, a frequent source of annoyance and trouble to the user. The comparative virtue of drives in which the tight side is on top or on the bottom is a subject of course which ties up closely with that of arc of contact and center distance.

Pliability is another factor of no small importance in drives of this character, and though as yet the scientific investigation of the problem is still ahead of us the best practice is tending away from the heavy, stiff, hard belt toward the lighter and more pliable one. From the above I would not ask any one to think that little work has been done, for really much has been, but there is still a good distance of road to travel. The quite thorough testing that has been done by at least three separate investigators on the comparative power transmission qualities of leather, and most of the principal types of substitute belting, has been of great value to the engineering world and the belt user, and should be a source of great economy.

The very satisfactory way in which these investigators have shown the leather belting superiority, particularly when it comes to carrying over-load or shock-load, should not be under-estimated. During the past few weeks a very careful comparison has been made to settle the much mooted question as to which side of a single belt should run next to the pulley, and Mr. Jones has prepared very complete figures which he is probably just about ready to publish, which represent an enormous amount of careful work and prove conclusively that the grain side of the leather belt is on the average decidedly superior to the flesh, though he has found that some belts, carrying very high amounts of grease, will do nearly as well when run with the flesh side to the pulley as the grain. These, however, are not representative of the great mass of standard leather belts upon the market.

In conclusion, I wish to encourage every manufacturer to consistently and diligently support the idea of research for I believe that the hope of industry is in this line, and that many of the wastes which are charged against industry in all lines will within the next few decades be largely eliminated through the diligent and painstaking care of highly trained scientists and investigators who leave no stone unturned to try to get to the bottom of the problems which affect their subjects.

Effective at once, says a C.P.R. report, Mr. J. Telford is appointed Road master St. John and Fredericton Sub Division with headquarters at McAdam vice Mr. W. H. Noyes, transferred.

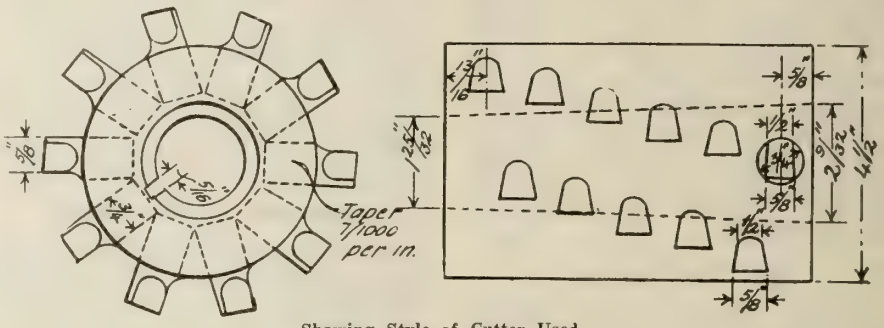
Standard Tool Shapes Have Been Adopted

Various Tools Used for Slotting—Milling—Cutting Off—Boring —Threading—Counterboring—Planing, etc. Standard Shapes Have Proved Efficient—Double Angle Iron Fixture for Planing Crossheads.

THE USE of the tool grinder and of standard cutting tools has become so general in manufacturing establishments where production work is the rule, that it is taken as a matter of course. The practice is growing in railroad shops and the Erie is one among the roads that has adopted the system for the general run of work. It is, of course, impossible to provide a set of standard tools that will meet every possible requirement that may arise, but the standard shapes that have been adopted on the Erie will be found to cover such a wide range of work that the field left open to special tools will be found to be exceedingly small.

Starting with the roughing tools, continues "Railway and Locomotive Engineering," the heavy round-nosed type has been found to be most efficient, and provision is made both in boring mill and lathe work for tools of this type for cutting both cast iron and steel. While the tools for both services fall under the general classification of "round-nosed" there is a marked difference in their shapes as adapted to the boring mill and the lathe. When taken in plain view, the boring mill tool has a rounder form than that of the lathe, whose contour more closely resembles that of a gothic arch. The usual difference in rake and clearance for tools intended for cutting cast iron and steel is noticed in that both the rake and clearance is less for the cast iron cutting than for the steel cutting tools.

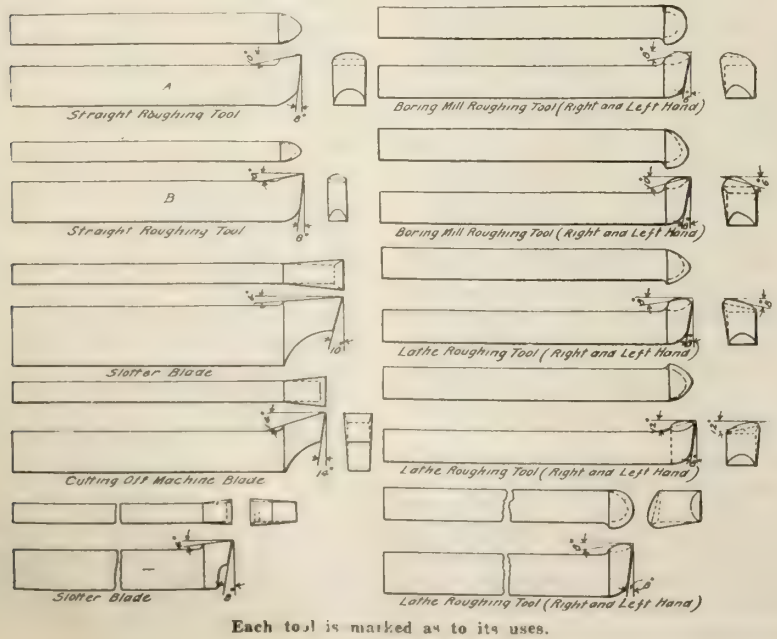
In the case of the boring tool for cast iron the rake is the same (8 deg.) but the clearance is 2 deg. less than for the lathe tool, these being 6 deg. and 8 deg. respectively. But, for cutting steel the rake is 2 deg. less for the boring tool than it is for the lathe tool, the angles being 10 deg. and 12 deg. respectively, while the clearance angle (8 deg.) is the same for both. The side rake for the boring tools is less in both instances than it is for the lathe tool.



Showing Style of Cutter Used.

it being in the steel cutting tool only 5 deg. as against 12 deg. for the lathe. As these angles and shapes have been carefully studied in order to obtain the greatest efficiency of the tool, they are deserving of close attention. This efficiency involves not only the possibility of the maximum speed in the cut but the minimum of cutting resistance and consequent heating of the tool.

All the tools above described have a side rake and are intended for what comes under the general classification of heavy work. But for lighter work roughing in either steel or cast iron but more especially for steel work there are two styles of straight roughing tools in use (A and B.). That is tools with no side rake. The two tools are of practically the same shape, that is, they have the same angles of rake and clearance, to wit: 10 deg. and 8 deg. respectively, and differ only that one is wider than the other and has a front face with a longer radius than the other so that, with the same feed, it will make a smoother cut.



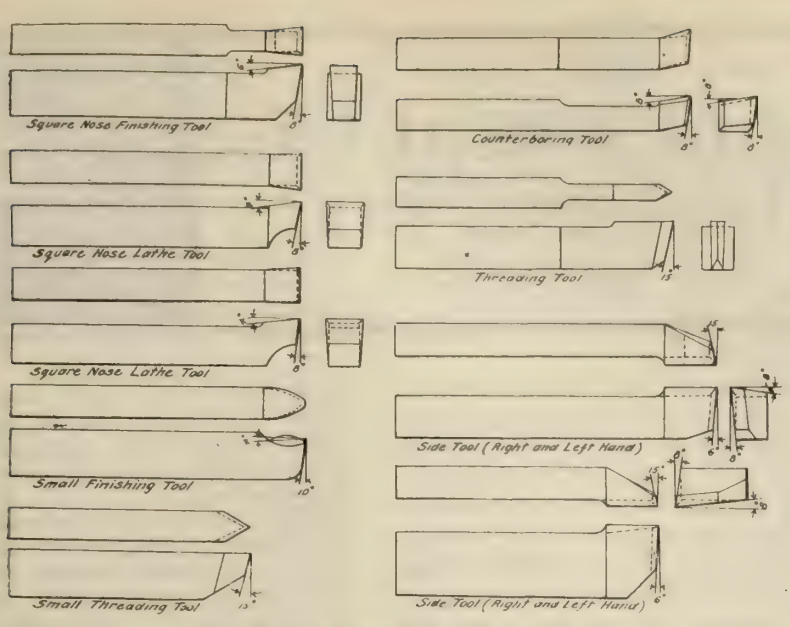
Each tool is marked as to its uses.

Slotter Blades

We next come to the slotter blades of which there are two forms differing only in the weight of the tool and the angle of rake which is 10 deg. and 8 deg. respectively. The heavier tool also has the greater width of cutting face but the angle of flare of the two is about the same.

The cutting off machine blade deserves especial attention because of the large angles of rake and clearance which it offers and the wide angle of flare and wide cutting edge presented to the work. The rake and clearance angles are the same (14 deg.), and in this the practice differs widely from that too often found in the average machine shop, where, for that very reason, cutting off, especially of heavy bars, is a piece of work that is very properly dreaded. Here we are apt to find that an attempt is made to do a cutting off job with a tool that may have no rake at all but be quite flat on the top, while the clearance is made as much as the strength of the tool will allow, so as to provide for the decreasing diameter of the surface that is cut. The result is a chattering tool and an excessive pressure put upon the upper surface by the chip as it curls up from the cutting edge.

With the large angle of rake of 14 deg. in the tool illustrated there is no tendency to chatter and the angle of



Refer to underline under each style of tool.

curl of the chip is so reduced that the pressure on the upper surface of the tool is greatly reduced, and with it, the power required to drive the tool through the metal. There is, on the other hand, a tendency for the tool to spring into the work, when it is raised at such an angle and cut away at the bottom, but this tendency is met by careful feeding so that the tool is held to a constant cut at all times. In this connection it is to be borne in mind that when the tool springs into the cut it turns about the front edge of its support in the tool port, so that, for a given height of cutting edge above that support, the angle at which it springs into the cut is the same regardless of the angle of rake, so that the greater the rake the less the pressure of the chip and the less the tendency to spring into the cut.

The square-nosed tools both for finishing and for lathe work that may require such tools are given a clearance of 8 deg. and a rake of 6 deg. for the finishing tool and 4 deg. for the ordinary square-nose tool. Here again attention is called to both of these points. It is a common practice to make a square-nose tool without any rake and. then, if it scrapes off the metal instead of cutting it, to grind a notch in the top face just back of the cutting edge. This may give a rake of as much as 45 deg. for a short distance when the chip is curved sharply upward. Such a tool will cut well while it lasts but its life is short, because of the rapid wear by grinding. The Erie practice, therefore, of giving all such tools as have thus far been touched upon a long even rake is worthy of attention. Not that it is a novel feature when attention has been paid to such things, but they do not always receive the attention that they ought.

In the case of the tools for cutting V threads attention is called to the wide angle of clearance (15 deg.) that is allowed, and also to the fact that there is an ample side clearance. The front clearance reduces the cutting edge of the tool so that it is a real cutter and not a scraper, and the side clearance leaves a clean thread besides adding to the side cutting qualities of the tool.

The counter boring tool has an advancing cutting edge that terminates in what closely approaches a point, but has its cutting edge protected by ample side and front clearance and back and side rake, an angle of 8 deg. being used at each of these points, so that the cutting qualities are as good as possible.

The side tools are made on the same general principles as the counter boring tool, but with the variation in shape that their work requires.

Cutter Head for Vertical Miller

The very sturdy cutter head shown in the illustration is used on a vertical miller for a variety of heavy work. It carries 55 cutters set in eleven horizontal planes, with five cutters in each plane, each of whose cutting edges overlap those of the plane above and below. As will be seen from the dimensions the head sets over the tapered end of the spindle and is driven by a 5-16 in. key.

The cutters themselves are of ¾-in. round steel ground to the cutting shape shown in the side elevation, with a cutting face ⅜ in. wide and tapered back with a side clearance to a width of ½ in. at the back. They are turned to fit a tapered hole in the head which has a diameter at the face of ¾ in. and tapers back at the rate of .007 in. per inch of length. Such a cutter is capable of doing very rapid and heavy roughing work.

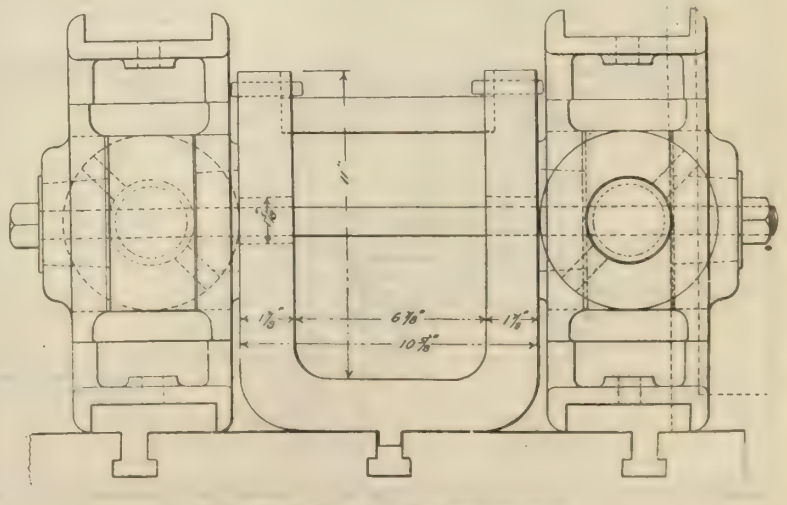
Wheel Boring Tool

A heavy tool or rather toolholder for boring and chamfering cast iron wheels at one setting is used with considerable success. The body of the tool is made to fit in the tapered hole of the spindle of the wheel borer. Just below the shouder a slot is cut for the reception of the chamfering tool, which, as its work is comparatively light, is held by a setscrew.

Below this the diameter of the body is reduced and it is threaded to take a nut. In the smooth portion below the thread another cross slot is cut for the reception of the roughing and finishing tool. A sleeve is also turned to fit over the smooth portion and it is cut with a slot to match that in the body and drilled on one side to admit a setscrew which is run into the body and serves to put a side pressure on the tool. This tool is slipped through the slots in the body and sleeve and can be held lightly by the setscrew while being adjusted to the proper cutting distances from the center. The setscrew can then be tightened and the nut run down, forcing the top of the slot in the sleeve against the top of the cutting tool which is thus held firmly in place by pressure both at the top and the sides.

At the bottom there is a hollow screw through which a hardened steel stem is passed. This stem has a roughened

(Continued on page 29)



Double Angle Iron for planing crossheads.



WHAT OUR READERS THINK AND DO



RE-THREADING WELL DRILLING SPINDLES

By C. E. W.

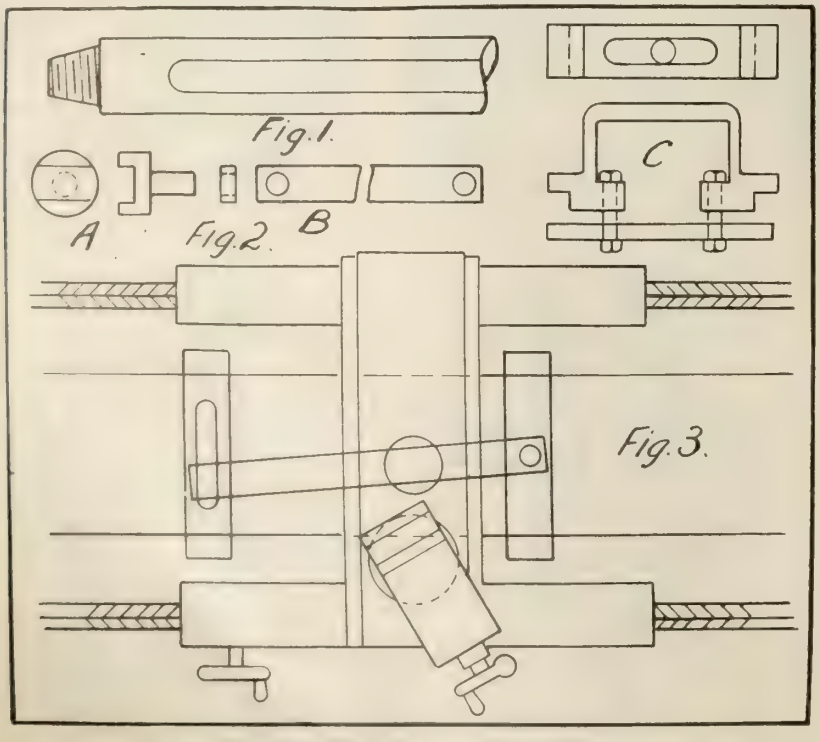
We had a number of drill spindles to re-thread, and fit, so in order to make these at least cost, we devised a taper attachment as shown in sketch. It will be seen from Fig. 1, that the thread is cut at a very steep angle, in fact too much for the regular taper attachment.

The threads must be absolutely correct, otherwise there is grave danger of the spindle working loose, and dropping off several thousand feet below the ground level. The drillers sometimes manage to recover such spindles by means of a special fishing tool, but they are occasionally lost and the hole has to be re-drilled.

The portion "A," shown in Fig. 2 represents a plug that was turned from a piece of shaft to fit a hole drilled in the cross feed saddle. The slot in top was cut to a sliding fit on the bar of steel B. Two brackets "C" were cast and machined to fit the lathe bed, one having a hole drilled and tapped about the center, the other having a slot cut in it to allow for adjustment.

In operation the bolts holding the cross-feed-screw nut are removed, leaving the saddle free to move back and forth. The plug "A" is slipped in place. The brackets "C" are placed in position, the slotted one in front and the tapped one in rear of the carriage. The bar "B" is pivoted on a cap bolt on rear bracket, and passing through slot in "A" is held by a clamp bolt which works in slot in forward bracket.

Bar "B" is made long enough to allow for sufficient travel of the carriage. The tool is carried in the compound tool post which is set at an angle of 38 degrees to the thread angle and of course, as the cross-feed is disconnected, all feeding is done by the compound. The assembly is shown at Fig. 3. This device has proven very satisfactory and is capable of being modified by drilling other holes in rear bracket so as to enable it to cut almost any angle.



Showing how well drilling spindles were threaded

CAN YOU ANSWER THESE QUESTIONS?

Judging from the number of replies you received to a recent query in "Canadian Machinery," your readers are certainly interested and willing to exchange ideas. Here are one or two other questions which I would like to see answered:

What is the proper method to cut the threads in the jaws of a universal chuck? Owing to the fact that the jaws come in contact with an ever-changing radius of the scroll as the jaws move up and down, some provision must be made for this. How is it done? I have only seen this job done once, and it was not at all satisfactory.

Some time ago you published an interesting article on the manufacture of steel ball bearings, in which it was stated that the scleroscopic reading for hardness was very erratic and even stated that for a certain size ball the reading was practically the same as it was before the ball was hardened. I got two balls out of the stock room, a large one about 1⅛ and one about ⅜. One tested with the scleroscope about 86 and one about 47. This prompts the question is the sclerescope a reliable hardness test? If those two balls had been ground flat, would the reading have been the same? Were we fooling ourselves when we tested the round surface of small shells with the scleroscope?

Editor's Note:—We will be pleased to pay space rates for any accepted material answering these two questions. Let us hear from you.

CUTTING WORN GEAR BLANKS

During the war it was very difficult to get contracts executed for small jobbing work. Thus, when the writer was presented with a rush job by an old and valued customer it was felt that the work must be undertaken although quite out of the line of work regularly handled. The job consisted of cutting three cast iron single threaded worm gears from the solid blanks which were furnished to the shop fully machined. The worm gears had a pitch line diameter of 28.-966 inches with 52 teeth 1¾ inch circular pitch. The worm was slightly over 5 inches pitch diameter. The face of the worm gears was about 3 inches. The shop was not equipped with any machine tools that were designed to take care of this work. There was not a hob of the required specifications in the shop.

A piece of carbon tool steel 6½ in-

ches in diameter and about ten inches long was located in the stock room. A formed milling cutter the same diameter as the worm was made. The form of the cutter was that of a milling cutter which would be used to cut rack teeth 1¾ inch circular pitch, of the involute tooth design. Then a regular hob was made which was to be used to finish the worm gears. The milling cutter was placed on the spindle of a Universal Radial Drilling machine. The worm gear was placed on a stock shop made dividing head. The swinging radial arm of the drill press was inclined at an angle to give the proper lead to the slots which were to be roughly milled as the first operation in cutting the worm gears. As shown in Fig 1 the dividing head was clamped to the cast iron floor plate. The radial arm was clamped in a position at 90 degrees with the arbor of the dividing head. The milling cutter was fed into the work by hand, using the hand crank on the end of the radial arm to move the head and drilling spindle along the radial arm in a horizontal direction. There was a stop clamped on the arm against which the head moved, and thus a uniform proper depth to the slots was secured.

After the worm gears were thus roughed out, the finishing operations were done on a 30 in. Gap Lathe. This Lathe had a type of saddle which lent itself to this particular job, the design of the tool slide, carriage, etc., being of antique vintage, as shown in Fig. 2.

The hob was keyed on a mandrel which was placed in the centres of the machine in the usual way. A dog was used as a driver. The worm gear was placed on the tool block in such a way as to permit it to revolve freely on a pin and on a level with the centre line of the mandrel. The gear blank directly under the cutting point of the hob is supported as shown in Fig. 2. The worm wheel was fed into the hob and allowed to rotate freely about the trunnion pin. The lead of the roughed slots caused the worm wheel to rotate at the proper speed. When the hob was fed into the proper depth the worm wheel was cut. The job is not one that embraced the latest and best in machine shop practice but it is no doubt an interesting example of what can be accomplished in emergency. The amount of time actually consumed in cutting after the hob and milling cutter were made was very creditable.

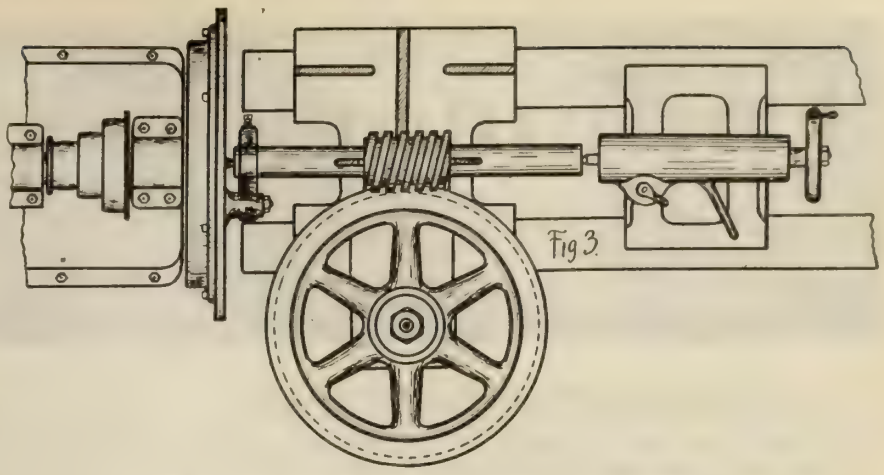


Fig. 3. Plan view of finishing operation on gap lathe.

A deputation headed by one of the aldermen of the City of Toronto has asked the Wards committee to build a new bridge on McClelland Avenue, Toronto. The bridge which is now in place has been condemned and is only capable of carrying a four-ton load. A motion recommending that next year's estimates include an amount for the bridge has been passed. In 1916 it was estimated that $700,000 would be necessary to cover the expenses for the erection of this bridge. Therefore it is safe to assume that the cost today will be around $750,000.

STANDARD TOOL SHAPES ADOPTED

(Continued from page 27)

face at the upper end which catches and serves to hold the tool while it is being adjusted centrally to make the correct diameter of cut, and before the nut and setscrew have been turned home.

Double Angle Iron for Planing Crossheads

This is a very simple device for holding two crossheads on the planer at once, and, at the same time laying out the ways on the crosshead, as can be noticed in the illustration.

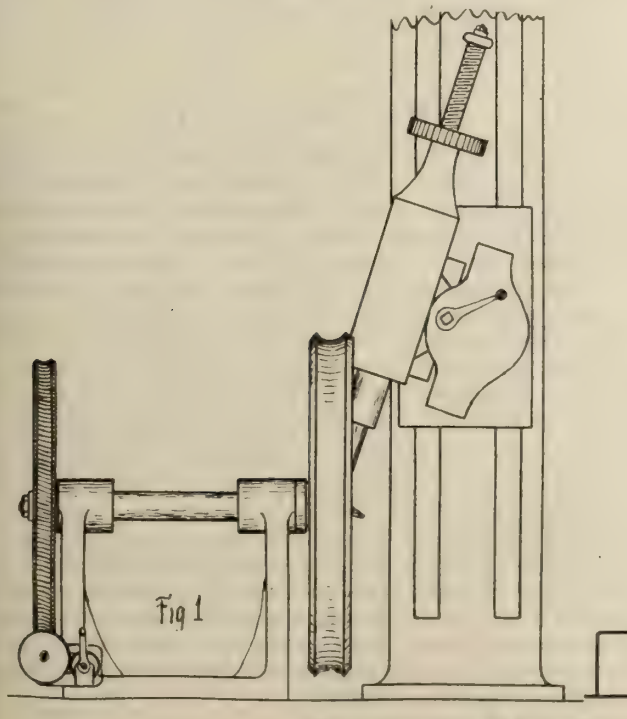


Fig. 1—Roughing out the worm.

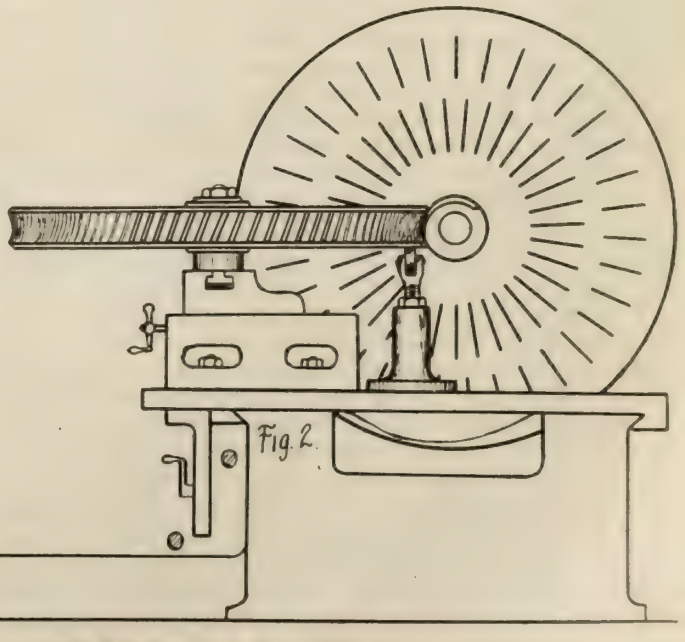


Fig. 2—Finishing on the gap lathe.



Heat Treating Steel Drop Forgings

"IN ORDER to speed up output and complete a stamping with the fewest possible blows," says Practical Engineer, "drop forgers frequently find it necessary to heat the metal to as soft a degree as possible in order that it may flow readily, and the article on leaving the dies is very hot and the steel in a bad state. The structural effect on the steel is that the crystals expand during heating and do not return completely to the fine structure. In some cases fusing occurs around the margin of the enlarged crystals, forming an oxidised film which tends to cause the material to disintegrate. But this occurrence is rare, and when it does happen no amount of forging will reunite the crystals.

"With the ordinary stamping, correction can be made by heat treatment if the heating is conducted within reasonable limits. The stamping must be re-heated up to a temperature depending on the carbon of the steel. For 0.25 carbon steel the stamping should be re-heated up to 820 deg. C. and plunged into whale oil. Not only does this heat treatment split up the crystals into the smallest form, but also it serves to release any internal strains which are apt to be engendered in the formation of difficult shapes. With higher carbon steels tempering after heat treatment is a good practice, the stampings being re-heated to 650 deg. C. and then exposed to air."

Trouble In Machine Tapping

IN DRILLING and tapping by machine there are certain points which should be observed if satisfactory work is to be secured. H. H. Armstrong, speaking on the subject of machine tapping in "Machinery," says among many other things that trouble often arises from the operator doing his own sharpening of the tap end. He puts it in these words:

"This is done by grinding a new taper on the tap, and while this may prove satisfactory for tapping operations on thin work, such practice should not be followed when tapping work in which the tap cannot pass entirely through, as the bottom of the hole will not have full threads. For the latter type of work, bottoming taps should, of course, be used, which permit cutting practically a full thread to the bottom of the hole. Recently my attention was called to some work in which the assembler could not enter the screws to the required depth. On examining the pieces it was found that the tapped holes were filled with the chips from the tap that had lodged in the thread and become firmly attached by a coating of rust. These pieces had to be sent back to the machine shop to be retapped. In this case the operator was required to do the work on his own time. Had he used compressed air to blow the chips out, this trouble would not have been encountered.

"If a steel screw is set down too tight in a cast-iron piece, the threads are likely to become crossed and stripped, especially if the thread in the iron piece is shallow. Success in tapping holes depends chiefly on having conscientious operators who are willing to follow instructions and set their machines up properly for each job. If trouble is encountered, it should be brought to the attention of the foreman, and not covered up to be discovered at some later period. All machine tapped holes requiring any considerable degree of accuracy should be given a thorough inspection with a limit plug gage. The operator can do this if there is no inspector, and the foreman should keep in touch with the work. It has been proved by experience that the quality of a man's work will invariably be higher if he knows that the work is to be inspected. When excessive tap breakage is experienced, it is well to investigate the cause; in many cases it will be found that breakage is due to inefficient holding methods, the work being allowed to move during the tapping operation."

Improving Magneto Design

SPEAKING about magneto design, the British Trade Review says that considerable attention has been paid lately to improving the slow speed work of the magneto, though the means adopted by different makers vary considerably. Some firms taking their cue from the dynamo and motor manufacturers have modified their early designs so as to permit much more thorough lamination of the iron magnetic flux-carrying parts of the armature and pole shoes, and thus obtain better sparking at low speeds with greater economy of active material; others obtain good results by the use of impulse starters, of sliding pole shoes operated by the timing lever, or by other mechanical means. The recent introduction of cobalt steel for magnets enables the magnet to be reduced very considerably in length and yet retain an undiminished strength.

How To Win Trade

HOW CAN WE secure trade? Sir Raymond Dennis, K.B.E., answers this question in System in the following manner. He says: "It is up to every manufacturer to take what steps he deems best to meet existing conditions. Amongst those that are necessary, to my mind, are the following: Write down your stock by 25-30 per cent., and reduce prices accordingly. Admit you made profits in the past, and equalise things by facing the loss. Push for sales at these prices in all parts of the world. Use every means in your power to induce the men's unions with which you are dealing to realise that it is either a case of hard work at relatively low rates per unit of work—or no work at all. Make your preparations complete for taking advantage of the low prices of raw and semi-manufactured materials from abroad, should your workers or sales connections fail in the end to meet you in the matter of cost.

"Be on the watch for any new openings which occur for marketing products at all similar to your own in any market that is open. Do not neglect a product because the market is small to-day. It may be big to-morrow. For instance, we have had successes recently with motor gully emptiers and flushers and motor mowing machines."



DEVELOPMENTS IN SHOP EQUIPMENT



HY-SPEED AUTOMATIC TAPPING MACHINE

The Cincinnati Hy-Speed Machine Co., Cincinnati, Ohio, have recently developed and placed on the market a line of tapping machines, the operation of which is either automatic or semi-automatic. Among the features of these machines is a patented spindle lead and automatic reversing mechanism. Through the use of the spindle lead device the tap is fed and returned in a positive way, entirely independent of the operator. It is claimed that the holes are tapped accurately without danger of threads being stripped or taps broken. The method of changing from full automatic to semi-automatic operation is by means of a half turn of a stop plunger at the side of the control handle.

When operating as a semi-automatic machine the spindle feeds downward, reverses, and automatically stops at the top position. When full automatic operation is desired the stop plunger is placed in the proper position and the spindle automatically reverses at the top and bottom of its stroke and continues to do so until the operator has reason to stop the machine. The depth to be tapped is regulated by adjustable dogs with limit stops. The machines are equipped with S K F ball bearings. They are designed to do right hand tapping but can be supplied with an attachment which will permit left hand tapping to be done. The machines are built in styles from one to three spindles and in two sizes of which the maximum tapping capacities are ½ inch and ⅞ inch diameter in steel. The regular machines are designed to be belt driven and stand on their own pedestal. Bench and belt motor drives are also supplied.

THREE AND FOUR WAY INDEX BASES

About a year ago the Industrial Engineering Co., Detroit, Mich., marketed their two way indexing bases for the first time. By means of this index base, work can be placed on one side of a fixture table while another part is being machined diametrically opposite. Then when the operation on the first piece has been completed, the table can be indexed 180 degrees to bring the unfinished part in line with the cutters. The same company has now placed on the market two more styles of bases which can be indexed to three and four positions respectively. These bases are made the same dimensions as the original style namely 10 and 16 inches in diameter, and the mechanism is based on the same principle.

NEW TYPE OF DOOR LOCK

Not a few aggressive business houses are preparing to make 1922 a much better year than 1921. There is an expressed feeling among them that industrial conditions are improving and that trade can be done by those who hustle for it. Among these firms is International Business Systems Co. of Toronto, whose large shop is now tooling up preparatory to turning out new devices for the registration of time. Chief among these machines is a recording door lock of ingenious nature. It is so constructed that when you put a key in the lock a registration is made as to who opened the door, which key opened it, whether the door was opened from the inside or out, whether it was locked or unlocked and the exact date, hour and minute when the whole operation was performed.

DIE-FILING MACHINE

The R. G. Haskins Co. of Chicago, Ill., have placed on the market a die filing machine suitable for filing templates, dies, tools, etc. The filing spindle is square in cross section and has a provision for compensating for wear. A reciprocating motion is imparted to the file through the medium of a hardened and ground tool steel block. The mechanism is entirely enclosed. A grooved table 9 inches square is provided. This table can be locked at any angle. The motor is of ¼ horse power and is mounted on a slide. It transmits its power to a friction disc. Moving the motor the full length of its slide changes the speed of the spindle from 700 to 300 strokes or revolutions a minute. The equipment is light and portable.

INDUCTION MOTORS

A line of general-purpose, polyphase, squirred cage, induction motors, has recently been placed on the market by the S. A. Woods Machine Co. of Boston, Mass. Up to one horse power the motors are entirely enclosed. Larger sizes are semi-enclosed. The incoming ventilating air is screened as it enters the motor. It then passes baffle plates and is guided over the windings and exhausted through the bearing heads, by the action of a fan. This system of ventilating, it is claimed, will keep the motor free from dirt and oil-soaked windings. The stator housings are corrugated thus giving additional radiating surface. All motors have a temperature rise of 40 degrees C. at full load and 50 degrees C. when carrying a continuous 25 per cent. overload. The bearings are lubricated through the use of wool waste. The stator windings are double cotton covered enamel wire, while the rotor windings are of the cast unit type. The stator and motor may be purchased separately thus enabling manufacturers to supply their own shaft and bearing heads for use in building the motors into standard machines as integral parts of same.

MILLING ATTACHMENT FOR BORING MACHINES

A vertical milling attachment has been developed in the shops of the Blomquist-Eck Machine Co. of Cleveland, Ohio, which can be placed on the horizontal boring machines manufactured by this firm. The attachment can be fitted to any machine that is turned out by this firm as all necessary drilling and machining is done on all standard boring machines. The attachment is supported by a cross rail placed between the horizontal spindle saddle of the machine and the outboard bar support. The vertical spindle saddle of the attachment may be adjusted along the cross rail by means of a rack and pinion. Motion is transmitted to the vertical spindle from the regular horizontal spindle by means of bevel gearing in the vertical spindle saddle.

COMBINATION WORK BENCH

A few months ago the Myers Machine Corporation of Columbia, Pa., introduced to the trade a combination work bench on which was mounted a geared automatic hack saw provided with a vise, a 10″ sensitive drilling machine equipped with a table and a ⅜″ chuck, a grinder with emery and muslin polishing wheels, and a 4″ machinist's vise. This equipment was driven by a ½ horsepower motor. Another work bench similar to this has been recently placed on the market. The new work bench is, however, equipped with a 10″ by 45″ engine lathe having a double friction coustershaft, instead of the hacksaw. This latter bench is known

as their No. 2 Combination Work Bench. The lathe is of standard design, having a hollow spindle, power cross feed, compound rest, thread-cutting mechanism, back gearing, and a three-step cone.

PARALLEL EXPANSION REAMER

A parallel expansion reamer has been developed by H. A. Hopkins and Co., Inc. of South Bend, Ind. It was especially designed to remachine automobile engine cylinders. Five sizes are manufactured ranging from 2¾ inches to 4 inches. Each reamer is suitable for cylinders varying not more than ¼ inch in diameter, and has an extra expansion of 1/16 inch to allow for grinding. The tool consists of only the body, nut and blades. The blades are attached to the body by means of flanges that engage slots in the body. The reamer is equipped with a pilot which permits the blades to enter the cylinder before cutting commences, the reamer then being adjusted to size. A micrometer dial facilitates accurate setting of the blades. A ratchet wrench is provided for actuating the reamer.

SURFACE GRINDING MACHINE

The No. 1 Surface Grinding Machine manufactured by the Wilmarth and Norman Co. of Grand Rapids, Mich., for several years, has been completely redesigned. The machine is now fitted with an adjustable swivel sub-table. Thus it enables the machine to handle angular or irregular shaped work. Suitable graduations to enable close adjustments are provided in connection with the swivelling apparatus. The sub-table is provided with "T" slots, for attaching a head and a tail stock, or a dividing head. A built-in trueing device enables the operator to true up the wheel without disturbing the work on the machine. The machine can handle accurate gauge and die work.

HORIZONTAL HIGH SPEED DRILLING MACHINE

The Acme Machine Tool Co. of Cincinnati, Ohio, have developed a high-speed drilling machine that is especially adapted for drilling small diameter deep holes, such as grease cup holes in king bolts, or similar work. The work is held in a lever operated automatic chuck. The turret slide saddle carries a casting which in turn carries the drill spindle. This permits long or short work be quickly accommodated in the machine. The work ordinarily revolves at 300 r.p.m. and the spindle at 3000 r.p.m. A special design relieves the spindle of all belt strain. A stop is provided which stops the drilling at any predetermined depth.

PORTABLE ELECTRIC DRILL

Two sizes of a portable electric drill have been placed on the market by the Hisey-Wolf Machine Co., of Cincinnati, Ohio. The drills are completely equipped with ball bearings and the electric motors are built by the Hisey-Wolf Co. They are known to the trade as the "Super" No. 38 KU which has a capacity up to ⅜ inch drills and No. 50 KU which has a capacity for drills up to ½ inch in diameter. Coil springs are provided at all ball bearings on the three shafts to allow expansion and contraction to take place without distortion. Quick cable springs are provided at all ball bearings on the three shafts to allow expansion and contraction to take place without distortion. Quick cable connectors are provided at both ends of the cable.

A patented switch is part of the regular equipment, and although externally mounted is protected by a removable handle cover. The brush holder is made of bakelite which is not affected by oil, moisture, or atmospheric conditions.

Forced ventilation is obtained for the commutator and brushes as well as the armature and field coils. The fan is so designed and mounted as to prevent the lubricating grease in the gear head from working into the motor parts.

TUBE MANUFACTURING EQUIPMENT

The Davis-Bournonville Co., of Jersey City, N. J., have recently developed and placed on the market a complete set of machines for the manufacture of welded tubing from commercial sheets. The equipment is designed to handle any gauge sheets from No. 10 to 22 and tubes from ⅝ inch diameter to 4 inch diameter can be manufactured. The equipment consists of a slitting machine which cuts the standard sheets into strips of the proper width to be rolled into tubes. The next machine is the tube forming machine which rolls the tubes at speeds varying from 50 to 100 feet a minute.

Next in line comes the tube welding machine which welds the tubes and can be operated either right or left hand. The oxy-acetylene process is used in the machines and adjustments are made according to the size of tube being welded. A machine for grinding the ridges produced by welding is among the line of equipment. The next machine is a straightening machine. A rotary swaging machine is provided with ten rolls in the head. On this machine specially shaped pipe is produced. The other machines in the equipment are a motor driven tube cutting machine having an oscillating head, a draw bench which has a capacity for tubes up to 2 inch diameter and No. 14 gauge, and several types of tube bending machines. The equipment is quite complete and enables a shop to produce tubes on short notice to any specifications within the limit of the various machines. It enables a shop to take care of a large and varying volume of trade without carrying in stock anything more than a representative range of sheets.

GRINDING AND POLISHING MACHINES

The St. Louis Machine Tool Co., St. Louis, Mo., have added several machines to their line of grinding and polishing machinery. Among these new productions is a grinding machine which has a wheel on each end of the arbor, a similar design of machine for polishing on the other end of the arbor. The column and head is the same in all three machines, being of cast iron, box section. The spindle is equipped with a pulley between the main bearings, which drives the arbor. Bolted to the column is an offset vertical extension which provides a base for the motor which is belted to the arbor pulley. The motors furnished are of the enclosed, repulsion start, induction run, type, either single or three phase, squirrel cage. The three phase motor operates only on three phase circuits at one voltage. The single phase machines operate on one, two, or three phase current at 110 or 220 volts. A direct current motor can also be supplied. Grinding wheels are driven at a surface speed of 5,000 ft. per min., and those on the polishing machine at 7,500 ft. per min. The machines are made in a large range of sizes, in stationary and portable types. The portable types vary in weight from 170 lbs. to 290 lbs.

The firm also manufactures a new design of heavy floor type machine in three sizes, for which wheels of 18 in. x 3 in., 20 in. x 3 in., and 24 in. by 4 in. are respectively recommended. The machine is driven by a central pulley of either the plain or cone type. The bearings are provided with large oil chambers, which are filled and drained through a pipe connection at the back so arranged as to prevent overflow of oil. The weights of these machines range from 700 lbs. to 1.000 lbs.

PORTABLE ELECTRIC DRILLS

Jones, MacNeal and Camp, of Chicago, Ill., have placed on the market a portable electric drill, known as the "Power King." There are eight sizes in the line, having various capacities up to drills of 1 inch diameter. Each drill is equipped with a two speed mechanism. This feature is useful when drilling in two kinds of material, one softer than the other, or in changing speeds for using carbon and high speed drills. Ball bearings are furnished throughout. Combined radial and thrust bearings are placed at each end of the driving shaft. The handle end is provided with a protecting cap of sufficient strength to take pressure from a jack or to resist shocks due to falls and rough handling. The drill parts are very accessible. The regular equipment includes a standard three jaw chuck, interchangeable with a No. 2 Morse Taper Socket, and a quick make-and-break type switch.

The number of motor vehicles of all kinds registered in Great Britain from Jan. 1 to Aug. 31, 1921, was 870,782. The gross amount of taxes collected from the same was £9,876,105, which is distributed as follows: England and Wales, £8,777,863; Scotland, £888,227 Ireland, £210,015.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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J. H. MOORE, Editor
T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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More Than Mere Manufacturing

IN DAYTON, Ohio, the National Cash Register Company continue producing their registers. A short time ago John H. Patterson, founder of this concern, stepped out to allow his son to take his place, but in thus handing over the reins of office, he also left behind him a record of achievement of which anyone might be justly proud.

When Mr. Patterson took charge, about the year 1884, the premises and staff consisted of one room and one man, but business gradually increased until at the present time some 7,000 are employed in production and 2,500 in selling. It is not this point, however, we desire to discuss so much as the obstacles, seemingly outside of the business itself, which Mr. Patterson overcame. When he started his factory the surrounding conditions were, to use his own expression, horrible. Gamblers, thieves and other undesirables infested his neighborhood. Boys broke his windows and did all sorts of damage to the plant. Instead of giving up, Mr. Patterson started to improve conditions on the assumption that the boys were really bad because they had nothing to do. He proceeded to clean up the premises, sow seed, plant flowers, etc., but the boys still broke windows and tore up the flowers.

A school was started and being suspicious at first, the boys came to cause trouble, but remained because of the treatment they received. Clay modeling and other classes were started, and even the girls were included. Gardens were developed, and before long the ring-leaders of the various window breaking gangs were actually in charge of the class activities.

The garden enterprise is now an incorporated company and the boys sell their products to the locality at large. Farm clubs have also been started, and many other schemes, including winter instruction classes in many trades. Similar classes have also been successfully run by the employees of the C. N. R. Co. and last year alone over 1,500 enrolled, 600 of whom graduated. To explain in detail all the schemes which are in force in the plant at Dayton would be impossible in this space. Suffice it to say that Mr. Patterson has amalgamated human nature and manufacturing with wonderful results. Every employee is proud to belong to his organization, and anyone submitting an improvement of any nature is given full credit for it.

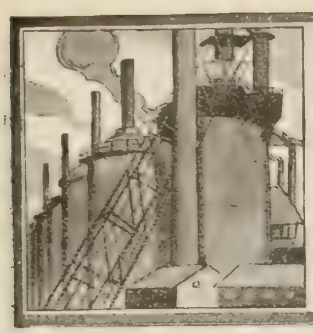
There is a lesson to be learned from Mr. Patterson's activities. We are apt to look on manufacturing as a cold-blooded business proposition, but if we mix human nature with it, and let the worker feel it is his personal business just as much as his employer's, it is wonderful the talent that can be brought out. Workers do not wish charity, but they do demand rightful recognition. Local difficulties and dissension in the ranks, can be cleared away by a common sense treatment of any trouble.

Waterways Scheme

WE HAVE from time to time commented on this proposition, and we are brought back to the subject by an editorial in a daily newspaper, which claims that the force of opinion of the twenty million people living on the shores of the Great Lakes will overcome all opposition to the scheme. It further says that nothing can prevent the St. Lawrence and the Great Lakes becoming the Mediterranean of America. We disagree with this viewpoint. One of the things that will inevitably prevent the Great Lakes becoming the Mediterranean of America is the fact that for six months of the year they are useless for navigation purposes. Further, they will be approached not by a channel twenty odd miles across, like the straits of Gibraltar, but by tortuous canals made more difficult by locks. Of the twenty million people mentioned the number living along the Canadian shore of the Lakes is a very minor part. As to the power question, we have had unfortunate examples of how far out estimates can be when a particular scheme is being pushed. The Chippawa development in Ontario that started out as a modest scheme to cost about $10,000,000 has now cost over $50,000,000 and the end is not yet. This question is not one for ill-informed politicians or boosters to settle, but requires the fullest and most painstaking investigation by experts. If it can be shown to be feasible beyond all doubt as a power proposition, then subject to suitable guarantees it may be gone on with. As far as navigation is concerned, we have very many doubts about ever seeing large ocean steamers docking at Port Arthur or Fort William, canals or no canals.

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MARKET DEVELOPMENTS



Not Much Activity on the Various Markets

Prices on Pipe Have Dropped About $5 to $6 a Ton—Production of Steel Likely to Drop Within the Next Two Weeks—Machine Tool Market Dull—Small Tools Hardly Moving.

THE MARKET during the past few weeks can be likened to an elevator. It has its ups and downs. December is always looked upon as a quiet month in the steel market, and yet, locally, we find that this month will show an improvement over November. Not that the volume of business has been large, but it has been more than was expected. The machine tool market, locally, is very dull, while the metals continue to show strength. Copper leads the list in this respect.

Pittsburgh reports an increase in discounts on standard steel pipe, also line pipe, this in turn effecting reductions of approximately $5 to $6 a ton. Oil country goods are also reduced about $5 a ton.

Pipe mills are operating at various rates, from about 60 to 80 per cent. capacity. Taking the rest of the steel industry as a whole, it is hardly operating at an average of 40 per cent. It is figured that the industry is producing about 21,000,000 tons a year, against only about 10,000,000 tons at the middle of last July. Prospects are, however, that the production of steel will decrease considerably in the next two or three weeks, on account of mills closing for short periods, either over the holidays, or for the first week or two of the New Year.

Very little activity exists on the Montreal market. With the exception of tin, prices remain unchanged. There have been a few orders for rails, but nothing of importance. Machine tools are very quiet, although small tools and supplies are moving in fair fashion. The metal market is firmer, having strengthened in sympathy with the new York and London markets. Should the demand on copper increase to any extent, an increase in price would not be surprising. The scrap metal market continues dull.

DISCOUNTS ON PIPE ARE INCREASED REDUCTIONS AROUND $5 AND $6 A TON

PITTSBURGH, December 20th.—The National Tube Co., (Steel Corporation) issued new price lists dated December 15, increasing discounts on standard steel pipe and O. D. pipe 2½ points, and discounts on line pipe three points, effecting reductions of approximately $5 a ton respectively, oil country goods being also reduced $5 a ton. These lists supplant those of September 16, which also represented reductions, the basing discount on pipe changes from 69½ to 71 per cent. off list.

The steel corporation's action was prompted by continued shading on the part of independents. This shading began shortly after the reduced lists of September 16 were issued, the reduction at that time having also been caused by the shading of independents. The shading gradually spread until it became practically universal among the independents on all their business, but it did not go much deeper. In standard pipe the usual thing was to give customers an extra 5 per cent. discount, beyond the regular trimmings of the leading interest. Frequently the independents give an extra 2½ per cent., and they claim they must do so on account of the consignment method the leading interest follows so largely in marketing its product.

While a strongly competitive condition existed the independents were deterred from cutting prices more deeply because they had 60-day price guarantees outstanding. The reduction now made by the leading interest goes deeper than the shading in the case of standard pipe. In line the reduction is merely in the price at which small lots are sold, for on large lines there is practically always a large concession given by any seller. Recent large line pipe orders have gone at $20 to $25 a ton under list prices, whereas the list prices are now reduced only about $6 a ton.

Prices Almost Stationary

The decline in tubular goods is interesting in itself and interesting in the commentary it gives on the general steel market situation, which has been that of prices remaining practically stationary on account of buying being rather light as a whole, and orders individually being small in size. There has been little incentive to make further cuts in price, even though there is a strongly competitive spirit throughout the trade. Tubular goods constituted an exception to this rule of there being a light demand, hence prices yielded. It is not an unfair assumption that if there had been heavy demand in another line of finished steel products the price would probably have yielded likewise. Experienced market observers have been predicting for several weeks that should a general disposition to buy develop, particularly for forward delivery, fresh declines would occur in the products involved. The declines would not be large, only a very few dollars a ton, as there is not room for declines. Prices in general are approximately at cost of production, with the present operating rate. With a higher operating rate costs would be somewhat lower. In tubular goods it appears there was a fair margin, and with the expectation of a heavier operation in prospect, mills were more ready to make concessions. Pipe mills are now operating at various rates, say from 60 to 80 per cent. of capacity. Taking the rest of the steel industry as a whole, it is hardly operating at an average of 40 per cent.

Steel ingot production reached a maximum, about November 1st, of 25,000,000 tons a year or perhaps a trifle more. The steel corporation and independents were operating at very nearly the same percentages of their respective capacities, say 48 to 50 per cent. Since then independent mill operations have decreased very considerably, while the steel corporation maintains its operations fairly well. For the industry as a whole the rate is probably about 21,000,000 tons a year, against only about 10,000,-

000 tons a year, at the middle of last July.

The better operation the steel corporation has as compared with the independents has been more or less in evidence for about a year past, and is due to the inceased good will the corporation acquired in 1920, by holding down its prices when the independents made large advances. Not only has the corporation a better operation, it has secured, on an average, slightly higher prices than the independents.

Prospects are that production of steel will decrease considerably in the next two or three weeks, on account of mills closing for short periods, either over the holidays or for the first week or two of the new year. Some have made a particular effort to operate in the past few weeks in order to give the workmen some holiday money. By the middle of January steel production should, in normal course, begin increasing, to reach something like the rate early in November, say 25,000,000 tons a year. The approach of spring may bring enough additional consumptive demand to push the rate still higher. From the present outlook the fairest guess seems to be that at no time between the middle of January and the middle of August will the rate be as low as 20,000,000 tons a year, in ingots, or as high as 35,000,000 tons. Production made a record in 1910, at 25,000,000 tons, while in both 1912 and 1913 about 30,000,000 tons were made. In other words, production next year is likely to make a fairly favorable comparison, in tonnage, with the best pre-war years, but some observers, thinking simply of the enormous capacity that has lately come into existence, regard the prospects as poor, since a 20,000,000 ton rate would be only 38 per cent. of capacity and a 35,000,00 ton rate would be 67 per cent. of capacity.

Prices in Detail

Bars, shapes and plates remain quotable in general at a range of $1.50 to $1.60, but the $1.50 price is more generally in evidence than formerly, and $1.60 is rather exceptional. If particularly desirable orders were going, $1.50 would perhaps be shaded on such orders. The sheet market can usually be depended on for developing interesting news. Recently it was the most irregular of all the finished steel markets, there being deep cuts interspersed with attempted advances, some of them successful. Now sheets have gone to the opposite extreme, for the market is firmer than that of any other finished steel product. In fact, it appears that the prices of $3.00 on black sheets and $4.00 on galvanized sheets are now being held with absolute rigidity, no buyer being able to secure even the slightest concession.

Tin plate is easier. The shading done for several weeks by one or two mills has spread until now several of the independents are shading somewhat freely, selling at $4.65 or less when the regular price, maintained by the Steel Corporation, is $4.75.

POINTS IN WEEK'S MARKETING NOTES

The discount on standard steel pipe has increased 2½ points, and 3½ on line pipe, this causing reductions of approximately $5 to $6 a ton. Oil country goods are also reduced $5 a ton.

Steel prices remain stationary, but if an active demand existed, it is quite possible declines would take place on this market also.

Steel ingot production reached a maximum about November 1, being about 25,000,000 tons a year. Since then independent mill operations have decreased considerably, while the Corporation holds its own very well. An average production for the industry would be about 21,000,000 tons a year against about 10,000,000 tons at the middle of last July.

Bars, shapes and plates are quotable at from $1.50 to $1.60, but the $1.50 price is general. $3.00 for black sheets, and $4.00 for galvanized, are being held with absolute rigidity. Tin plate is easier, selling at from $4.65 to $4.75. Foundry pig iron is selling at from $19.50 to $20.50 valley; bessemer remains at $20, while basic is still at $19, both at valley furnaces.

The local steel market is quiet. Tubes and sheets are the only active members, and even this activity was not expected. Compared with November, the present month will be much better than the former. Machine tools are dull, while the metal market shows continued signs of strength.

Montreal reports a quiet week on all markets. Very little business is moving, and with the exception of tin, prices remain unchanged. Machine tools are rather dull, but small tools and supplies are moving not so badly. Non-ferrous metals are stronger, but the scrap metal market continues to be dull.

Pig Iron

Foundry pig iron has been quotable for weeks past at $20.50, valley, the price lately becoming practically nominal as there were no transactions of importance to test by In the past ten days a few relatively small inquiries have come into the market, and they developed a price of $19.50, at which the market is now quotable. Bessemer remains at $20 and basic at $19, both at valley furnaces. Whether these prices would be shaded on a nice order remains to be seen, the balance of probability being in favor of the buyer.

TORONTO MARKET IS VERY QUIET

TORONTO, December 20th.—"I think a good plan would be to have a gramophone record made, playing it over for you each week as you enter the door." In these few words a steel dealer unconsciously summed up, in a rough way, the local steel situation. With slight variations, the same report of a month ago would cover activities at the present time. For some unforeseen, and unlooked for reason, business has been better this week, but this is taken simply as a last spurt before the winter vacation period sets in. Boiler tubes and sheets were active during the past week, and even dealers themselves do not attempt to explain the demand. It was there; they were pleased to get the business, but they do not expect the demand to last. Apart from these two numbers, the steel market is merely moving. Compared with November, the month of December will be the better one from a business standpoint. As January and February are always dull months, no move of importance can be expected on the steel market for some time.

Machine Tools

The machine tool market is very quiet these days. A few dealers report good sales, but this is too spotty to be of any special significance. It's a case of turn about fair play. The dealer who was busy last month may be the very one who shows poor returns this month. There is no definite demand, and dealers themselves refuse to comment on what the New Year will bring forth. On several occasions, this market has shown signs of life, only to fall back again into the now familar rut.

The small tool trade has diminished almost to the vanishing point. From a healthy member, it has developed into a very sick patient. When it will regain its strength, no one cares to predict. As long as manufacturers keep to their hand to mouth buying policy, this market will not improve much.

The metal market continues to show signs of strength. During the last two or three weeks copper has shown more activity than at any other time in 1921. Not only has the price advanced, but the demand has increased. Tin is a rather speculative material at present, and the existing price is not expected to hold. Lead has surprised quite a number, because, although it is generally understood that December is a poor month for this metal, there has been more lead sold within the past two weeks than in the complete month of November. Trading in foundry scrap is light, and until a larger volume of business is secured by foundries throughout the country there will be no improvement in this section. A more complete story of the metal market follows this brief report.

BRIEF SURVEY ON METAL MARKET

SPEAKING on the condition of the metal market at the present time, Ernest W. Knight, of Frankel Bros., Iron & Steel merchants, Toronto, says that copper has shown more activity in the last three weeks than it has at any previous time during the year.

"The rise in price has been steady and gradual," continues Mr. Knight, "and is likely to be maintained for some little time yet, but I do not anticipate a continued advance beyond 14½c. to 15c. per pound. I am under the impression that after the present movement has subsided, which will probably be during the early part of January, the metal will again settle back to about 14c. level, at which it will remain until the buying movement starts for second quarter copper. I do not anticipate any reduction and there may possibly be some further advance, and I would suggest that the present time is opportune for covering requirements for the first quarter."

"I understand that electrolytic copper has been sold for first quarter at 14½c., New York. If this is worked out on a basis of 8 per cent. American Funds, it will be seen that electrolytic ingot, laid down in Toronto, costs $17,-40. I presume that the Tadanac people would offer Canadian ingot in the neighborhood of 17¼c. I wonder if Canadians realize that with the single exception of the Central Powers and Russia, non-ferrous metals are more expensive in Canada than they are in any other country in the world.

"Tin is again in a highly speculative market, and it is extremely difficult to forecast what is likely to happen, but I understand the squeeze which was existent during the past two or three weeks, has been removed, and I look for prices being a little lower for the rest of the year. The market is extremely difficult to forecast, but I would recommend only purchasing for present requirements. In regard to tin, readers will probably understand that the forces controlling the output and marketing of this material, are ruled by one of the most exclusive rings in existence, with millions of capital behind them. Unless something unforeseen happens, there is no reason in the world why tin should even maintain the price at which it is being offered today.

"Spelter shows signs of strength, but I do not anticipate any noticeable advance for some time to come. Zinc producers seem to have the market well in hand and are refusing orders at current market prices, which would seem to indicate that when the first quarter demand really makes itself felt, higher prices will be the rule of the day. I do not think anyone would make a mistake by covering their requirements for first quarter zinc right now. Prompt shipment zinc is being quoted at $4.85, East St. Louis, and this price, on a basis of 8 per cent. American Funds, means that Prime Western to-day, costs $6.75 per hundred pounds. f.o.b. Toronto. The Tadanac people will probably quote $6.65 to $6.70, but I have been unable to confirm the actual Canadian quotation.

"Lead is also an uncertain commodity to-day", concluded Mr. Knight, "and it is hard to prophesy what is likely to happen in the near future. Generally speaking, December is a very quiet month in the lead markets, but it is a positive fact that within the past two weeks, more lead has been sold than during the entire month of November. This is a most unusual state of affairs, and it may lead to some little fluctuations. The American Smelting & Refining Company's price is quoted $4.70, both East St. Louis and New York, which also is an unusual feature. The outside market is quoted at $4.40 East St. Louis and $4.75, New York. I do not look for any advance worthy of note in lead and think that first quarter buying can be satisfactorily left until after the first of January."

PRICE OF TIN ADVANCES SLIGHTLY— NOT MUCH ACTIVITY ON MARKET

MONTREAL:—Probably the next two weeks will be the quietest of a very quiet year. Very little business has been moving and prices with but few exceptions have remained unchanged. The financial reports of some industrial firms have been published and all show reduced earnings, and consequently have declared smaller dividends. Generally speaking, everyone unconsciously compares these reduced earnings, to the abnormal profits which were so common during the war years. This method of comparison is not good practice. Most of these companies are financially sound and are only fortifying themselves against the future, and it is a sign of strength and foresight to be able to present such reports, which in nearly all cases show reduced bank indebtedness, small stocks of raw material, and reasonably large cash or liquid assets. However, owing to the Christmas season, many of the larger machine shops in this locality are closed, there being little business offering. Thus the purchasing departments of many concerns are not actively functioning in as far as actually placing orders, is concerned. These departments are, however, watching the markets with eagle eyes; collecting quotations on various lines; sending out many pertinent inquiries, and in a multitude of ways showing there is a general consensus of opinion that early in 1922 business conditions will revive. The disturbing factor of the general elections is a matter of the past. The calendar year of 1921 will have soon passed, the quiet season during the Christmas recess is rapidly approaching, therefore we have more than the usual quota of reasons to believe that we are turning over a leaf and starting on a new sheet, free from many of the fettering entanglements of the present season.

Business in the steel end of the industry is rather dull but not the least discouraging. There have been a few small orders for rails from the Canadian National-Grand Trunk System, divided between the Algoma & Dominion Steel Corporations. There is a light trading in merchant bars. Structural steel is also in light demand. Sheets and plates are moving but not in any greater volume than for the past few weeks. Cold rolled steel and tool steels are very quiet Prices for all the various steel products remain unchanged at the prevailing low levels.

Pig Iron also shows small activity and the prospects are not rosy for any sudden change for the better. There is no doubt that as soon as general retai conditions show any marked sign of improvement, foundries will be among the first to feel the better conditions reflected in increased activity. Prices o pig iron remain unchanged and really are somewhat low all matters considered.

Machine tools are still very quiet. Before this line of trade increases to any marked extent, several other movement in the chain of business must act a "prime movers." Retail conditions mus create a demand from the industria and manufacturing concerns. Thes firms at present have much idle machinery, and until this machinery is place in a fair way to earn its keep, the manufacturer is not going to be intereste in the ordinary type of general purpos machine. The single purpose machin the automatic lathe and screw machin brought up to the last minute in design, will have a certain amount of interested prospects. To sell this type machine it is often necessary to ca into play the best engineering ski available in the designing departmer of the manufacturer. New develo ments in standard machines, that woul enable them to enter into competitio with specially designed machines in pr duction work, but at the same time ha a broader field of application, are a tracting the eye of the engineering d partments of many large firms and all probability some of these types machine tools will enter largely in specifications for new equipment. Ge erally speaking, prices are gradual coming down to a very reasonable lev but are still above pre-war prices.

The small tool and supply busine continues to be an active factor in t business. The volume has dropped off little and prices are undergoing a sl

(Continued on page 44)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shaues, Pitssburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross Montreal	Toronto
Lake copper	$17 75	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	39 00	38 50
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 25
Aluminum	27 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ in.	$ 6 50	$ 8 50	$	$ ....
¼ in.	4 89	6 99	5 91	8 01
⅜ in.	4 89	6 99	5 91	8 01
½ in.	11 82	14 88	14 71	17 77
¾ in.	6 50	8 03	7 95	9 48
1 in.	7 99	10 06	9 95	12 02
1¼ in.	15 99	20 13	19 90	24 04
1½ in.	19 11	24 06	23 79	28 74
2 in.	25 72	32 38	32 01	38 67
2½ in.	40 66	51 19	.....	.....
3 in.	53 17	66 94	.....	.....
3½ in.	67 62	84 18	.....	.....
4 in.	80 12	99 74	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 in.	$29 42	$36 08	$35 71	$42 37
2½ in.	44 17	54 70	54 11	64 64
3 in.	57 76	71 53	70 76	84 53
3½ in.	69 46	86 02	85 10	101 66
4 in.	82 30	101 92	100 83	120 45
4½ in.	95 89	1 20	1 30	1 54
5 in.	1 12	1 40	1 52	1 80
6 in.	1 45	1 81	1 97	2 33
7 in.	1 89	2 37	2 53	3 01
8L in.	1 99	2 49	2 66	3 16
8 in.	2 29	2 87	3 07	3 64
9 in.	2 74	3 43	3 67	4 36
10L in.	2 54	3 18	3 41	4 05
10 in.	3 28	4 10	4 39	5 21

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4 in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 25
Cut nails, base	4 85
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	.....
Queen's Head, 28 B. W. G.	7 75	.....
Flerur-de-Lis, 28 B.W.G.	7 25	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 25
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 75
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	4 00

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	.12½	Popular	.10
Standard	.11	Keen	
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White	20	Dark colored	.13
Mixed colored	.14		

This list subject to trade discount f quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28

ANODES

Nickel	.55 to
Copper	.38 to
Tin	.70 to
Zinc	.16 to

Prices per lb.

COPPER PRODUCTS

	Montreal	Toro
Bars, ½ to 2 in.	$31 00	$34
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42
Copper sheet, planished, 16 oz. base	42 00	48
Braziers', in sheets, 6 x 4 base	35 00	41

LEAD SHEETS

	Montreal	Toro
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9
Sheets, 3 1-2 lbs. sq. ft.	8 25	8
Sheets, 4 to lbs. sq. ft.	8 00	9

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

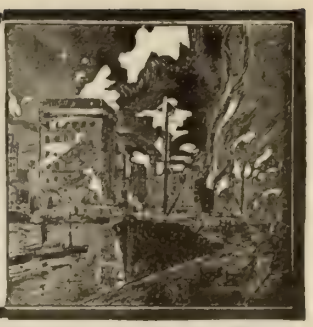
Acid, boracic	.2
Acid, hydrochloric	.0
Acid, nitric	.1
Acid, sulphuric	.0
Ammonia, aqua	.2
Ammonium, carbonate	.1
Ammonium, chloride	.1
Ammonium, hydrosulphuret	.7
Ammonium sulphate	.1
Arsenic, white	.1
Copper, carbonate, annhy.	.3
Copper, sulphate	.0
Cobalt, sulphate	.2
Iron perchloride	.6
Lead acetate	.3
Nickel ammonium sulphate	.1
Nickel carbonate	.3
Nickel sulphate	.1
Potassium sulphide (substitute)	.4
Silver Chloride (per oz.)	.8
Silver nitrate (per oz.)	.6
Sodium bisulphate	.1
Sodium carbonate crystals	.0
Sodium cyanide, 127-130%	.3
Sodium hyposulphite per 100 lb.	6.5
Sodium phosphate	.7
Tin chloride	.8
Zinc chloride, C.P.	.3
Zinc sulphate	.0

Prices per lb. unless otherwise stat



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

A fire recently damaged the planing ill and machinery owned by Reid & ., Berkeley St., Toronto, to the extent $50,200.

Construction of a glass factory at colette, Que., is contemplated by the nerican Optical Co., and will cost ap-oximately $75,000.

The Hamilton Tar and Ammonia Co., rolina St., N., Hamilton, Ont., will ct a factory and warehouse at Ot-wa, Ont. costing $50,000.

E. S. Manny & Co., 27 Cote St., Mon-al, Que., report very good business in ir line locally and have had to turn ay orders lately.

Fire losses in Canada during the ek ending November 30th are estim-d by Monetary Times at $258,500, mpared with $334,000 the previous k.

The Preston Mineral Springs Co., plan erection of a hotel and a sanatorium cost $250,000.

lans will be prepared for a public mming bath to cost $150,000 for the of Ottawa, Ont.

two million dollar bond issue to fin-e the construction of roads in British Columbia, was sold recently by the Gov-rnment to a large Toronto financial sy licate.

onstruction of retaining walls at a co of $100,000 on the Rideau canal, is co emplated by Ottawa improvement co mission. Plans are also being pre-ed for a swimming pool to cost $2 000 for the city of Welland.

ork has just commenced on the new ga ge, service station, offices and show rocs for the Gotfredson Joyce Corpor-ati, at 242 Spadina Ave., Toronto. Th John V. Gray Construction Co., of To nto, have the general contract at a pri of approximately $80,000.

e Fuller Brush Co., Toronto, Ont., wa exporting to Canada in 1920, and sal were $5000 a month. In 1921 the commenced to manufacture in Can-adand sales are now $80,000 a month. 250 alesmen are being employed.

Aquarter million dollar steel and ce-men bridge which has been erected in the icinity of Milton, Ontario, is comple and ready for traffic. The bridge is a ong the largest in Canada and cov-ers span of nearly 1,000 feet. It is 125 eet high and the traffic floor is 20 feet n width.

Mr. Grayson, American manager William Jessop & Sons, Sheffield, England, was on a visit to their Toronto office a few days ago. He is in charge of the Washington plant, and also has charge of their other interests in the United States.

The Simplex Iron and Tool Co., has been incorporated to manufacture adjustable wrenches. They are located at 216 Adelaide St., W., Toronto, and Mr. Dunlop, president of the Dunlop Coal Co., is also president of the above mentioned concern. Mr. Harington of the Harbor Commission, is vice-president of the new firm.

The Ingersoll Machine and Tool Co., Ingersoll, are developing an ironing machine of size and type that is said to be more easily adaptable, in size and price, to average domestic requirements. It is operated by electricity and heat may be supplied either from gas or electricity.

The Hiram Walker Metal Products Co., Walkerville, are overhauling their foundry and installing the latest equipment, for the handling of grey iron castings on a production basis. Included in the plant is a Whitney self-feeding cupola. A separate building is being fitted up for the production of chromel (element) wire.

For the purpose of testing the valve, water was, for the first time, turned into the penstock of No. 1 generator at the Chippawa development on Tuesday. Formal opening of the plant is expected to take place on December 28th or 29th. There is some concreting work to be done, removal of wood structure and machinery before actual completion of the work.

After going the round of the world's markets including German, French, Swiss, British, American and Canadian, says the Mercantile-Guardian, an English publication, buyers have found that Canadian aluminum is cheapest. They also state that the Canadian product is of beautiful quality—the best seen for some considerable time. It is also pointed out that such aluminum often goes by the name of American, because it is shipped from New York.

The Dennis Wire and Iron Works, London, have the contract for installing solid bronze cages and grill work in the new head office of the Banque de Hochelaga, St. James St., Montreal. The contract is in the neighborhood of $17,000. They are also installing the fireproof stairways in the new public utilities building at Galt. Mr. E. R. Dennis reports conditions in their particular line to be very satisfactory at the present time, the demand for metal lockers, shelving, grillwork, etc., being representative of a wide range of activity.

After more than a year's inactivity Canadian Creosote Co. will resume operations of a Transcona plant next year at full capacity. This is according to a statement made by W. E. Dean, director of the company. The resuming of operations will give employment to 250 men, the plant to have the capacity of one million ties a year.

Word has been received from Montreal that the International Paper Co., is planning to start its newsprint mill at Three Rivers, Quebec, during the month of February. It is understood that the initial production will be 100 tons a day from two machines with a capacity of 50 tons each. It is planned to increase this amount shortly, if the market warrants, by another 100 tons a day, making the total production 200 tons a day, or 60,000 tons per year.

Mr. F. W. Staples, a dealer in Ford cars at Ingersoll, Ont., has been busy recording the best year in his business history. By sheer hard work he has sold over eighty new cars, 12 trucks, 14 tractors, 11 tractor plows and many thousand dollars of accessories to say nothing of repairs and used car sales. He enlarged his premises and added to his equipment. His 1921 business shows an increase of about 33 % over that of 1920.

In the report of Mr. E. L. Cousins, Department of Industry, submitted to the Board of Control of Toronto this past week, the definite opinion is expressed that normal times are already here. Mr. Cousins stated that the representatives of 17 United States industries have recently investigated manufacturing possibilities in Toronto, and, in the adjustment of the department, there are excellent chances of a number of new branches being opened shortly.

Young Lyle appearing for a local financial house, whose name he refused to divulge, has asked the property committee of the city of Toronto to let his firm erect a 17 storey building on the North West Corner of Bay and Adelaide St. After some discussion the application was granted. The building is to cover an oblong 200 by 132 ft. Mr. Lyle urged the committee to come to a decision, as a million and a half dollars was involved in the transaction, which would have to be put through at once.

The General Forgings and Stampings Ltd., Merritton, Ontario, have increased their capital to $650,000.

Application to erect a new planing mill, with machinery and steam boiler, by the Rastall Lumber Co., of Dawes Rd., Toronto, has been granted.

The Montreal Cottons Ltd., are enlarging their yarn manufacturing plant to make yarn of the finer counts for sale to the trade.

The Canada Paper Co., Windsor Mills, Quebec, have just put into operation a new boiler plant in connection with their St. Francis mill and it contains three 250 h.p. water tube boilers and has room for a fourth.

Among the new members entered on the roll of the Canadian Manufacturers Association for the month of November are the John McCrae Machinery & Foundry Company, Lindsay, and the Atlas Engineering & Machine Co., Toronto, Ontario.

The Prest-O-Lock Co. of Canada Limited, with head office at St. Catharines, Ontario, has been incorporated with a capital of $50,000 to manufacture automobile locks.

The Climax Rubber Co., of Canada, with head office at Dunnville, Ont., has been incorporated with a capital of $1,500,000 to carry on a general foundry and machine shop business and to manufacture every description of iron and steel and other metal works.

Negotiations between the city of Peterborough, Ont., and the Canadian Pacific and Canadian National Railways, for construction of a Union Station has begun to bear fruit. The C.N.R. has given its approval to the scheme and the three parties have agreed on the site for the erection of the station.

The D. Moore Co., Hamilton, have added a line of electric ranges to their present list of products. These ranges are being offered to the public this winter along with the Sunfire electric grate. The latter mentioned is adaptable for house, office or store use. The company have also added to and improved their different lines of popular ranges.

At the last meeting of council of the British Empire Producers' Organization a resolution was passed unanimously approving the successful visit to Canada on behalf of Empire trade by the Chairman, Mr. Ben H. Morgan. As a result of this work several Canadian industrial organizations have applied for affiliation and a number of Canadian firms and public men have been elected as associate members of the organization.

German manufacturers of machinery are said to be steadily regaining their markets in Japan. It is stated that immediately after the war, orders for machinery were placed with Germany for goods peculiar to German manufacture. It has been found, however, by subsequent trial orders that the goods received are equal to those produced before the war, and it is claimed that prices are lower than those asked for British and American goods.

The organization is announced of the Ruddy Mfg. Co., Brantford, Ontario, who are to take over the unit of the plant of Ham Bros. on January 1st., 1922. Kitchen cabinets, woven wire goods, and bee keepers' supplies are made. Mr. Joseph Ruddy, now vice-president of the Canada Starch Ltd., becomes the general manager of the new company. Ham Bros. are taking a large financial interest in the new company and their president, J. C. Ham, is one of the directors.

The Consul for the Republic of Mexico at Toronto writes that he has been instructed by the Government to inform persons wishing to go to Mexico that their passports must be stamped by the Mexican Consulate nearest to their place or residence, and not by the Consulates at the Mexican frontier towns.

The Consulates in Canada are at Toronto, Montreal and Vancouver. The charge for stamping a passport is ten dollars, United States funds, or the equivalent in Canadian money. Two photographs must be sent with passports.

Brantford, Ont.—On account of His Honor, Lieutenant-Governor Harry Cockshutt having to reside at Government House, Toronto, during his term of office, he has resigned as president of the Cockshutt Plow Company, and vice-president, George Wedlake, has been elected to this position. Colonel Cockshutt will still retain his connection with the company as chairman of the board of directors. Mayor Wedlake, who was vice-president and general manager, now assumes the dual post of president and general manager.

The Postoffice Department advises that a large number of letters addressed to Great Britain and other places in the Empire are being mailed prepaid at the old rate of postage. The new rate of postage on letters to the United Kingdom and other places within the Empire is 4 cents for each additional ounce or fraction thereof. It is emphasized that such letters when insufficiently prepaid are sent forward surcharged double the deficient postage, and in order to avoid this it is suggested that care be taken to prepay properly the postage.

The Vancouver Magnetic Steel Smelting Co. is endeavoring to obtain concessions from the City of Nanaimo in consideration for the erection of a 50-ton electric steel-smelting furnace, which is to be the first unit of a much larger plant. The company claims to have spent $67,000 in experimental work, and to be backed to the extent of a million sterling British capital. The company proposes to develop water-power from the Nanaimo river, and to erect a plant at the water front. It is asking from the city a free site for the plant, and freedom from taxation for a number of years. A committee of representative citizens has been appointed to inquire into the company's status and requests. In the event of such inquiry being satisfactory, it is likely that the requests may be granted.

Edward Beck, secretary of the Pu and Paper Association in an address "The Outlook of the Canadian Industry before the Montreal Paper Club, sa that the paper mills of Canada could a would produce a million tons of new print during 1922. As to other pu and paper products, Canada has reac ed a point where it could produce in a dition to newsprint, 138,678 tons board, over 15,000 tons of fine pap 60,000 tons of wrapping paper, and 024,796 tons of pulp of various grad giving the industry a total annual to nage exceeding 2,300,000 tons. H views concerning the future were ve optimistic.

Christiania, Norway:—Mr. H. P. M tet, a mill owner of Aalesund, Norw has invented a new twisting machine, t principle of which is that, in contrast types now used, the bobbin-spool rotat as the same time as the spo which takes up the ready-made thre a process resulting in spinning fr both ends, which has not previously be done. The process is said to give greater firmness and strength in t thread than does the present method. is claimed also that the new machi works about seven times the speed the machines now in use. The invent has already taken out a patent in se eral countries under the name "Mittets Cabler." He is now making journey through Europe, and will a visit America in order to demonstra his new patent.

Trade Commissioner W. McL. Cla at Milan, Italy, says that he has been touch with an important firm of che cal importers at Milan which wishes obtain supplies of caustic soda and c bonate of soda in Canada. The t countries generally furnishing the la est quantities of these products to It in the past have been Great Britain France. Now, however, owing to agreement between two well kno manufacturing houses in Paris and L erpool by which the English house dertakes not to export its products Italy for two years, it would seem, marks the Commissioner, that Canad producers would have a favorable portunity for the introduction of th products. What is principally requi by the Italian trade is caustic s (66/67, 70/72 and 76/77), the sec formula being the one most freque asked for. If Canadian prices quality were in competition this firm alone would be prepared to take least from 4,000 to 6,000 tons of cau soda per year. During 1920 the t importation of caustic soda into I amounted to 23,459 tons, of wh France supplied some 8,611 tons, G Britain 7,006 tons, and the Un States 7,381 tons. It may be poi out that the Italian duty on liquid c tic solda is 2 gold lira per quintal, on solid caustic soda 4½ gold lira pe quintal. Canadian firms interested w be well advised, the Commissioner e lieves, to get in touch with the Milan n quirer.

The Stoney Oil and Gas Co., Winnipeg, Manitoba, has been incorporated with a total capital stock of 1,000,000 for the purpose of mining oils.

Yowles and Rottenberg Co., builders, will erect a building at the corner of Richmond and Sheppard Streets, and another will be built at the corner of Bay and Adelaide Street, Toronto.

Fire at Sydney, New South Wales, caused damage at $5,000,000. Among the buildings destroyed was the Pastoral Finance Association's wool stores opposite the circular quay, the loss of 30,000 bales of wool resulting.

Two office buildings in addition to the structure which will be erected by an insurance company at the corner of Bay and Temperance St., Toronto, are to be erected in the down town district, although real estate firms interested in the buildings were unable to state as to the exact date for commencing operations.

The water supply of Montreal has been increased 25,000,000 gallons a day by the action of the Water Board cutting a hole in the banks of the St. Lawrence, which enables the river to flow into the completed part of an aqueduct that has been under construction for the past twelve years.

Many important changes in grounds and buildings were foreshadowed at the final meeting for the year of the Canadian National Exhibition directors this past week. Over $1,500,000 has been spent in the erection of new buildings for Toronto's Exhibition within the past 9 months. This is exclusive of the new cold food building.

The Agent-General for Ontario in the British Isles, Mr. William C. Noxon, has just arranged for an Ontario Government film illustrating lumbering to be shown at more than 1,000 Cinema Houses in Great Britain and Ireland during the next twelve months. This is in addition to a large number of Ontario films which are in constant circulation in the old country.

Contracts for the construction of the extension of the Timiskaming and Northern Ontario Railway, seventy miles beyond Cochrane, will, it is expected, be let within a few days. The Ontario Government and the T. & N. O. Commission is anxious to see the work on the extension started as quickly as possible. By November next the commission desires to have 50 miles of track laid, so that supplies and material will have to be taken in before the middle of March.

The complete Toronto factory equipment of the Thompson Knitting Co., has been brought to Bowmanville, Ont., and is now in operation with the exception of a few machines, which are being installed. The new industry is already proving a big asset to Bowmanville industrially. The total capacity of the mill is 700 dozens pairs of hosiery a day, and as the machinery is installed and the apparatus becomes efficient the factory is gradually working up to capacity. There are at present more than 75 on the pay roll, and additional employees are required, which will increase this number to more than 100. The company has sufficient orders on hand to keep them going full capacity up until next June.

There is a movement afoot providing for the establishing of a carding mill at Orono near Cobourg, Ontario. The movement is part of one that is seemingly becoming general throughout Ontario, on the part of farmers, to have their wool manufactured in their own district. A committee has been appointed to get details of manufacturing expenses and machinery. No mention has yet been made whom this information is being gathered for.

Manufacturers in the Eastern part of the Dominion are showing much more activity in their respective industries. One Montreal branch of a large United States concern which had not issued catalogues for three years, is now having one prepared which will be the most elaborate it ever put out. A Toronto branch of another United States firm whose far reaching interests have placed it in the front ranks of world industries and its reputation business foresight, is making extensive preparations along these lines. In the store and heating industries two large campaigns will shortly be under way. A kitchen cabinet manufacturing concern in ordering its catalogue was elated with present conditions.

Extensive plans for the development of the natural resources of Newfoundland with the immediate employment of two thousand men was announced by Mr. P. C. Reid, president of The Reid Company, New Foundland, the other day, on his return from a three months' visit to Great Britain. Mr. Reid said that while in London, England, he had negotiated a contract with the Armstrong Whitworth Co. of that city to develop the resources of the Humber Valley. Under the project, he continued, paper mills would be established twice the size of the large Farmsworth plant at Grand Falls which supplies newsprint for the Northcliffe papers in London, with a capacity of 1,000 tons daily. Mr. Reid described the contract of guaranteeing the expenditure of $7,000,000 within two years with the establishment of aluminum works and other industries at Grand Lake and extensive water power development.

The city of Sherbrooke, Que., is showing a very encouraging activity in building and construction at the present time. St. Charles college is making an extension to cost $5,000. J. Guay is building a duplex on Mary Street costing $10,000. The Corporation Episcopal of Sherbrooke is erecting a chapel at a cost of $12,000 and Mr. E. Bradley will erect four apartments and three stores at a cost of $15,000. These may be only small items, but it goes to show that building activity is not at a standstill. The same city is also going to build a new city hall to cost $75,000.

Total contracts awarded for construction in the Dominion of Canada for the month of November 1921 totalled over $16,500,000.

The Algoma Steel Corporation secured an order for 6,000 tons of rails from the T. & N. O. Railway in connection with the extensions decided upon by the Ontario Government. The above order will be filled during the winter months and presumably will be for the Spring delivery. The business was placed with a view to relieving unemployment in the steel centres, and, taken in conjunction with the financial orders of other Canadiam railways, will make for a fair degree of activity for the winter months. It will be recalled that the Grand Trunk Railway System placed an order for 29,000 tons of rails to be divided between the two Canadian producers, and this in turn was preceded by another order from the Canadian National Railways and the C.P.R. Railway rolling stock repair work is furnishing additional employment. The Canadian National Railways is not purchasing new rolling stock this year but is seeking to bring track equipment up to a reasonable standard of efficiency.

St. John, N. B.—Considerable interest is manifested locally in the announcement that the New Brunswick Electric Power Commission has favored the construction of a transmission line from St. John to Moncton in order to enable the supply of 4,000 horsepower asked for by Moncton. It is understood that the government is agreeable to a survey for this line being made immediately and if St. John should decide to take all the current from the Musquash development, the government will commence the development of one unit on the lower falls of the Lepreau. It is felt that the requirements of Moncton, Sackville, Sussex and Hampton will make the development of the Lepreau necessary. In planning the transmission line from Musquash to St. John the hydro commission provided for the early development of the Lepreau by deciding upon a line sufficiently heavy to carry the current from both sites. While the initial expense was greater, it is said that it will effect quite a saving by obviating a second line for the carriage of the Lepreau current.

A firm in Paris, France, contemplates the importation of live lobsters from the Maritime Provinces of Canada. Before undertaking the project, however, they are investigating the practicability of taking the live crustaceans in tanks through the Gulf Stream. If it develops that the sudden changes in the temperature of the water will not prove injurious to the shellfish, it is the firm's intention to start shipments next year. If the scheme proves to be successful, it means that special carriers will have to be built, of twenty tons capacity. Next year, providing the scheme proves feasible, about six such loads will be taken from the east coast. The lobster is highly prized in France, and indeed, in every part of the world which is in a position to procure it.

IMPROVEMENT IN INDUSTRIAL AND COMMERCIAL CONDITIONS IN U.S.

CONTINUED improvement in industrial and commercial conditions is shown by figures just published by the Department of Commerce in its monthly "Survey of Current Business." Greater output of iron and steel, and of textile products is shown, while a widespread increase in building, stimulated to a large extent by the President's recent conference on unemployment, has made itself felt in lumber, cement, brick and related industries. The department notes further declines in prices during October, but on a much smaller scale than earlier in the year. This relative stability of prices and the improved banking situation, as evidenced by increased reserves, smaller loans and lower interest rates, are considered favorable to further business improvement. The most serious drawback is stated to be the low price of agricultural products and the consequent decreased buying power of the farmers.

Production Increasing

Increased production was the general rule in October, as shown by figures in the "Survey." Substantial increases were reported in pig iron, steel, bituminous coal and coke, and smaller relative increases in cement, anthracite coal and wheat flour and in the consumption of cotton by mills. Zinc production remained stationary and petroleum production decreased slightly. Surprising results are shown by the comparison of the latest production figures with the low point of the year. This shows increases of about one-third over the minimum for pig iron, cotton manufactures, by-product coke, cigars, cigarettes, and manufactured tobacco, while bituminous coal output rose 70 per cent. from the minimum and the production of wheat flour, oleomararine, beehive coke, steel ingots, cement and wool products is about double the minimum figures. A small increase over the low point is noted for anthracite coal, while zinc, copper and petroleum are still close to the year's minimum production. Production of cigarettes and wheat flour exceeded even the highest point in 1920 and cement production was the largest ever recorded.

The "Survey" points out that, except for metals, the quantitative production of the important industries is as great or greater than before the war. Bituminous coal, petroleum, wheat flour, oleomargarine, cigarettes, cement, by-product coke and cotton and wool products are all greater than the 1913 average, while the output of anthracite coal, manufactured tobacco and cigars is very slightly less. With metal production only recently at its low point and the great recovery noted especially in iron and steel during the past two months, considerable progress is seen in putting this whole industry on the road to normal production.

Retail prices on November 1st showed no change, according to figures published, and wholesale prices declined slightly. Prices paid to producers for crops and livestock, however, still declined markedly and both groups are below the 1913 level for the first time since the beginning of the war, while wholesale and retail prices are still about 50 per cent above the mark. Wholesale prices in Canada, the United Kingdom and France also declined during October but continued inflation increased the price level in Germany and Italy.

Unemployment conditions continued to improve in October. Figures for the United States as a whole and for New York State show more men employed and larger payrolls, but average earnings appear to be on the decline. This factor is also reflected in the decline in Postal Savings. The small excess of immigration over emigration has also helped labor conditions. Increased buying is reflected by greater sales in October by mail-order houses, and chain stores, greater advertising in magazines and larger postal receipts.

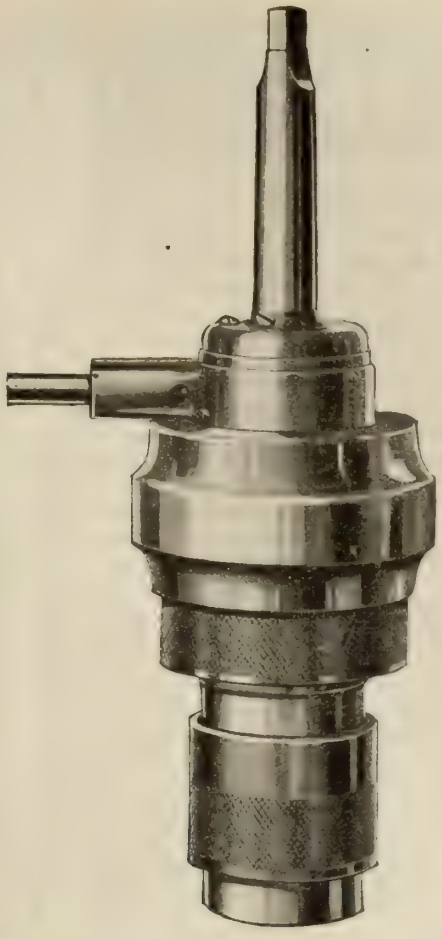
The following paragraphs summarize the more important movements shown: Tertiles—Woollen mills were more active in October and imports of wool declined. Cotton consumption increased 2 per cen. and the ginnings exceeded the 2 per cent. and the ginnings exceeded the cotton and cotton cloth were the highest this year, the former being the largest since the beginning of 1920. Stocks of cotton were greater than a year ago. Substantial increases were shown in the October production of pig iron and steel ingots and a small increase occurred in iron and steel exports. Unfilled orders declined but structural steel sales were the largest since May, 1920. Copper and zinc production did not change materially. Production and exports of both bituminous and anthracite coal increased considerably in October. Consumption of petroleum rose to the highest point since January, but production declined. Imports and stocks, however, increased during the month.

Building costs declined and the value of business, residential and industrial building rose, the latter by 50 per cent. during the month. Residential building was twice as large as a year ago. Orders, production, shipments and exports of lumber were larger than in September. Shipments of bricks increased but production and stocks remained virtually unchanged. Cement production for October was the highest on record. Production of leather declined slightly in September but was larger than a year ago. Exports of leather increased in October but shoe exports declined. Imports of hides were also smaller. Increased traffic was noted in October through the Panama Canal and also through the Sault Ste. Marie Canal, but the tonnage of vessels in foreign trade entering and clearing from American ports declined. Ship construction continued to decline. The surplus of idle freight cars was cut in half during October, largely due to the threatened railroad strike, and car shortages increased, especially for coal cars. Bad order cars were reduced and total car loadings increased, especially coal and merchandise. Debits to individual accounts and bank clearings in New York City increased, but less activity was noted in the rest of the country. Further declines occurred in discounts and note circulation of the Federal Reserve. Business failures showed a large increase. Interest rates declined and increased activity was noted in the security markets. Declines occurred in new capital issues and in dividend and interest payments.

MORE POSTAGE NEEDED CAUSES SERIOUS DELAYS

Canadian manufacturers are requested to draw the attention of their mailing departments to the fact that considerable mail is being received in Japan with only sufficient stamps affixed thereon for domestic postage. While this has caused a great deal of delay and annoyance for some time past, in spite of repeated warnings from this office, it has now become a very serious item owing to the new International Postal rates recently established, which are much higher than the former rates. To give Canadian correspondents some idea of the delay and annoyance entailed through the carelessness of their mailing departments, continues the report, on the Empress mail alone, arriving this week the postage short on letters received for one day only (the Empress mail generally taking four or five days to thoroughly clean up in Japan) fines to the extent of Y1.60 were claimed by the Japenese postal authorities. As there are some ten or twelve large mail boats arriving here from Vancouver, Seattle and San Francisco every month, correspondents will readily understand that this negligence on their part involves a great deal of totally unnecessary expenditure which the Yokohama office has to defray. If such fines imposed are not sent in to the post office when the only and somewhat dilatory official in charge of the short postage department happens to be on duty (and his hours are very short), all such mail must lie in the post office until the following day, no matter how important it may happen to be. Therefore, continues the Yokohama office of the trade commissioner service they would be much obliged if Canadian manufacturers utilizing their service would render them every assistance in this direction, and would draw the attention of their mailing clerks to the fact that this office has the option of refusing mail on which sufficient postage has not been paid.

MAKE A TIME STUDY OF STOPPING AND STARTING YOUR DRILLING MACHINE TO CHANGE TOOLS



THEN COMPARE THE STEADY SAVING WHEN USING A JARVIS HIGH SPEED TAPPING DEVICE WITH QUICK CHANGE CHUCK.

With the ordinary equipment, the machine must be repeatedly brought to full stop in shifting tools, where there are a number of different operations in a radial drill or heavy duty drilling machine.

ALL THIS LOST TIME IS CONSERVED
BY THE JARVIS TAPPING DEVICES WITH QUICK CHANGE CHUCKS

Engine Cylinder Heads are drilled, tapped and studs set, while other parts are drilled, reamed, counterbored and tapped or spot-faced without a stop.
Jarvis Tapping Devices with Quick Change Chuck can be used on any Radial Drill job that calls for tapping or stud setting. One manufacturer taps a number of different size holes in a wall-radial drill without stopping the machine.
Different style devices fit them particularly for the requirements of the work in hand.

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Sometimes a job requires a positive drive with no reverse. Then the Jarvis Style R Device, with Locking Ring, is Used

Any standard Jarvis Product will be sent on trial to Reliable Concerns.
Jarvis High Speed Tapping Devices and Quick Change Chucks and Collets are carried solely by the Geometric Tool Company.

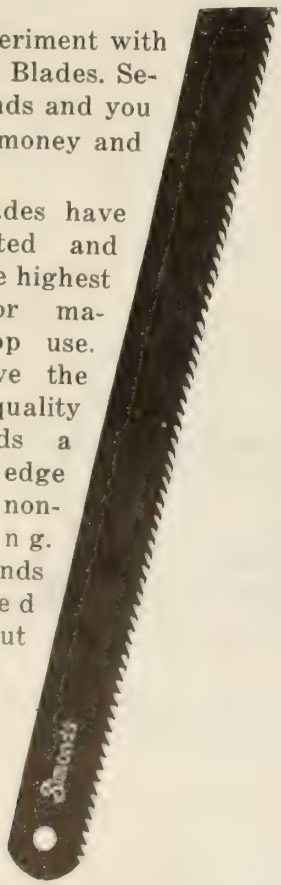
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Canada Saw Co., Ltd.
"The Saw Makers"
Montreal, Que.
St. John, N.B. Vancouver, B.C.

MONTREAL LETTER

(Continued from page 36)

but steady reduction. Prospects for the business in the New Year are very bright. The non-ferrous metals all present a very firm tone. No actual rise in the price of copper has been quoted, but it is extremely difficult to obtain any great supply of the metal. Should any increase in demand occur early in the year, there will be a sharp rise in price and more or less acute shortage. Some jobbers are picking up a little copper for stock purposes and this may have the result of forcing up the price or at least maintaining the stiff tone.

Tin is another cent and a half, for no apparent reason unless that of sympathy with the all around strong tone in the prices of other metals. New York and London markets in non-ferrous metals are strong and have been so for over two weeks. Local prices went up in sympathy, although the volume of local business has not increased to any extent. The rise in sterling also contributed to the stiff tone. No great increase in local trading is looked for before the New Year. The scrap market still remains extremely quiet. No actual reports of business have been received and quotations are neither asked for nor given. As far as attention to this department of the metal business is concerned, the only activity is, that of those interested, in endeavoring to obtain lower freight rates.

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MEASURING ONE THOUSANDTH OF A SECOND

Part of the work of an observatory depends upon a means of measuring extremely short periods of time. For example, in receiving any signal by wireless telegraph or otherwise, it is vitally important that the precise time of receipt as recorded by a clock should be known. In order to facilitate this highly accurate determination, a British observatory has developed an appliance based on the Oscillograph, itself a British invention. This apparatus can register clocks' times of any signal accurately within one thousandth part of a second.

MEETING AN EMERGENCY

The Canadian Brakeshoe Co. of Sherbrooke received a carload of 5,000 gallons of fuel oil which after unloading proved incorrect for their needs. The proposition that confronted them was the pumping of the oil from their tank up into the car, which meant a lift of from 22 to 25 feet and the only machine available was a gear pump rated at 10 gallons per minute.

Hand pumping meant the erection of a suitable platform on which to set the pump and the time of two men to operate it costing at least $20. Not considering demurrage charges on the car. Their master mechanic while erecting the platform thought of using a Little David drill which they had, and connected it by setting a set screw chuck to the spindle of the pump. The pump and drill were connected up and started at 10.15 a.m. and the job was completed at 6 p.m. the drill running continuously without an attendant, thus saving some $15.00 in labor without considering the possible demurrage charges. The same concern used a pneumatic drill for powerizing a hand crane used for lifting ladles in front of their electric furnace, thus proving they are equal to emergencies.

OBITUARY

Thomas Findley, president of the Massey-Harris Co., died a few days before our going to press. Mr. Findley has been in poor health lately, in fact, some five years ago, sought medical attention and advice, but without the success he wished for. Some five weeks ago, he was compelled to discontinue his daily duties and this went especially hard with him, as he was only in his 52nd year.

Starting as a farm boy, Mr. Findley worked his way up to not only riches but outstanding influence. He had a international reputation as a financier and business man, and at the time of his death was president of the Massey-Harris Co., director of the Johnston Harvester Co., vice-president of the Toronto Housing Co., director of the National Trust Co., director of the Verity Plow Co., and president of the Bain Waggon Co. He has always had the interest of the workmen at heart, having himself passed through the school of experience.

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Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

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Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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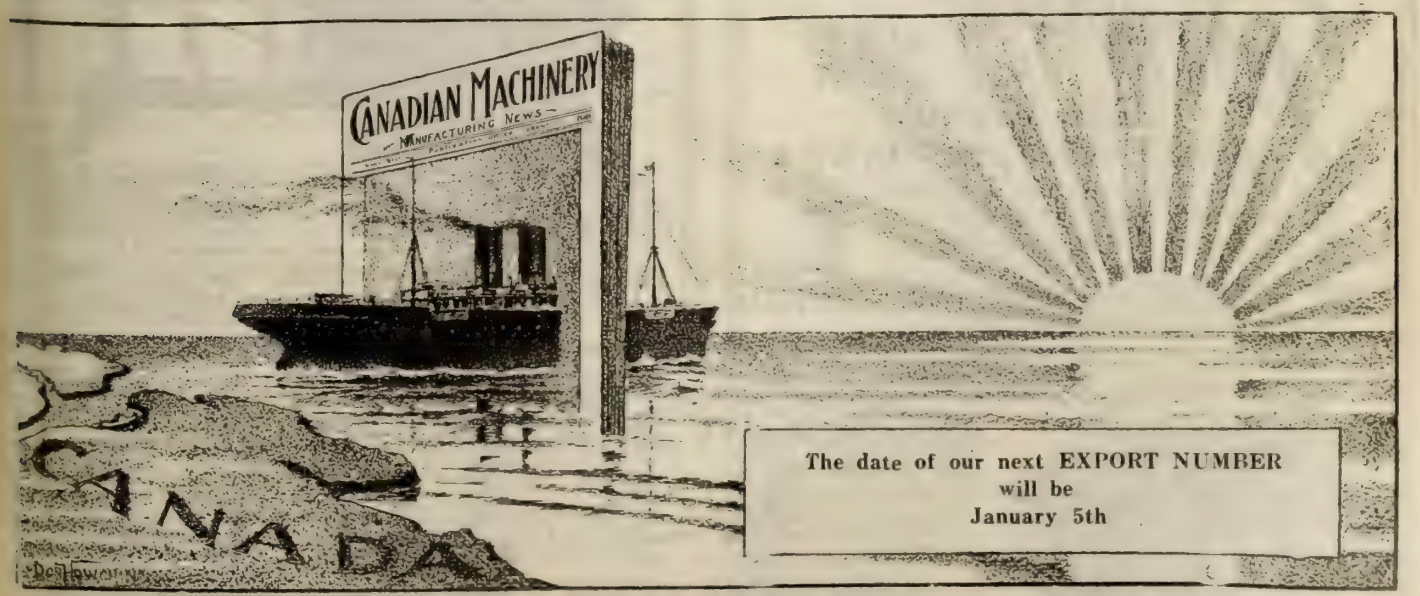
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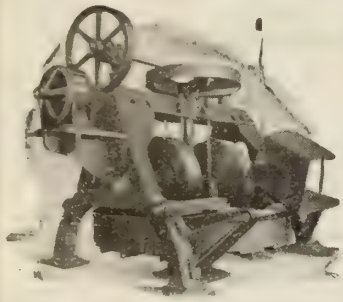
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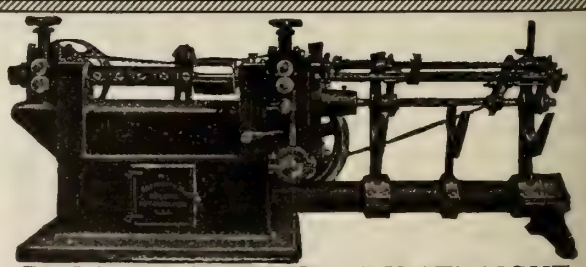
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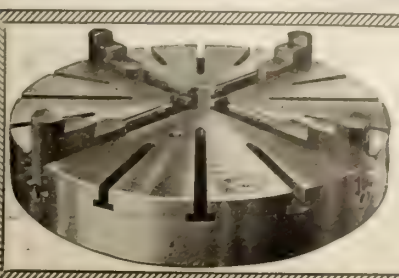
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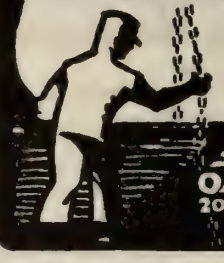
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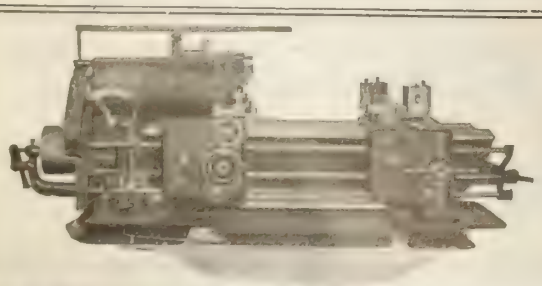
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Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Can. Hart Products, Ltd., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
Prest-O-Lite Company, Toronto.

Accumulators, Hydraulic
Stewart & Co., Duncan, Glasgow, Scot.

Anchor Belts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Augers
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R I
Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.
Skinner Chuck Co., New Britain, Conn.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Hoist Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas Ont.
Gisholt Machine Co., Madison, Wis

Bars, Boring, Portable
Ingersoll Rand Corp., H. B., Philadelphia, Pa.

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hoist Steel Co., Ltd., New Glasgow, N.S.
Hoist Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hoist Steel & Tool Co., Montreal, Que.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.
Sumner & Co., New York City

Belting, Leather
Atkins & Co., Inc., E. C. Indianapolis, I
Can. Fairbanks-Morse Ltd., Montreal Q
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd. Hamilton Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)

Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont.
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa

Boring, Drilling and Milling Mach., Vertical
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

Brass Pipe Fittings
Pure Sanitary Drinking Fountain Co., Haydenville, Mass.

Bricks, Fire
Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Bulldozers

Building Materials
Robertson Co., H. H., Cleveland.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd. Hamilton, Ont
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Kaltz Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., B. B., Philadelphia, Pa

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto

Dies, Forging
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co. Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont
Oliver Machy. Co., Grand Rapids, Mich
Wheel Trueing Tool Co., Windsor, Ont

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co. Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont

Drill Holders
Armstrong Bros. Tool Co., Chicago.

Drill Rods
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto.
Pratt & Whitney Co., of Canada, Dundas, Ont.

Drilling Machines, Heavy Duty
Armstrong-Whitworth of Canada, Montreal, Canada
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis
Williams Machinery Co., A. R., Toronto Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can , Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Sanfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd , Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co , W. S., New York City

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Murnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd. Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis,
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthle, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd , The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd. Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd , Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co , Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Fons Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hose, Flexible Steel
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Que.

Japanning and Varnishing Ovens
[illegible] & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinists
Parker Co., Charles, Meriden, Conn.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Rockefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Rockefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Terry & Co., John C., Birmingham, Eng.

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que.

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rochester Co., F. B., New Haven, Conn.
Stewart & Co., Duncan, Glasgow, Scot.

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
... Fairbanks-Morse Ltd., Montreal, Q

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., ... Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont

Shaping Machines
Hendey Machine Co., Torrington, Conn
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto, Ont
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton Ont
Can. Blower & Forge Co., Ltd., Kitchener
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton,

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, O...
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q.
Ferd-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Montreal.

Unions, Pipe
Crane Ltd., Montreal, Que.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
[illegible] Company, Wallace, Hamilton.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
L'Air Liquide Society, Toronto Ont
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton, Ont
Prest-O-Lite Co. of Can., Toronto, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.
Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

Seven pages printed here each week for your convenience

Consult this Buyers' Directory when you want the names of reliable makers of machine tools, parts, steel, in fact any equipment you may need.

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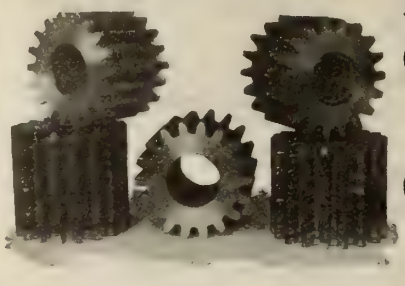
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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Annual Review and Directory Number

Volume XXVI — Toronto, Canada; December 29, 1921 — Number 26



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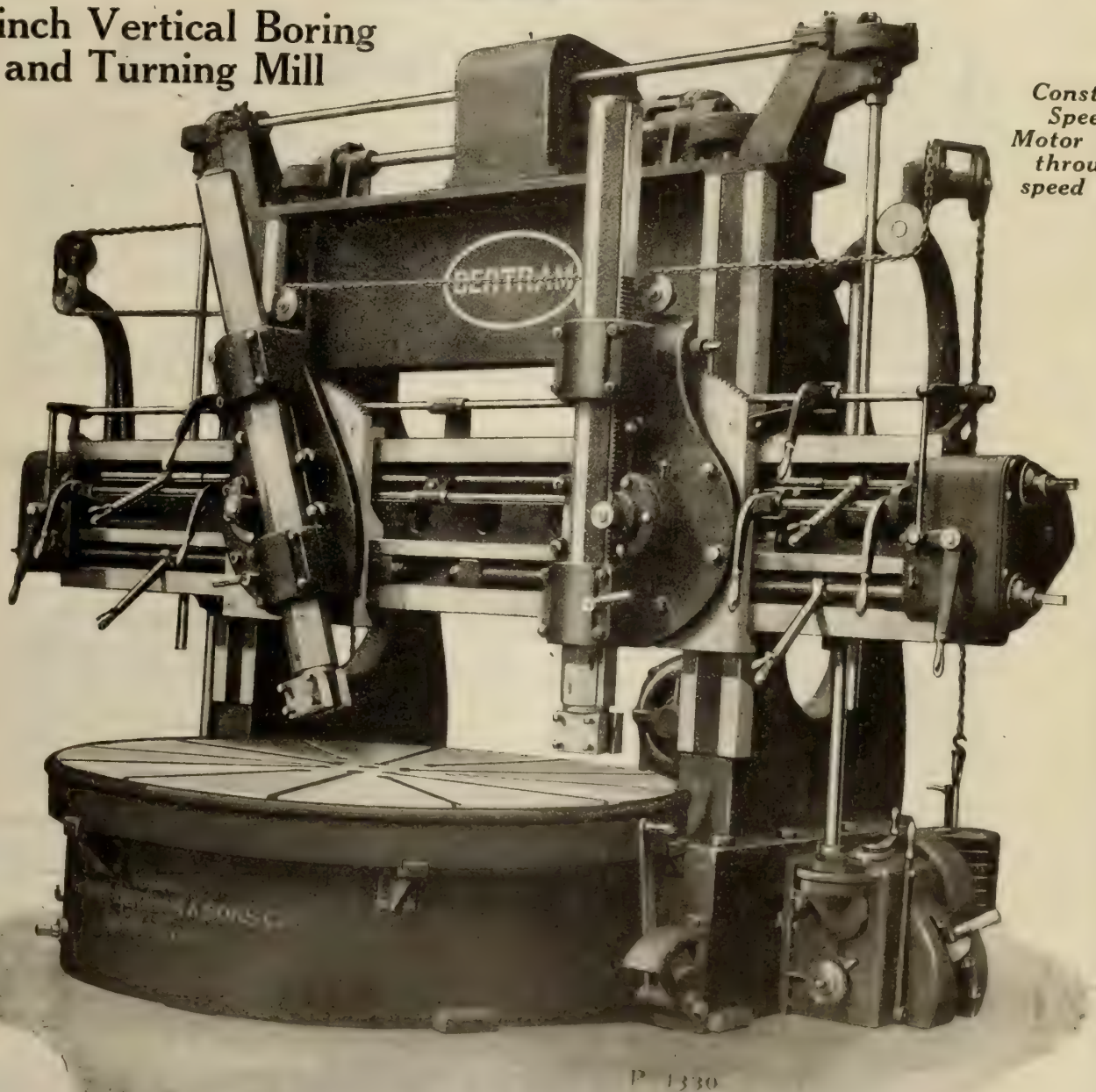

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The BERTRAM Page

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Know our Costs as well as your own

A FEW months ago the Lincoln Electric Company of Canada made a rather unusual announcement to the readers of Canadian Machinery.

This offer which is being received and acclaimed on all sides was to the effect that Lincoln Sales Engineers are not talking electric welding these days so much as they are advocating close checking of welding costs.

What One Canadian Manufacturer Found

For instance, one Canadian manufacturer who stated that he was doing some oxy-acetylene welding, as well as a considerable amount of riveting on tanks, is now checking up his costs on this work and has definitely decided that he will send his next job to our shops in Toronto, along with his superintendent, so that he may know exactly the electric welding cost on his class of work. He had been in the habit of bidding on many jobs that he had not secured. He wanted repeat orders and he was looking to the future. He saw very quickly that it was up to him, in these, his slack times to **know** the costs.

Completes Cost Finding Buys Lincoln Welder

"One well known concern has already completed its cost finding" states Mr. George Bertram, the Lincoln Sales Manager. "It is now using a Lincoln Welder recently purchased, instead of oxy-acetylene. Another Manufacturer has also investigated the Lincoln methods and finds that they would save him money. He is, therefore about to close for the purchase of a Lincoln Welder."

"Two other manufacturing concerns in Ontario have work in our shops this minute awaiting the arrival of their engineers who are going to check their own costs with ours."

Sends Work For Test

Mr. Bertram also handed us a letter dated December 7th, from a prominent firm which states— ".....we are shipping a piece of work and we would like to have test made as soon as possible as we are now tendering on a new order."

Know These Things For Yourself

On all sides our plan is being approved and many are preparing to take advantage of it, so that they may secure actual costs on electric welding —using a Lincoln Arc Welder—thereby securing the lowest possible costs. Our own experience proves that 20 per cent. greater speed can be secured by the use of the Lincoln Arc Welder over that of any other electric welder now manufactured.

If you have never investigated Lincoln welding you are especially invited to do so now. Many superintendents, shop foremen and engineers have visited our plant in the last few months and examined our costs on their particular jobs.

The Lincoln Electric Company of Canada, Limited, Head Office and Works: 136 John Street, Toronto, 'Phone Adelaide 7200. Montreal Office: Coristine Bldg.

LINCOLN ELECTRIC WELDING

If interested tear out this page and place with letters to be answered.

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How Can I Cure My "Motor Troubles?"

is the question that is being asked garages and repair shops by automobile owners. There is a good reason for this as the automobilist knows that the cylinders are the heart of the motor and that unless they function properly it is useless to overhaul and groom the car for next spring's opening.

Ground cylinders save gas and oil, they increase the power, and give a good many more miles per dollar expense. At this time such economy appeals to the owners of both low and high priced cars.

Motor owners neglect this work owing to the inconvenience of not having a shop handy that is equipped to take care of it. It is high grade work, commands high prices, and has been a life-saver for many during the business depression.

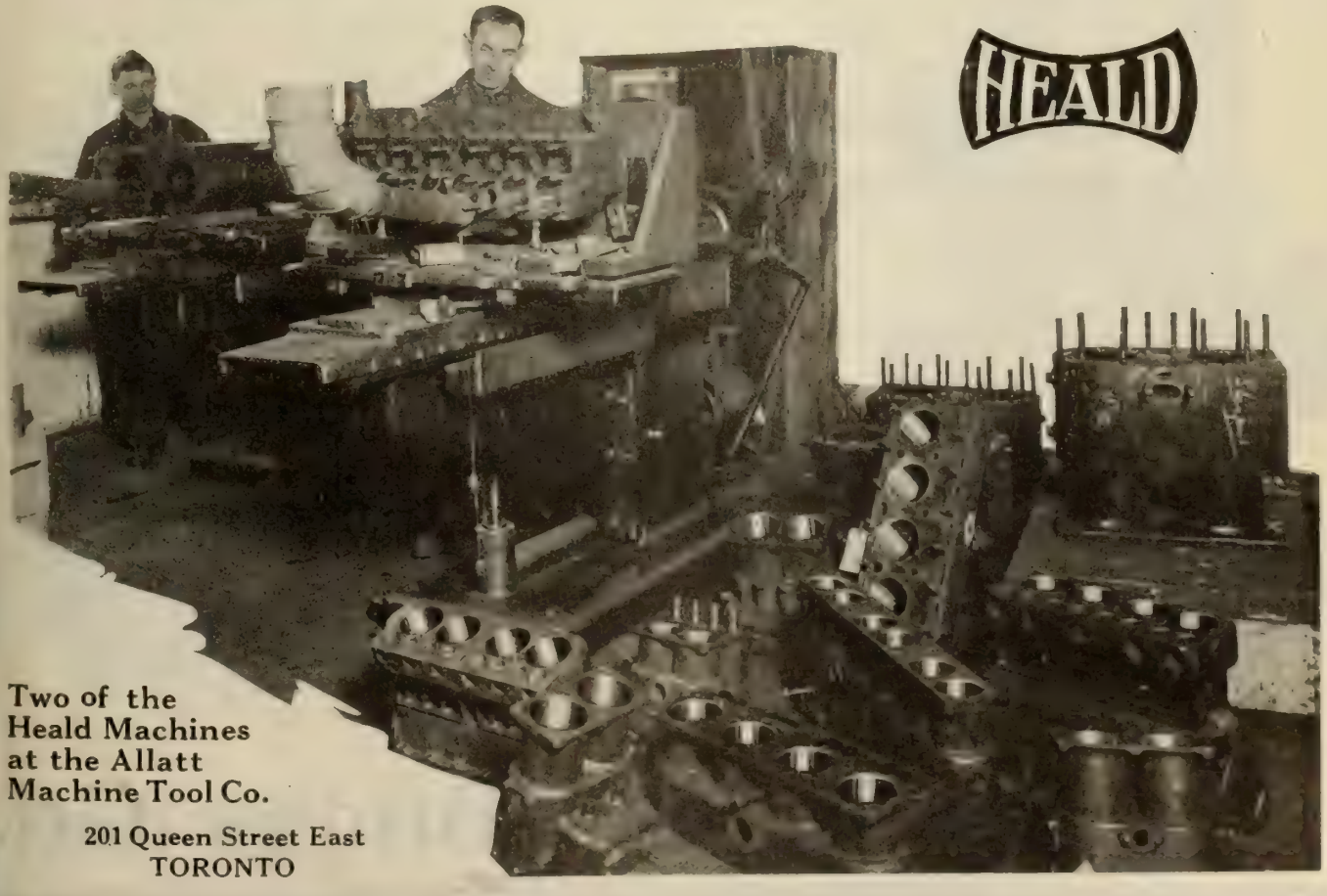
Most small machine and repair shops are already equipped with everything except a Heald Cylinder Grinding Machine. We can offer you two styles—No. 55, which is simple, self-contained, with a large range and at a nominal price. This machine is being used by a large number of those just starting in the regrinding business. The style No. 65 is much heavier, with extra speeds and feeds and when equipped with our universal jig is ideal for regrinding work.

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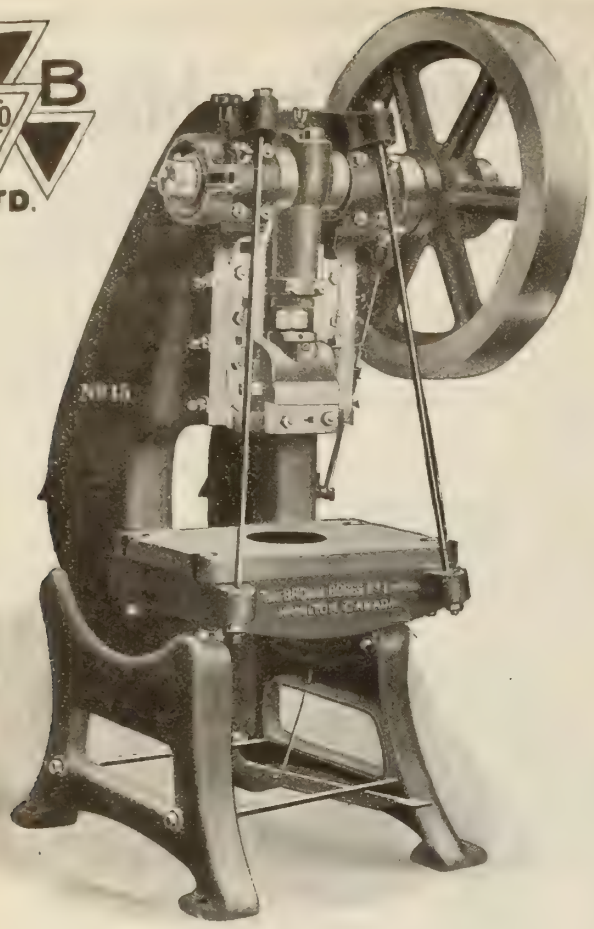


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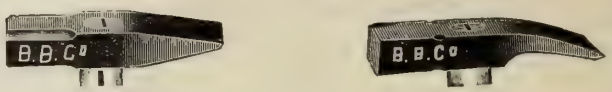
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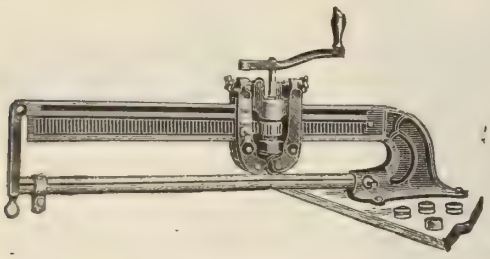


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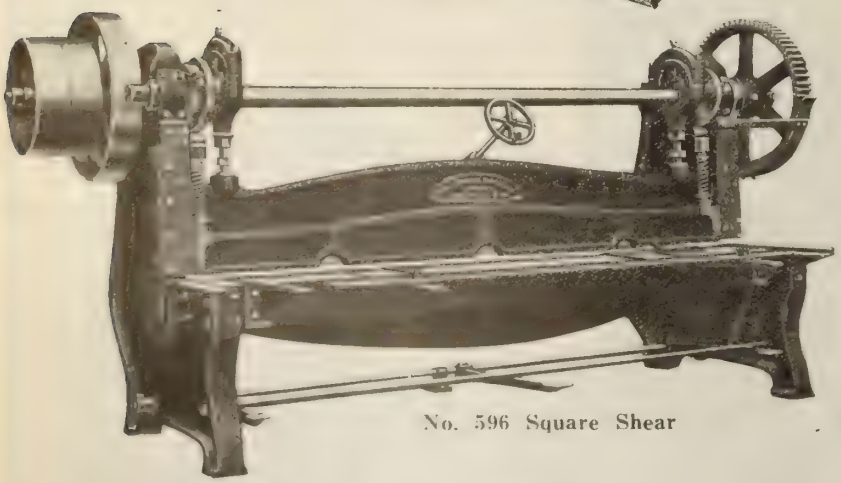
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The Brown-Boggs Co., Li

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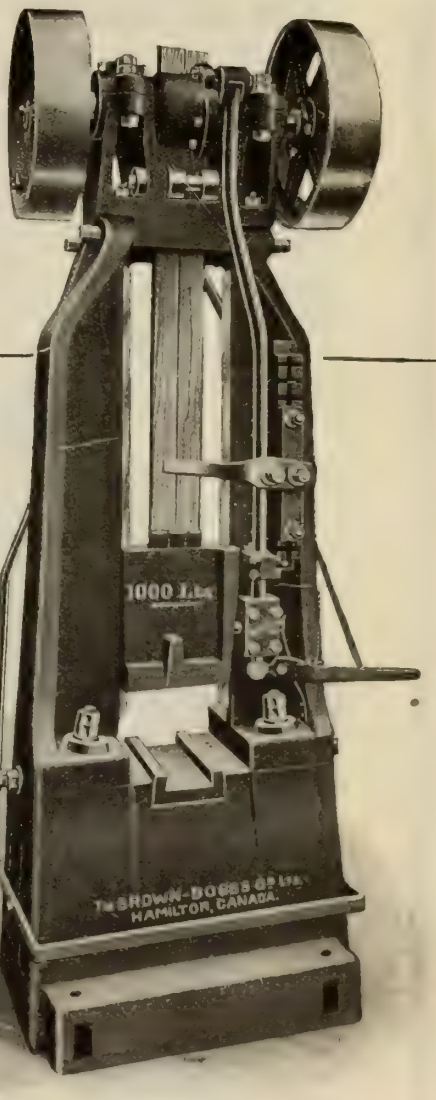
wn-Boggs

Metal Workers' Tools

In the Shop that Gets the Business

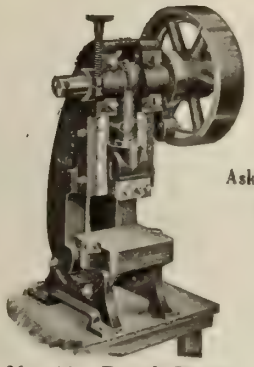
you will usually find "B-B" Tools at work. **For "B-B" Tools are business builders!** They are used from coast to coast by the kind of Tinsmiths and Metal Workers who know that ever reliable tools return many times their cost.

"B-B" Tools are reliable because even the smallest details receive the careful attention of experts. The oldest and most complete manufacturing plant in Canada is at your service when you choose "B-B" Tools.



1,000 lb. Board Lift Drop Hammer

B B Co Ltd.



Ask about Special Machinery.

No. 10—Bench Press



No. 449—Shear

There is a fund of engineering advice and full description of all "B-B" guaranteed tools in our catalogue No. 25. Write for a copy to-day.

Limited, Hamilton, Canada

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SPECIAL FORGINGS

A Variety of Intricate Shapes Impossible with any other Machine

INCLUDING within their range all kinds of bolts and forgings that are possible on Forging Machines, Acme Forging Machines are capable of intricate shapes **not possible** on ordinary types. Acme machines are universal because bolts and forgings are made with equal facility by exactly the same mechanical movements. This is a distinctive feature.

Note the powerful, simple and efficient construction of the 2½-inch All Steel Heading, Upsetting and Forging Machine shown below. It may be used in continuous or intermittent motion.

The Acme Machinery Co.
4530 St. Clair Ave., CLEVELAND

Canadian Agents:

THE JOHN BERTRAM & SONS CO.
Limited

Dundas, Ontario



The Acme Forging Machine Catalogue proves its worth many times as an education in Forging possibilities.

Write to-day for a copy.

ACME
Heading and Forging Machines

MADE IN CANADA

Torrington

MACHINE SCREWS



Standard and Special Machine Screws, Rivets, Threaded Wire and Specialties

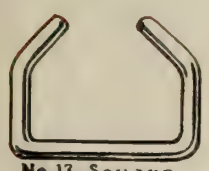
WE KNOW what Torrington Machine Screws have done in the past and are doing to-day—and we know all that is necessary to convince you that they are superior to the screws you are now using is to put them to brief, comparative test. Shall we send you samples? In addition to our well-known machine screws we make high-grade Rivets from Brass, Copper, Steel, German Silver and Aluminum; also Threaded Wires and specialties in various kinds of Headed Work.

Save Expense!

If you are making parts on screw machines we would advise you to investigate the cost of production. Then send us a sample or blue print of the work, and we will then submit an estimate of our cost to supply them to you. By our process we can produce them at a considerable lower cost—the benefit of which will accrue to you.

Bear in mind, when you buy **Torrington** products you have complete choice of standard makes to choose from, and when special parts are required the **Torrington** factory has adequate facilities for producing all manner of work quickly and economically. **How may we serve you?**

Torrington Belt Hooks



No 13 Square

Another of our products that has made good. Torrington Belt Hooks are stronger and last longer than ordinary hooks. Don't merely say "Belt Hooks" in your order—specify "Torrington." How may we serve you?

Enquiries Solicited

The Torrington Company, Limited

Upper Bedford, Quebec

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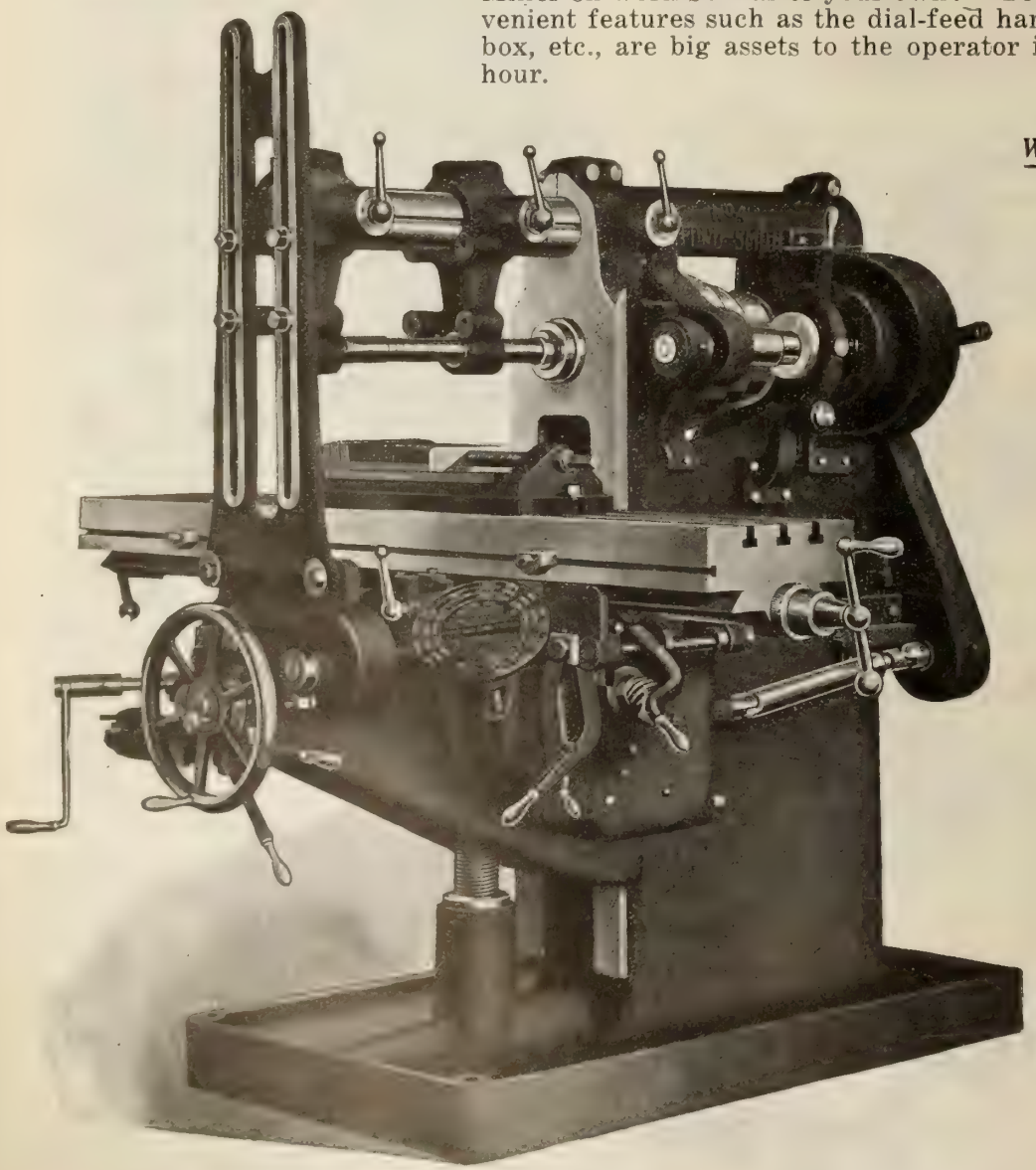
FORD-SMITH

Cutting Shop Costs with a

No. 4 Plain Miller

Are you getting the most from your milling operations? Isn't t a proper time to make sure your costs are down to a rock-bottom bas Won't you let us send you production figures with a Ford-Smith N Miller on work similar to your own? You will find that the many c venient features such as the dial-feed hand wheel, location of the f box, etc., are big assets to the operator in getting out more work hour.

Cone Drive



Wide Range — Rapid Po

The new arrangement of dial-feed hand-wheel g twelve changes of feed. in conjunction with the c feed handle at the front of umns gives 24 changes the back gear is in. Thro out the entire constru rigidity is the keynote and is backed up by plenty power, speed and unfailing curacy. Thoroughly test absolutely guaranteed.

The Ford-Smith No. 4 Mille is fully described in our lat est catalogue. You will fin in it worth-while facts abou milling. Ask for a copy.

Let us Quote on Dies and Special Machine

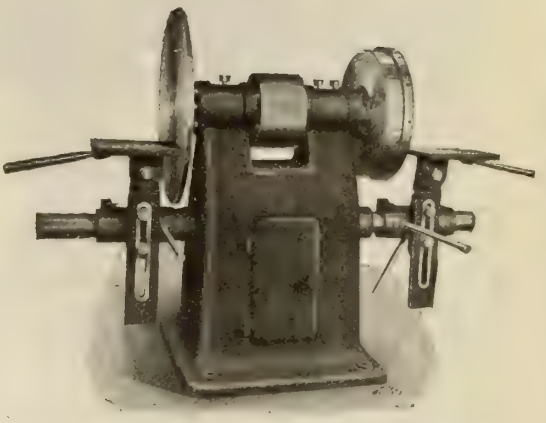
We design or build ma chines from your ow specifications. Our f cilities enable us t make dies as large a eight tons. Have ou engineers co-operate.

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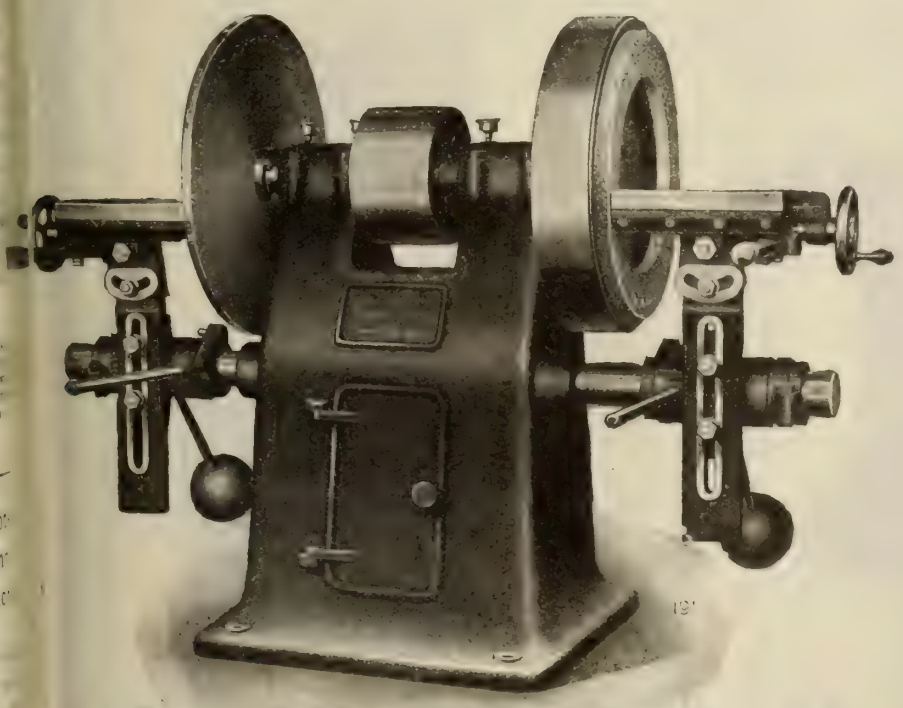
FORD-SMITH

Increasing Shop Turnout with these
Production Grinders

The point that we have been trying to drive home to you ever since we designed this type is the fact that Ford-Smith Production Grinders make possible **more turnout** at **much lower cost.** They have the power and the range to handle much of the work that costs more money to have done on a larger machine tool. They save wages because they can be operated by unskilled help. Built in essential features and equipped with inexpensive workholders.



All Ford-Smith Grinders are equipped with work holders and other convenient features that enable the operator to make all his time count.

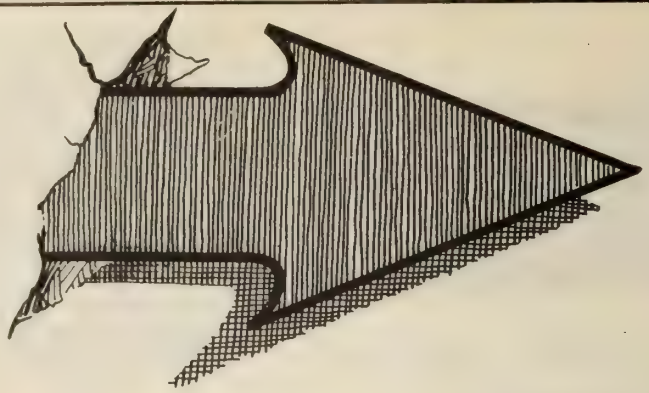


HERE is another fact that's worth remembering. Ford-Smith Production Grinders are **not** expensive machines. In first cost they demand only a modest investment. And after that **nothing!** Strong and sturdily constructed they seldom require adjustments under normal conditions. Thoroughly tested before leaving the factory.

We are now on the rising curve to increased prosperity. 1922 has fitting rewards for the man who steps in with both feet. Ford-Smith Grinders will help you. Ask for catalogue.

The Ford-Smith Machine Co., Limited
HAMILTON, ONTARIO, CANADA

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FORD-SMITH

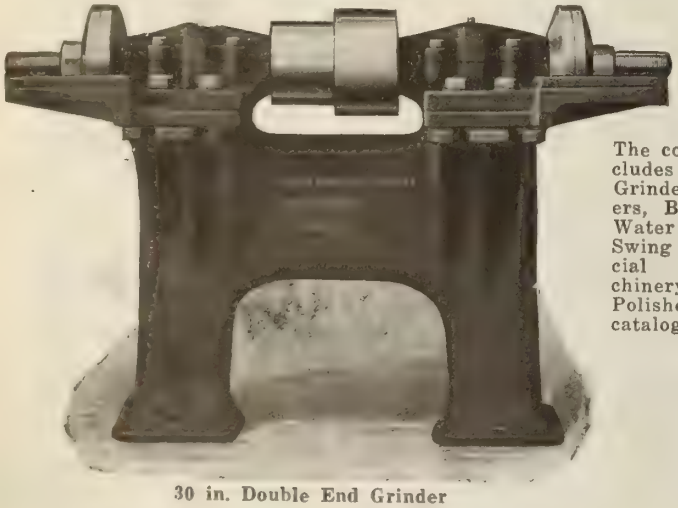
Types

For Getting Volume Production

IT ISN'T an easy task to invest in new equipment in these days when high manufacturing costs shake hands with low selling costs. Yet consider what Ford-Smith Grinding and Polishing Equipment will really accomplish for you.

These machines fill a very important niche in manufacturing operations. Castings, forgings, in fact everything requiring fine finish or size reduction are quickly handled. Bigger turnout pays their cost in short order.

These grinding and polishing machines are designed from the standpoint of **strength, sturdiness, stability** that enables them to meet present day conditions and show a profit.



30 in. Double End Grinder

The complete line includes Motor Driven Grinders, Floor Grinders, Bench Grinders, Water Tool Grinders, Swing Grinders, Special Grinding Machinery, Buffers and Polishers. Ask for catalogue.

Grinding and Polishing Equipment



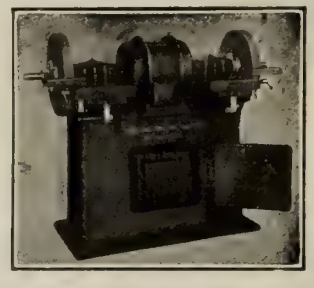
Water Tool Grinder



Heavy Type Polisher



Light Type Floor Grinder



Motor Driven Grinder

The Ford-Smith Machine Co., Limited

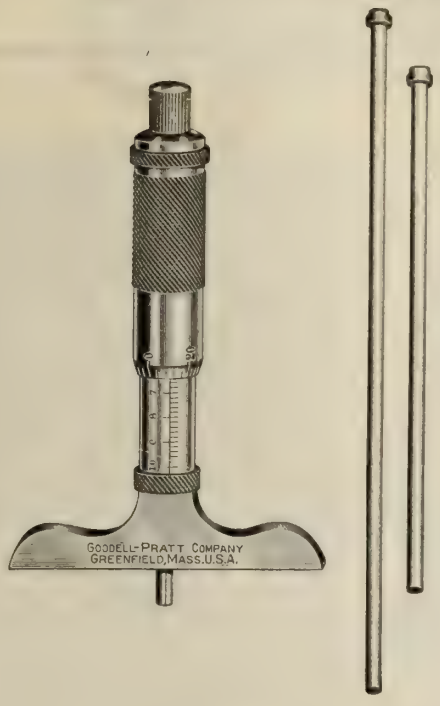
HAMILTON, ONTARIO, CANADA

Foreign Agent: **W. E. Storey, London, Eng.**

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GOODELL-PRATT

1500 GOOD TOOLS



DON'T TAKE ANYBODY'S WORD FOR IT—

Find Out For Yourself.

We believe that we are making the most accurate line of machinists' tools now on the market. But we don't ask you to believe us.

All we ask is that you thoroughly test Goodell-Pratt tools and find out for yourself. Tests that you can make yourself under your own working conditions will convince you more thoroughly than anything that we can do or say.

Whether it is a Micrometer, a Depth Gauge, a Steel Rule, a Square, or any other precision tool, we will stand squarely back of the materials and workmanship, and we guarantee the accuracy. The finish you can readily see for yourself, and the serviceability you will find out after years of use.

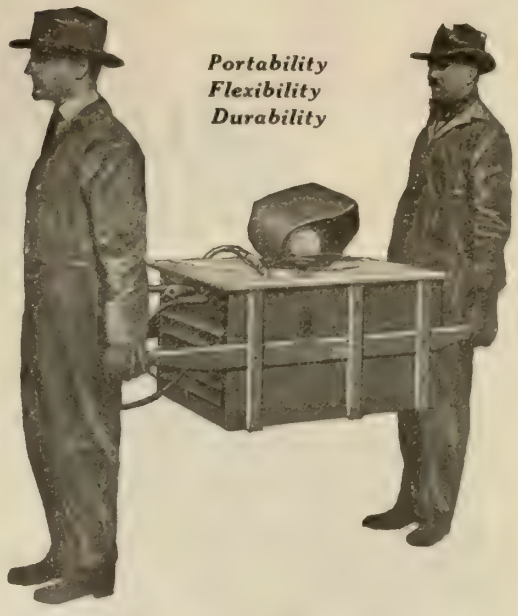
Ask your dealer, or write for "Tools for the Toolmaker"

Goodell-Pratt Company

Toolsmiths

Greenfield, Mass., U.S.A.

"ALTERNARC"



Will Tackle Any Arc Job and Make Good!

Look at this one! A hoist winding drum broken clear **through** 3 spokes and flange. A heavy job. The "Alternarc" welded it **perfectly.** On cast iron A. C. will show superiority.
"Alternarc" is doing great things all along the line. And has the great advantage of being least expensive —to buy and to operate.



Don't decide before you have asked about the "Alternarc"

The Electric Arc Cutting & Welding Co.
152-58 Jelliff Ave. Newark, N. J.

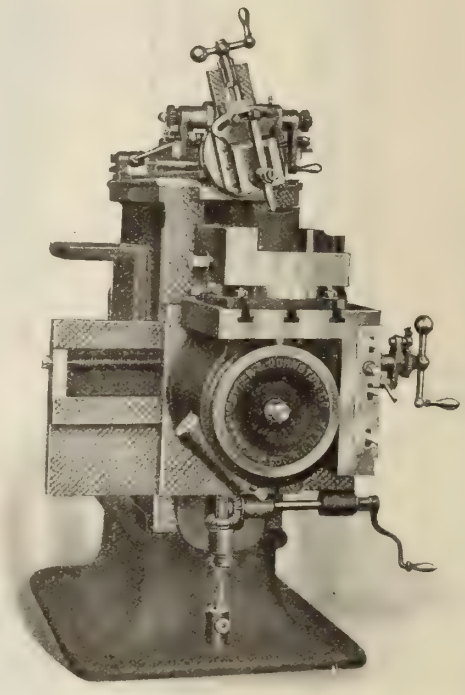
Exclusive Representatives for Canada
INTERNATIONAL EQUIPMENT COMPANY
Transportation Building. MONTREAL

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UNIVERSAL SHAPING MACHINES

15" Type

Swivel table with auxiliary tilting side.
Power down feed on any angle.
Automatic feed stop.
Graduated collars on tool head feed screw and table feed screw.
Swivel vise with graduated base.



24" Type

Swivel table with auxiliary tilting side.
Power down feed on any angle.
Automatic feed stop.
Graduated collars on tool head feed screw and table feed screw.
Swivel vise with graduated base.
Swivel table raised and lowered by power.

No special vises or fixtures needed; the Universal features of these machines take care of everything, making them particularly adapted to:—

Die Work
Tool Making and
General Manufacturing

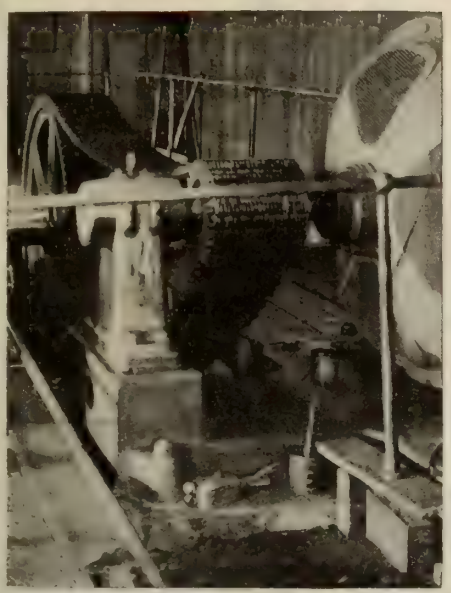
Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office and Show Rooms:
11 Wellington Street East, TORONTO, CANADA

RENOLD

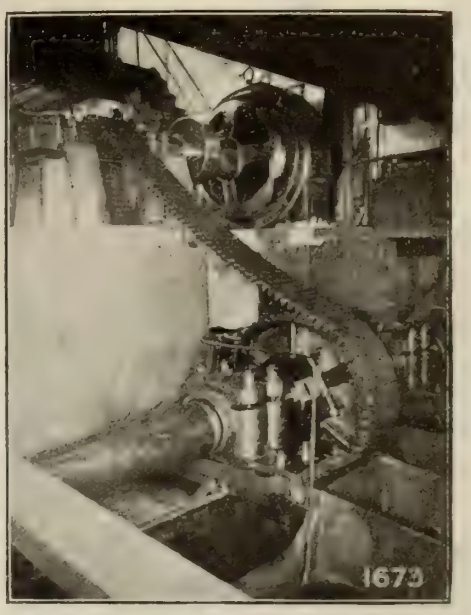
DRIVING CHAINS



175 H. P. Main-shaft Drive

THE SYMBOL OF QUALITY H.R

The Chain With a World-Wide Reputation



125 H. P. Line-shaft Drive in Paper Mill

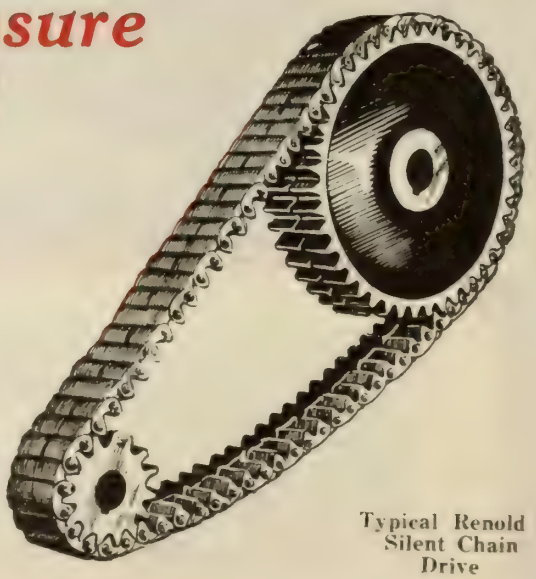
Save Power--and Ensure Greater Production!

RENOLD DRIVING CHAINS—

(1) Have a maintained efficiency of 98.2 per cent.
(2) Save Power.
(3) Ensure maximum production.
(4) Run SLACK between shaft centres, thereby eliminating bearing friction and reducing maintenance costs.
(5) Are not affected by heat, cold or moisture.
(6) Require little or no attention when once installed, etc.

Our ENGINEERING SERVICE is entirely at your disposal.

Write for Bulletin 2005c, "Notes on the Selection of Chain Gear."



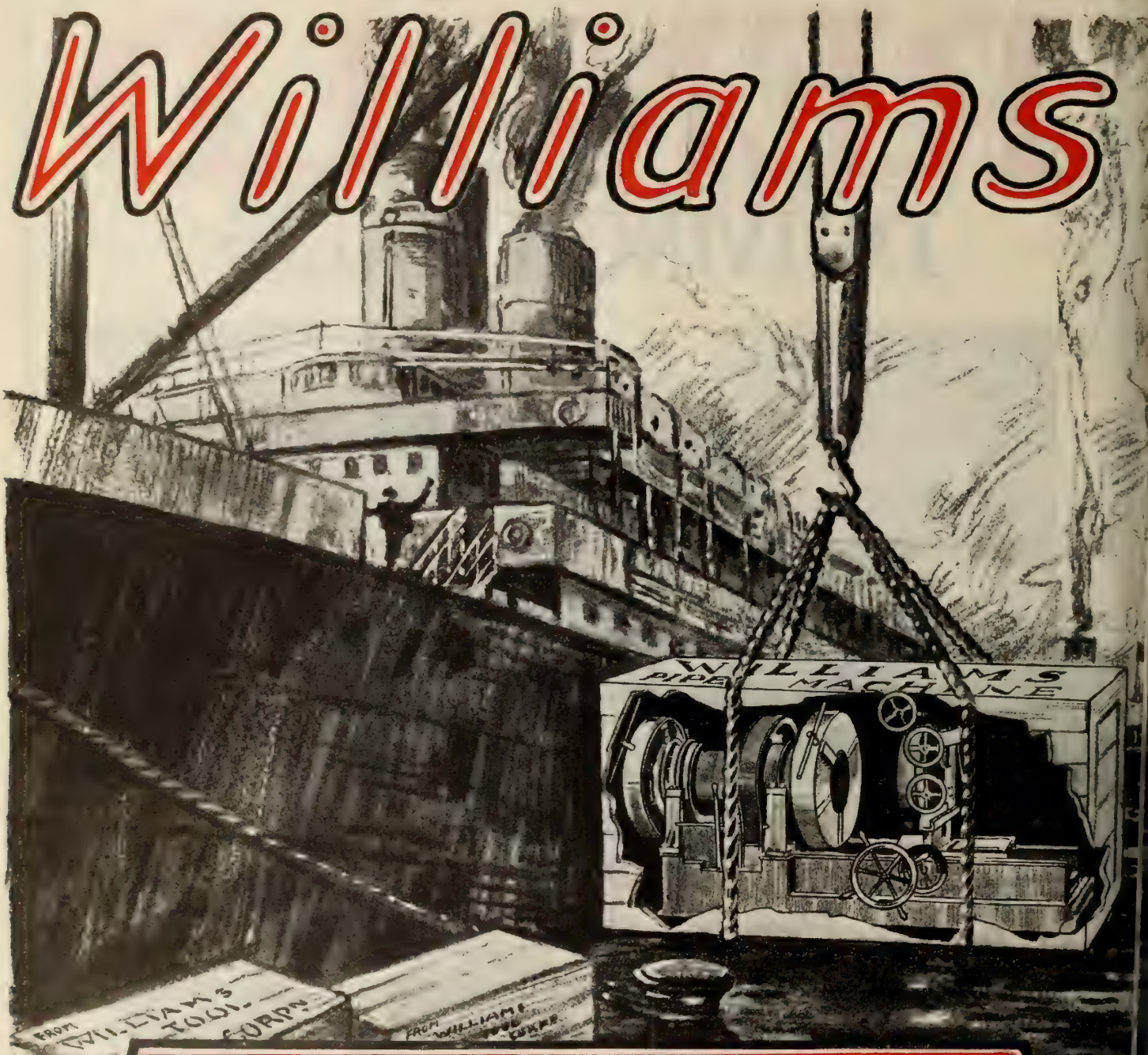
Typical Renold Silent Chain Drive

HANS RENOLD OF CANADA, Limited

11 St. Sacrament Street, MONTREAL

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Williams



TO obtain and maintain, a world-wide distribution of any commodity, it must possess extraordinary features. If it's a machine tool, it must possess features which lift it out of the ordinary class; it must be a rapid and efficient producer of work. Williams Pipe Threading Machine has a universal distribution. It has features possessed by no other lathe of its kind. That's why "Williams Goes Abroad."

A recent shipment was a Williams 16″ machine to the Central Lafayette, Porto Rico and an 8″ and a 4″ to Fortaleza, Ceara for the Chilean Government. These Williams, like many others, are making the trip to cut and thread pipe better, quicker and at lower cost.

WILLIAMS TOOL CORPORATION of CANADA LIMITED

Successors to John H. Hall & Sons, Ltd. Brantford, Ont.

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Goes Abroad



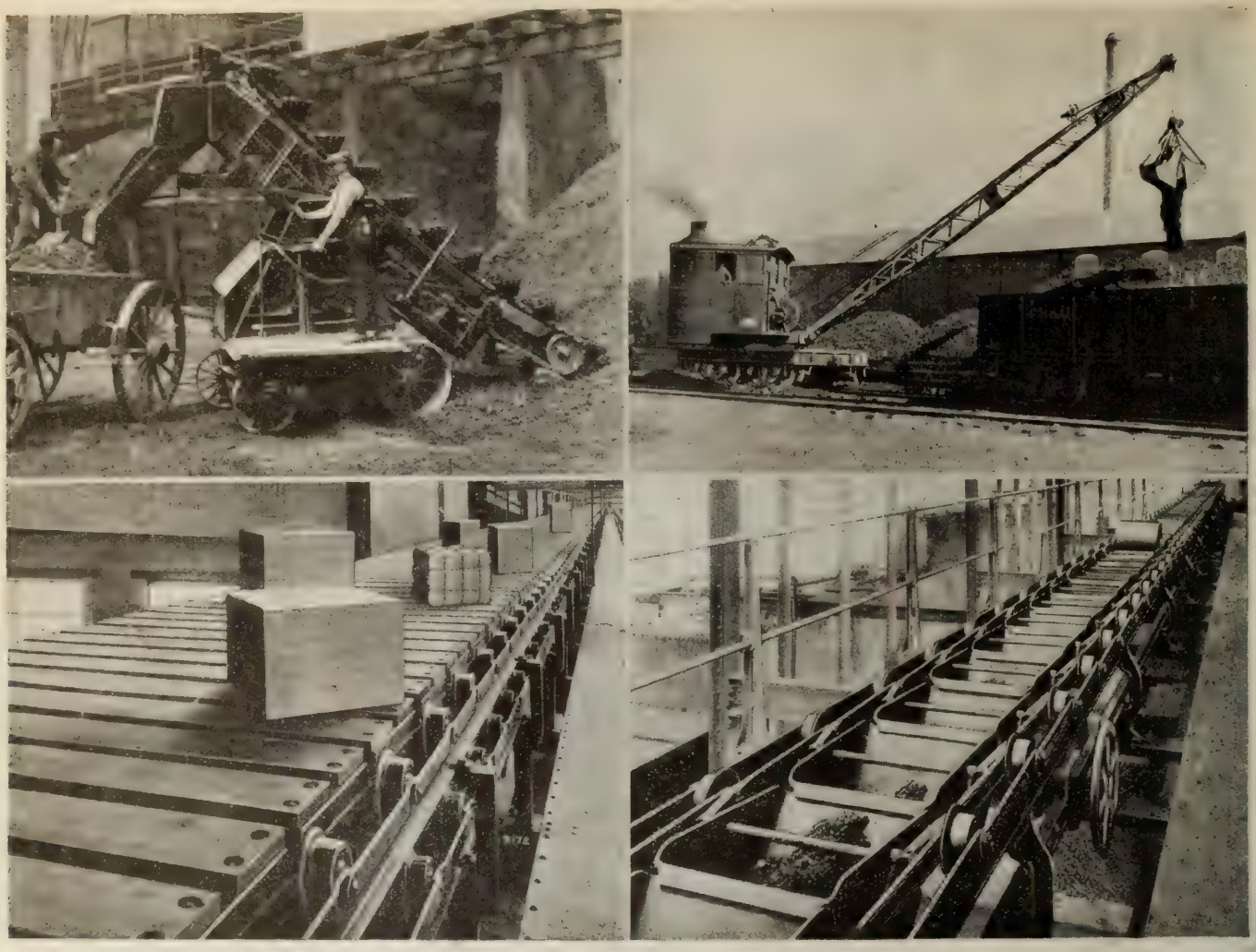
Williams Pipe Machines today combine all the outstanding features of the famous Canadian **Hall** Pipe Machines and **Williams** Pipe Machines, the foremost of their kind in the United States.

These features in a nutshell include: single pulley drive; special swivel reaming tool and post; compact control lever on operator's side; quick change—eight speeds; hand wheel on rear chuck; large spindle and spindle bearing; extra large oil trough —no dripping over; special overflow valve; rotary pump, reversible L.H.; all racks and gears machine-cut; specially constructed reservoir and filter; and all gears are amply protected. There are many other points to be considered by the discriminating buyer; our catalog explains them—may we send it to you?

WILLIAMS TOOL CORPORATION of CANADA LIMITED

Brantford, Ontario **U.S. Plant: Erie, Pa.**

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Cutting the Cost of Material Handling

NO matter what you handle, there is a Link-Belt way of doing it quicker, cheaper and better. The use of a locomotive crane, electric hoist, portable loader or some other type of Link-Belt elevator and conveyor might be the means of saving you time and money in the handling of your materials.

The equipment shown on this page represents only a few of the many types of Link-Belt material handling equipment.

Write us about your requirements. Let our engineers show you where handling costs can be reduced. Send for Catalogs.

CANADIAN LINK-BELT CO.,

Limited

Toronto - Wellington and Peter Streets.
Montreal - 10 St. Michael's Lane

LINK-BELT

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Emblem of Integrity

LIQUID AIR Co

Standard of Excellence

OXYGEN
ACETYLENE
BLOWPIPES-REGULATORS
FILLING RODS - FLUXES
ACCESSORIES

THE LIQUID AIR Co

SOCIÉTÉ L'AIR LIQUIDE

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OPERATED IN CONJUNCTION WITH A CONTINENT WIDE NET-WORK OF DISTRIBUTION STATIONS



"Liquid Air" Oxygen Means a Saving in Transportation

With a network of Factories not only planned, but in actual operation, and a number of Distribution Stations situated at all large centres all over Canada, Purchasers of Oxygen can obtain their supplies at a point very near to the point of consumption. This completely obviates heavy freight charges on cylinders and assures an immediate supply at any time within a few hours and even minutes after the orders are placed.

All cylinders conform to the specifications of the Canadian Railroad Board and are made to ensure safety without unnecessary weight. When purchasing "Liquid Air" Oxygen you not only save on freight, but in very many cases this expense is almost eliminated.



There Are Diamonds - and Diamonds

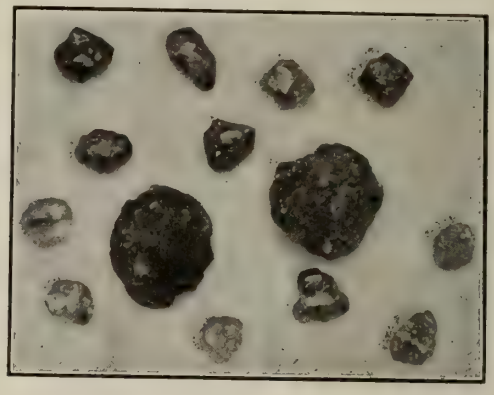
THE South African diamonds which are used in Mechanics come out of the same mines that milady's solitaires and sunbursts do. These industrial diamonds possess all the qualities of the decorative ones except brilliancy. In addition there is the carbon or black diamond found only in Brazil, which is as much of a diamond as the gem itself except that it appears in non-crystaline form.

Although these industrial diamonds are but five per cent. of the output they are inestimably more essential than all the others combined.

There is nothing to take the place of the industrial diamond. Its hardness is unapproached by any other known substance. But, like anything else which comes out of the earth it is found in varying grades.

Only experts can tell the grade of a diamond. Only experts of long experience know what kind and size of diamond should be used for particular industrial uses. You should not chance a purchase on such costly equipment. The Wheel Trueing Tool Company has established an impregnable reputation for integrity in its twelve years of diamond importing and diamond tool manufacture. If you do business with this house you are guaranteed the exact stone for the job, you are assured of the most reliable service in keeping your diamonds and diamond tools in perfect condition and you are given, free of charge, a cost-keeping system which will permit you to secure minimum cost per dressing.

Write us for Catalog



Are You Using the Right Kind in Your Dressing Tools?

WHEEL TRUEING TOOL CO.

IMPORTERS
OF
BORTZ & CARBON DIAMONDS
MANUFACTURERS OF
DIAMOND TOOLS FOR EVERY MECHANICAL PURPOSE

WINDSOR, ONT.

-BORTZ- W DIAMONDS T -CARBON- C

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Where Progressive Industry Multiplies

Galt has more than seventy enterprises, among which are many highly developed specialties—Centre of machinery manufacture—Long-established concerns that contribute to city's reputation.



Main Street, Galt, an example of extensive paving improvements.

Galt has exceptional manufacturing advantages. It is served by C.P.R. and G.T.R. and is the hub of interurban electric railway systems with outlet ports on Lake Ontario and Lake Erie. Manufacturers have easy interswitching facilities, and the city's central location contributes to ideal residential conditions. Galt is the home of highly skilled labor and encouragement in this direction has tended largely towards its development as a leading industrial centre.

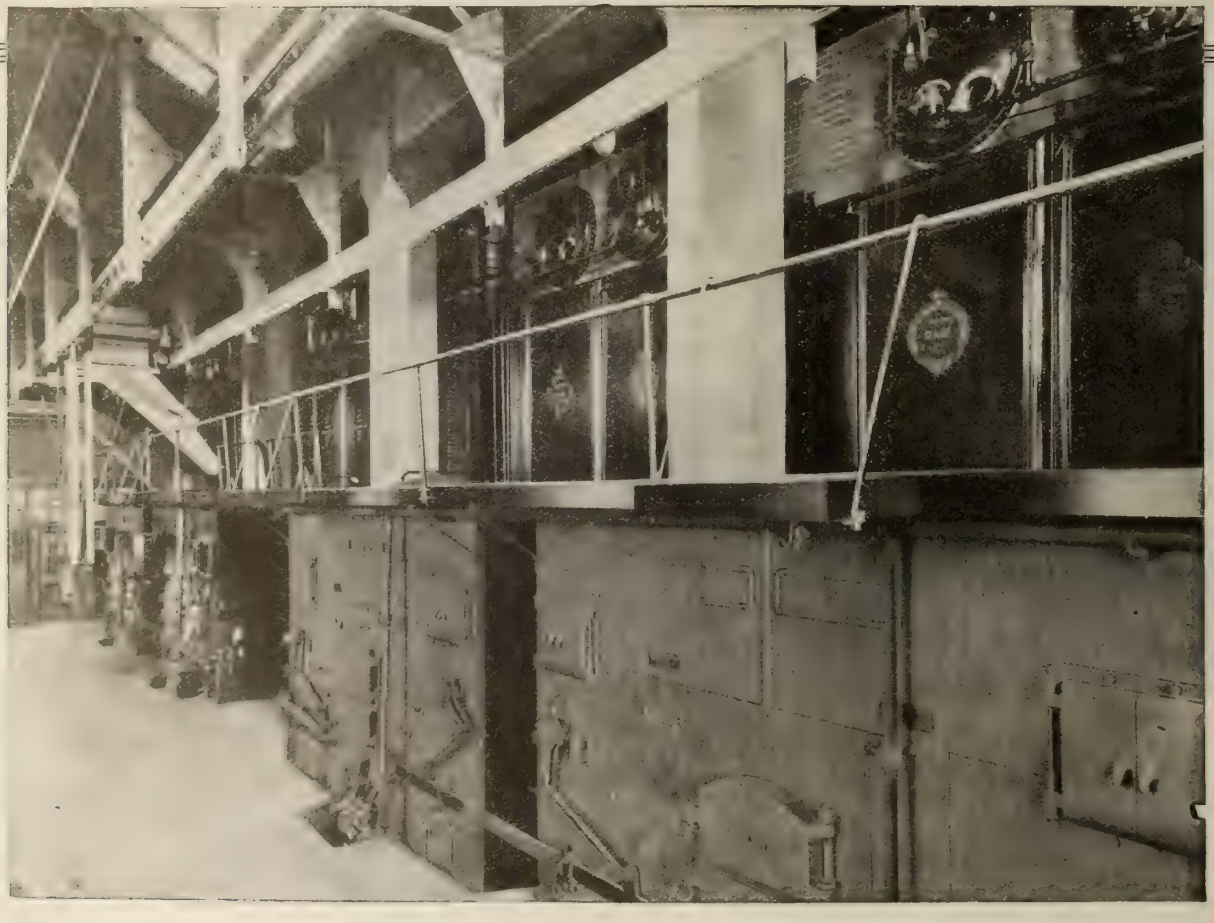
The following section is representative of Galt's machinery enterprises.



View of a manufacturing section in Galt. Here are seen boot and shoe factories, silk and knitting mills and machinery plants.

If it is made in Galt, there is nothing better

DEPENDABLE POWER EQUIPMENT



Four Double-Drum
G & McC. Sectional Water Tube Boilers

The G. & McC. Boilers shown here are installed in the Central Heating Plant of the Dominion Parliment Buildings, Ottawa, and are giving perfect service. Equipped with large steam and water drums and connecting nipples of increased size, they assure positive and rapid circulation and increased steaming capacity. G. & McC. Sectional Water Tube Boilers are built to meet the demands of the largest heating plants. They are constructed of the best quality steel, all parts which are subjected to steam pressure being of forged steel.

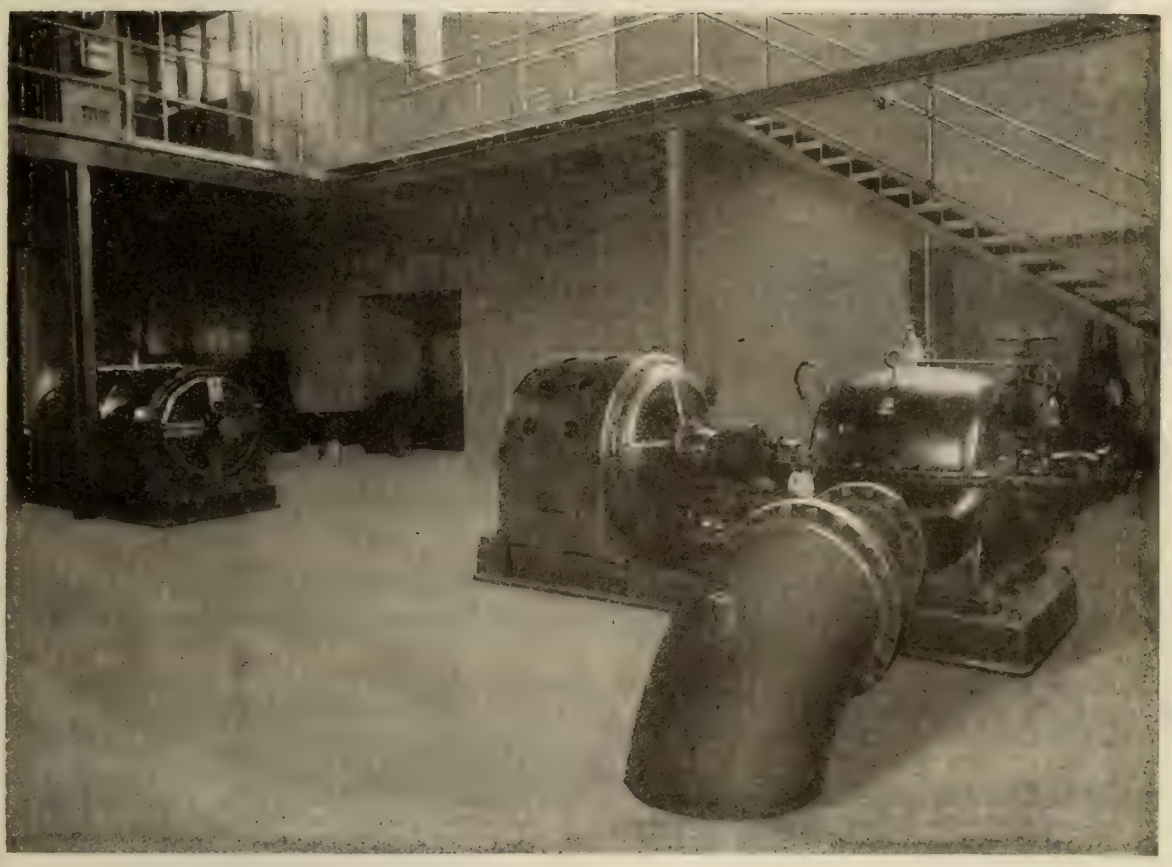
The features contained in these boilers merit better acquaintance

Goldie & McCulloch Engineers are Always Ready to Cooperate

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If it is made in Galt, there is nothing better

REES RoTURBo



Pumps Giving Dependable Service at Windsor Water Works

Where high efficiency is required under varying conditions of load Rees RoTURBo PUMPS fill the most exacting demands. The installation shown above is an example. Two Rees RoTURBo PUMPS are seen in the plant of the Windsor Water Works and records show that they are giving consistent every-day service. Rees RoTURBo Pressure Chamber Pumps, Rotary Jet Condensers and Rotary Air Pumps are demonstrating their dependable qualities the world over in mines, power stations, marine service, water works, and all kinds of industrial plants. Our catalogues will be forwarded to parties interested.

THE GOLDIE & McCULLOCH CO. LIMITED

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Toronto Office:
Suite 1101-2,
Bank of Hamilton Bldg.

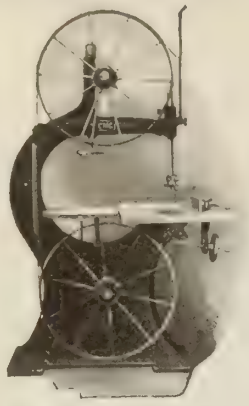
Quebec Agents:
Ross & Greig
100 St. James St
Montreal, Que

Western Branch:
248 McDermott Ave.
Winnipeg, Man.

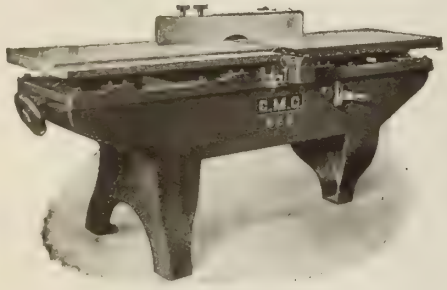
British Columbia Agents:
Robt. Hamilton & Co
Vancouver, B. C.

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Efficient Pattern Shop Equipment



No. 714, 36" Band Saw.



No. 823, 16" Buzz Planer

C.M.C.

Equipped with all time and labor saving features, C.M.C. pattern shop tools are giving universal satisfaction.

Besides those illustrated we supply Sanders, Rip and Cross Cut Saws, Wood Lathes and Surface Planers.

Send us your inquiries. Full information on request.

CANADA MACHINERY CORPORATION
LIMITED
GALT - ONTARIO

Toronto Sales Office: 721 BANK OF HAMILTON BLDG.

Preston & Schwartz

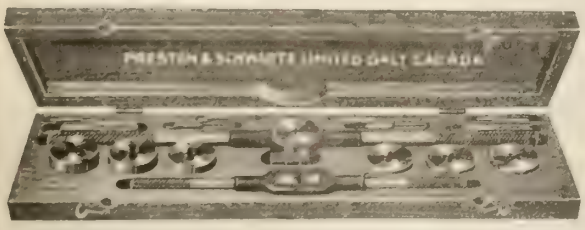
Manufacturers of High-Grade

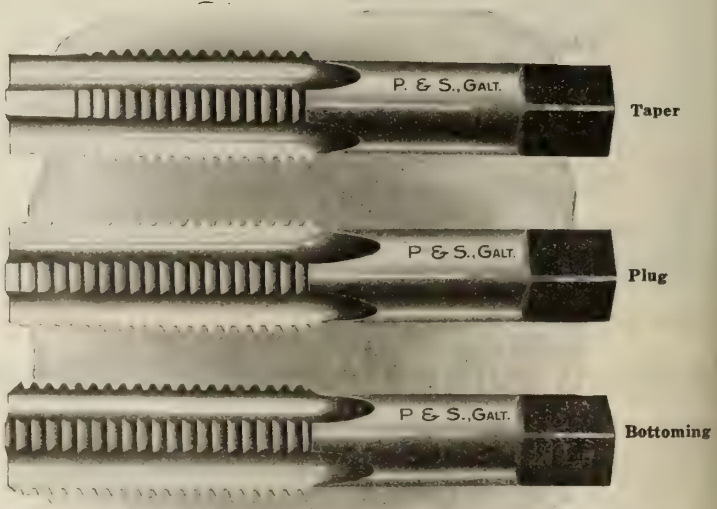


TAPS DIES

AND

THREAD-CUTTING TOOLS





WE have concentrated our energies in one direction:—in the making of high-grade taps, dies and thread-cutting tools. Our tools are warranted against defects in material and workmanship. A trial order will prove their superior merits.

Preston & Schwartz Limited

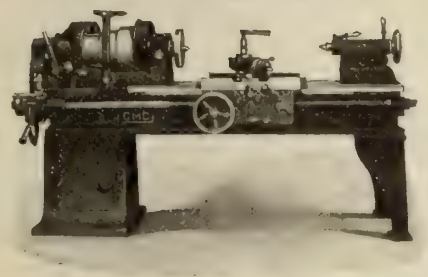
Galt, Ontario, Canada

If interested tear out this page and place with letters to be answered.

If it is made in Galt, there is nothing better

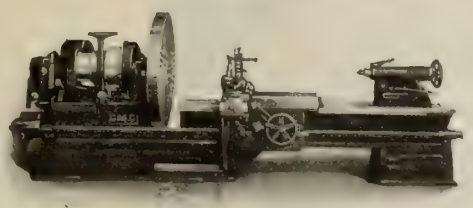
C.M.C. MACHINE TOOLS

High Grade Accurate Rigid Machines For The Particular Buyer



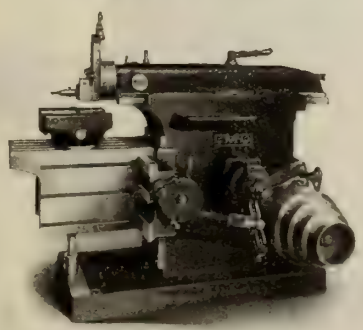
Engine Lathes—14-in. to 48-in. swing.
Arranged for belt or motor drive, with plain and quick change gears.

WE ALSO BUILD BRAKE and FACE LATHES



Gap Lathes—18-in. to 36-in. swing.
Built with plain and quick change gears exclusive. Extra rigid gap and gap piece design.

SLOTTERS, RADIAL DRILLS, PLANERS



Back Geared Crank Shapers—Three sizes, 16-in., 20-in. and 26-in.
All built with power down feed to head, constant table support, bearings cast integral with column, one side operation and constant reading stroke indicator.

DROP HAMMERS and SPECIAL MACHINERY



Punches and Shears.
Supplied single or double end, for belt or motor drive, in seven sizes, with throats from 9 in. to 48 in. in depth. All with simple but effective mechanism and extra strength.

Photographs, Specifications & Details Sent on Request.

CANADA MACHINERY CORPORATION
LIMITED

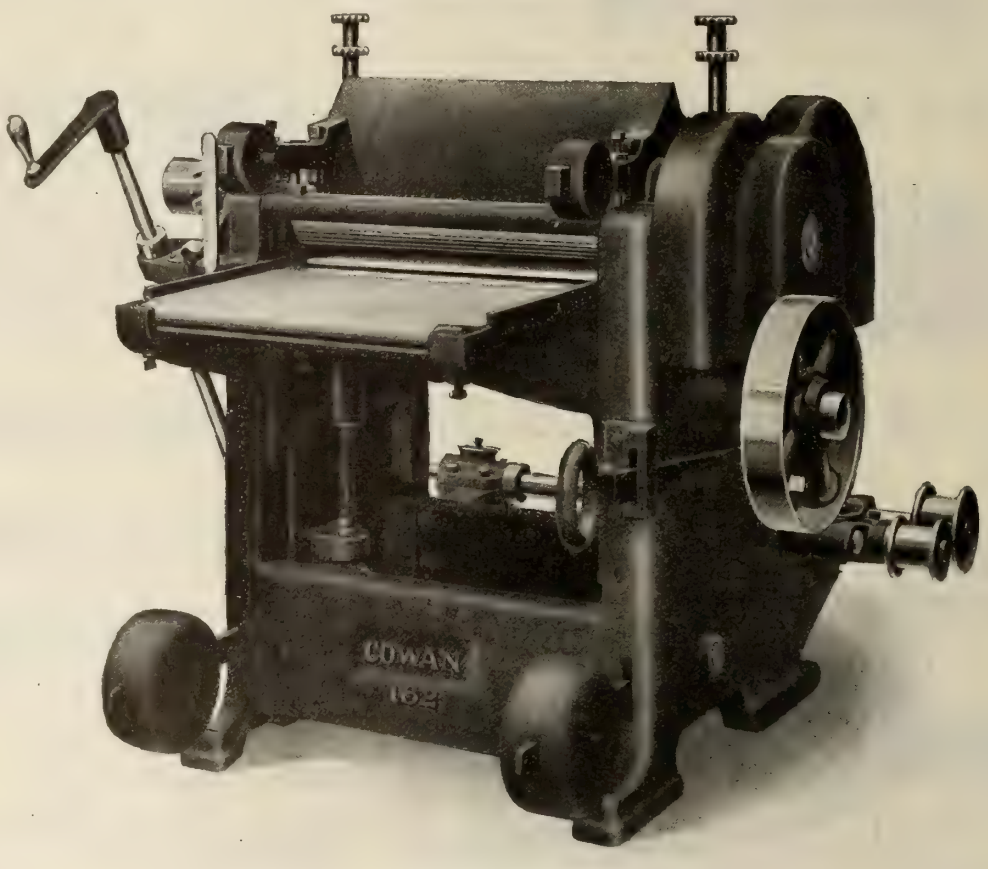
Toronto Sales Office - - - 721 Bank of Hamilton Bldg.

If interested tear out this page and place with letters to be answered.

Cowan
Woodworking Machinery

For

Pattern and Carpenter Shops; Planing Mills; Sash, Door and Furniture Factories; Shipbuilding Plants; Carriage and Wagon Shops, Etc.



Pony Surface Planer 182

Planes 16", 20" or 24" Wide; 6" Thick.
Upper Rolls Driven, 3" solid steel. Lower Rolls 5". Feed 30 feet per minute.
Feed Driven from Cylinder. Controlled by lever and belt tightener.

Cowan & Company of Galt, Limited

Manufacturers of

Planers	Mortisers	Band Saws	Sanders
Moulders	Borers	Scroll Saws	Grinders
Shapers	Lathes	Cross Cut Saws	Clamps
Tenoners	Resaws	Rip Saws	Veneer Presses

Office and Works: Galt, Canada.

If interested tear out this page and place with letters to be answered.

If it is made in Galt, there is nothing better

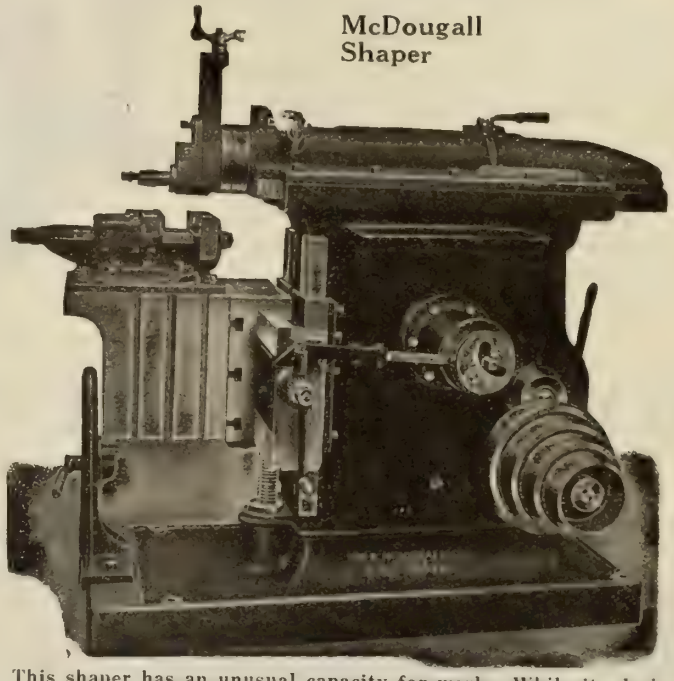
McDOUGALL

High-Grade Tools

ARE-MAC-DEE IS A GUARANTEE

McDOUGALL Shapers and Lathes have gained a widespread reputation for their correctness in design, their stability and convenience for producing work accurately and rapidly. You may know, therefore, when purchasing a lathe or shaper bearing the name R. McDougall & Co., you have made a first-class investment. Years of concentrated effort is the secret of their success.

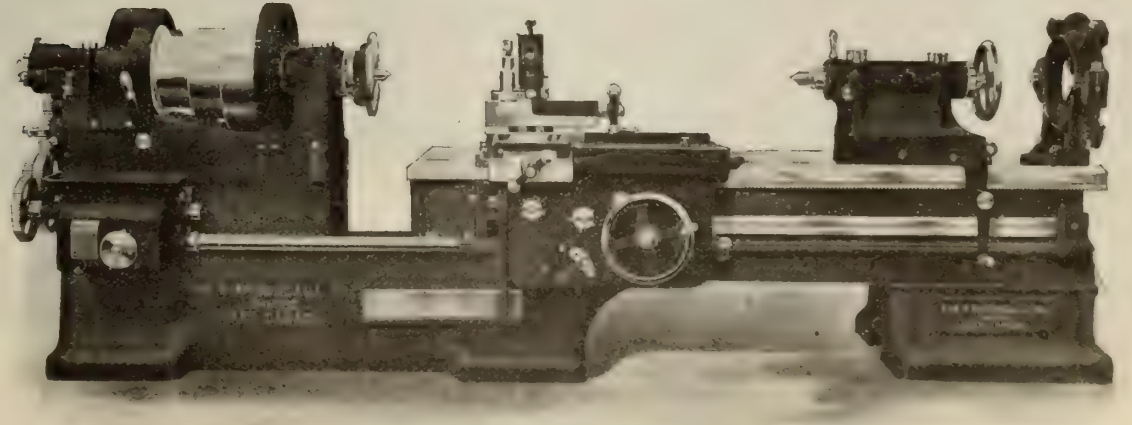
McDougall Shaper



This shaper has an unusual capacity for work. While its design is simple, it is an embodiment of all the best and most essential features required for exacting service.

lcDougall Gap Lathe

lte the strong, id construction c this lathe. lery detail tends trard accuracy, ee of operation al increased pro- d tion. Beds nde in any length i all sizes. Bul- l ns will be sent o request.



THE R. McDOUGALL CO., LIMITED

GALT, ONTARIO, CAN.

Sales Agents: The CANAD AN FAIRBANKS-MORSE CO., Limited

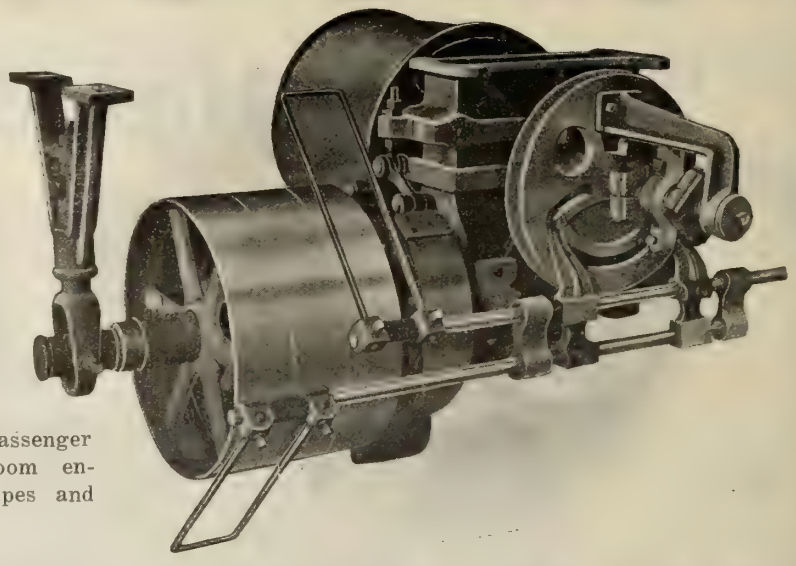
If interested tear out this page and place with letters to be answered.

ROELOFSON

Electric, Hydraulic and Hand-Power Freight and Passenger Elevators and Dumb Waiters.

WORM-GEARED BELTED FREIGHT ELEVATOR

The Simplest and Best Elevator Made

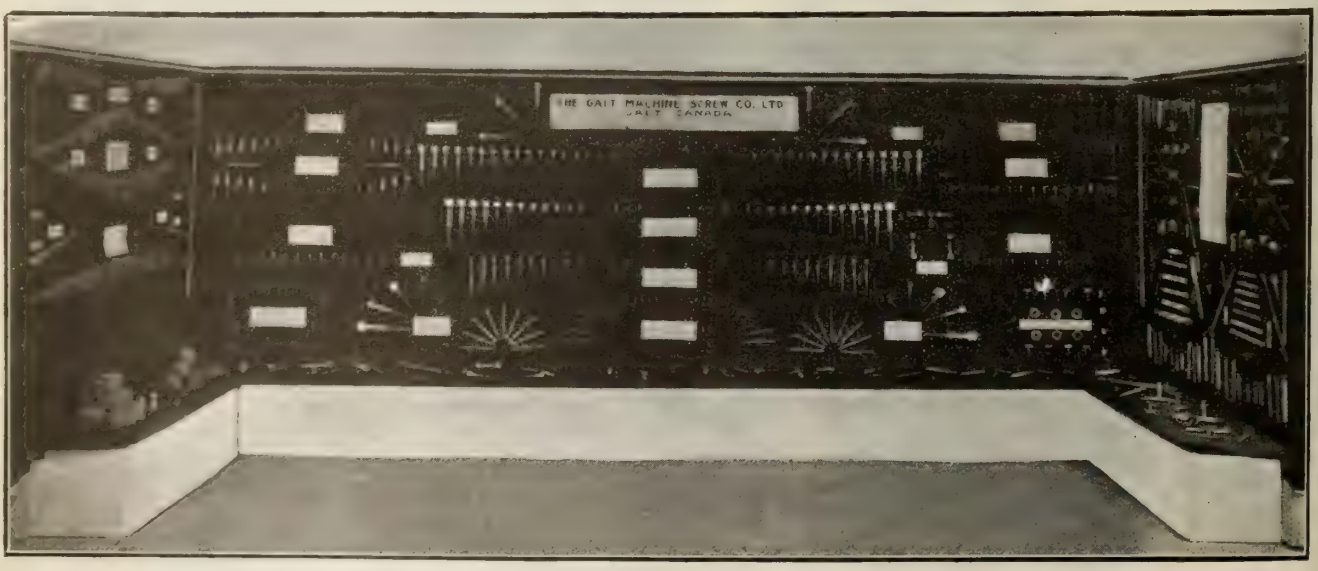


Some of its features:

Equipped with self-adjusting brake. Has phosphor bronze gears. It is noiseless and smooth-running, self-oiling and dust-proof. Capacity, 1,000 lbs. to 10,000 lbs. Absolutely safe and reliable! In addition to Electric, Hydraulic and hand-power freight elevators we make passenger elevators, dumb waiters, motors, toolroom enclosures, wire machine guards, fire escapes and ornamental iron. **Enquiries solicited!**

ROELOFSON ELEVATOR WORKS

GALT, ONTARIO



A partial view of our exhibit at THE MADE-IN-GALT EXPOSITION.
Note the wide range not only of special pieces, but of standard Cap and Set Screws, Semi Finished and Finished Hexagon Nuts, Studs and Taper Pins.
We make it a specialty to carry a full range of Standard Parts in V, USS and SAE threads, hence the up-to-the-minute service we give our customers. Try "GALT" screws and nuts for accuracy and prompt shipment.

THE GALT MACHINE SCREW COMPANY, LIMITED

GALT, ONTARIO

EASTERN REPRESENTATIVE:
F. Bacon & Co.,
131 St. Paul St. West,
Montreal, Que.

WESTERN REPRESENTATIVE:
D. Philip,
138 Portage Ave.,
Winnipeg, Man.

If interested tear out this page and place with letters to be answered.



GREY IRON--SEMI-STEEL

REPETITION

CASTINGS

Are you paying for a plate with two on when you could get six at the same molding expense? Are you buying a hundred dollar pattern when a cheaper one would serve your purpose? On the other hand, rearrangement of your existing patterns might reduce your casting cost 50 per cent. A different method of molding might double your production at no increase of molding cost. **We can tell you** as these records are being made daily.

We are Anxious to Make YOUR Castings

The help we offer you with your patterns is included in the service we are able to give our customers in the production of

Light and Medium—Bench and Floor REPETITION WORK

The knowledge and experience we have gained in 20 years handling of yours and similar problems, is at your service to obtain **better castings** cheaper.

We can refer you to the best firms in Ontario who have proved us with their requirements.

May We Do So?

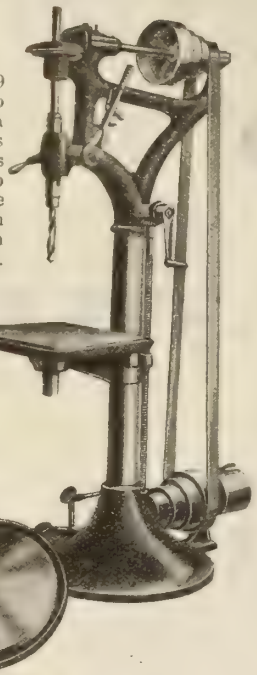
THE KATIE FOUNDRY
GALT, ONTARIO

"Perfect"

20 "Perfect" Lathes for the Toronto Technical Schools

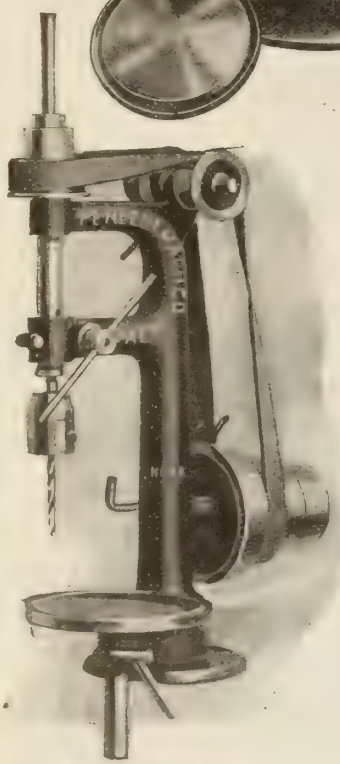
THIS is convincing evidence that "Perfect" machines are living up to their name. It was not without a widespread and thorough investigation that the Toronto Technical School Board decided in favor of using "Perfect" lathes for teaching students to become first-class mechanics. "Perfect" tools for perfect mechanics! "Perfect" lathes were chosen because they embody the most modern principles in design, because they are always carefully built and bear a splendid reputation in the best shops in Canada.

What is true of "Perfect" Lathes is true of "Perfect" Drills, Hack Saw Machines, Drill Presses and other machine tools.



No. 19 Drill

Perfect No. 19 Drill, geared 2 to 1, is driven by a 2-in. belt; has lots of power; handles a drill from 0 to 29/32. Its value is shown when compared with other 18 x 20-in. drills.



No. 18 Drill

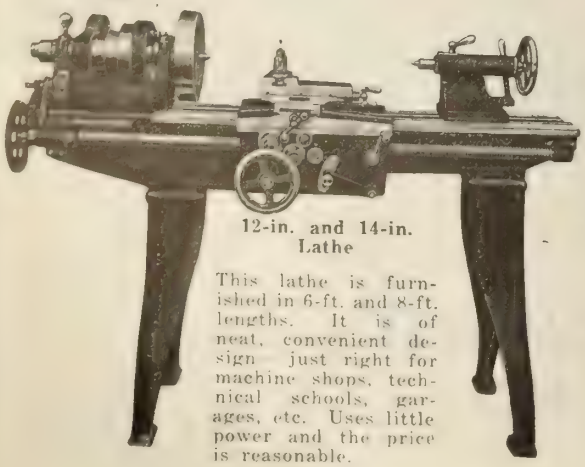
This drill combines efficiency, accuracy, durability and convenience of operation.

Drills to centre of 10 in. Speed 2,500 R.P.M.

Perfect Machine Co., Limited

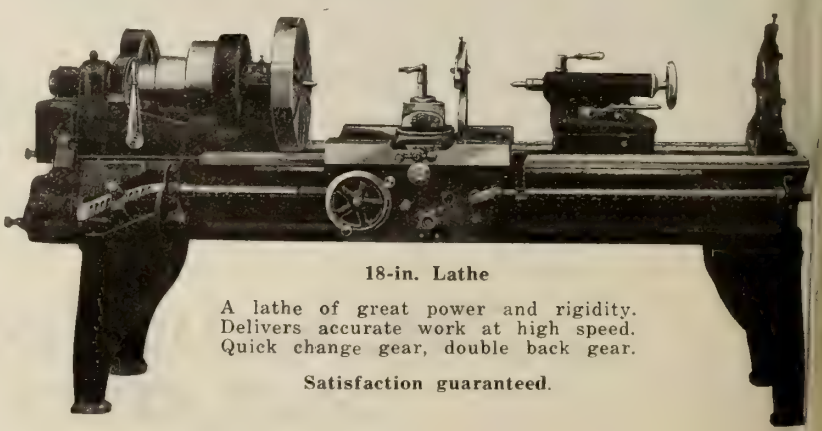
Galt, Ontario, Canada

Ask us about our new Lathe 12" x 4' 6" with taper attachment and draw-in-collet, also about our Spinning and Speed Lathes.



12-in. and 14-in. Lathe

This lathe is furnished in 6-ft. and 8-ft. lengths. It is of neat, convenient design just right for machine shops, technical schools, garages, etc. Uses little power and the price is reasonable.



18-in. Lathe

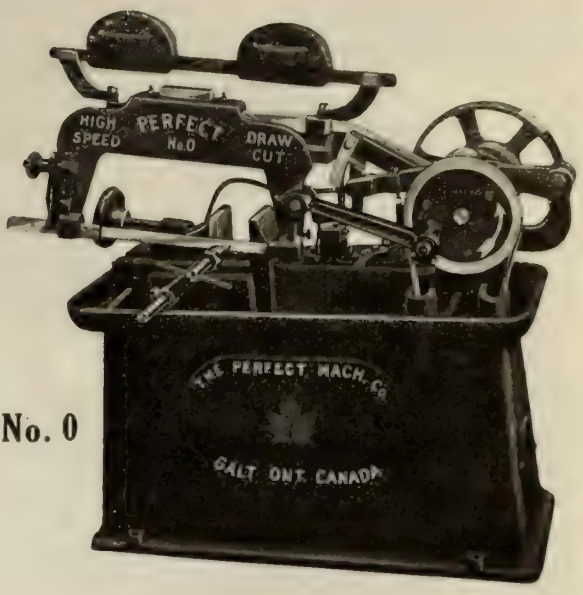
A lathe of great power and rigidity. Delivers accurate work at high speed. Quick change gear, double back gear.

Satisfaction guaranteed.

If interested tear out this page and place with letters to be answered.

If it is made in Galt, there is nothing better

Machines



No. 0

If you are not located in Canada have us do your work

WE HAVE a strictly modern Foundry, Pattern Shop, Machine Shop, a staff of engineers and a force of mechanics whose skill is second to none. The service that we can give you makes it unnecessary for you to pay heavy tariff charges, necessary in shipping machines into Canada.

No work too difficult.

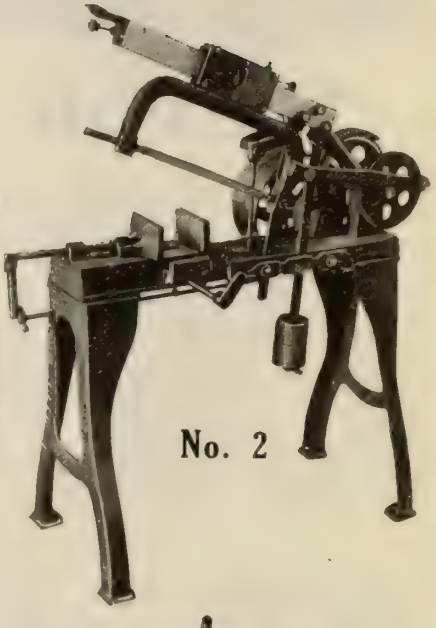
Communicate with us now.

Perfect Hack Saws

No. 0 Perfect Hack Saw—Capacity 0 to 6 in. or more on request. Speed 120 R.P.M. Weight 600 lbs.

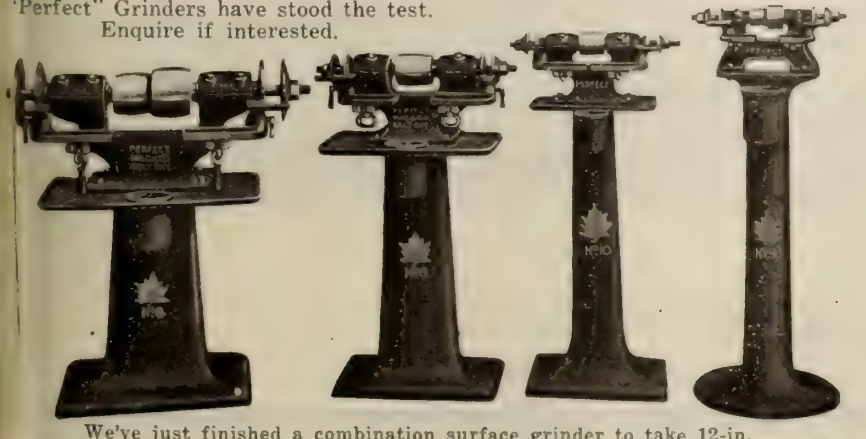
No. 2 Perfect Hack Saw—This is a smooth, easy-running machine. You'll find it's worth every dollar you pay for it. Capacity 5 in. x 6 in. Speed 80 R.P.M.

No. 3 Perfect Hack Saw—An ideal, all-round Machine Shop Saw, always ready. Automatic shut-off, adjustable arm and screw guide.


No. 2

Perfect Machine Co., Limited
Galt, Ontario, Canada.

"Perfect" Grinders have stood the test.
Enquire if interested.



We've just finished a combination surface grinder to take 12-in. x 2-in. wheel. Table 8 in. x 18 in. will travel vertically 8 in. Table has micrometer adjustment.


No 3

If interested tear out this page and place with letters to be answered.

If it is made in Galt, there is nothing better

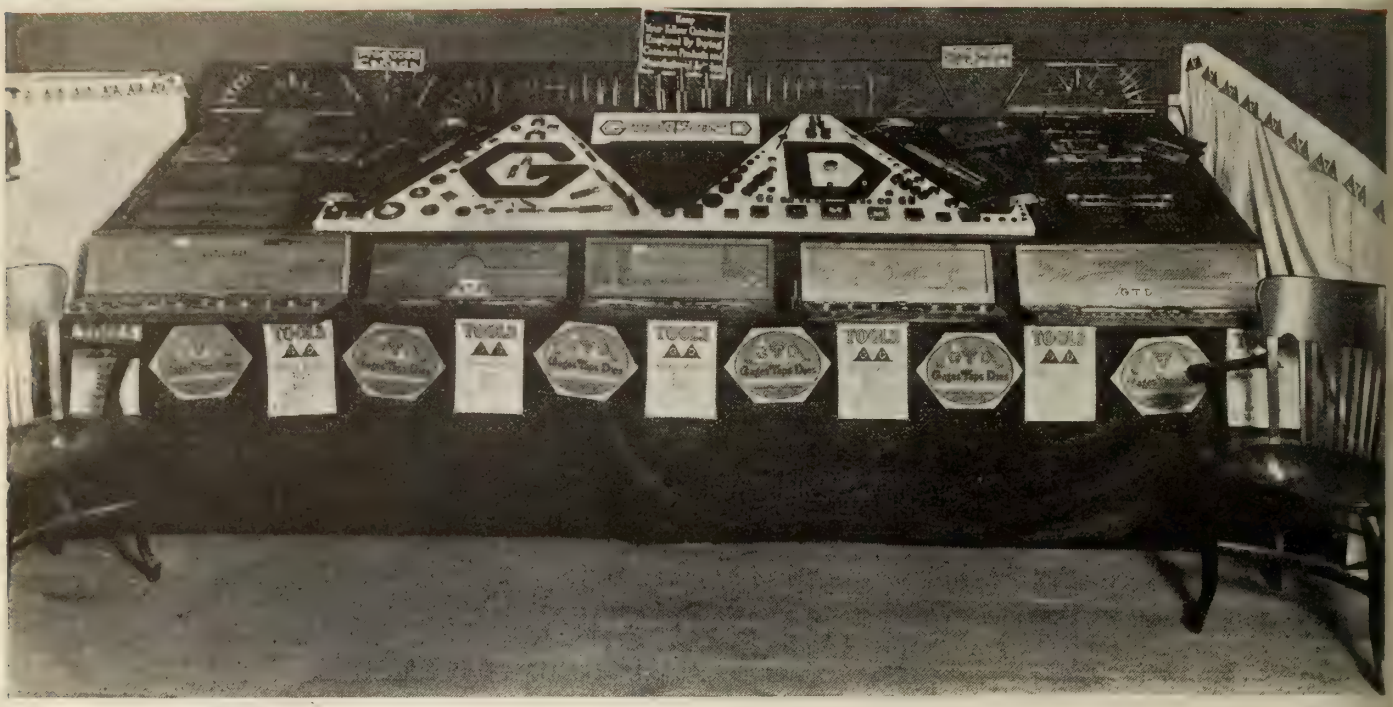


Exhibit of GTD Galt Products

The great crowds who were afforded the privilege of visiting the "Made-in-Galt" exhibit, held in Galt during the week of November 12th, enjoyed the opportunity of viewing this complete line of Taps, Dies and Screw Plates manufactured in Galt, Canada, by the Greenfield Tap & Die Corporation.

This excellent well-laid-out exhibit, appealed particularly to the many machinists and other workmen who were in evidence at every session of the exhibition.

This exhibit consists of Round Split Adjustable, Little Giant, Bolt and Pipe, Square and Acorn Dies. Machine Screw, Hand, Machine Nut, Tapper, Boiler, Pipe and Maxi Staybolt Taps. Little Giant, O.K. and Button Die Screw Plates. Hexagon Die sets. Also Gauges, including Plain, Plug and Ring, Male and Female thread, Limit Thread Gauges for Tapped Holes, and Limit for Male Screws, Pipe Thread and Limit Snap. These represent only a portion of their extensive lines, shown in their new No. 46 catalogue, furnished free, on application.

GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO

REG. U.S. PAT. OFF.
GTD

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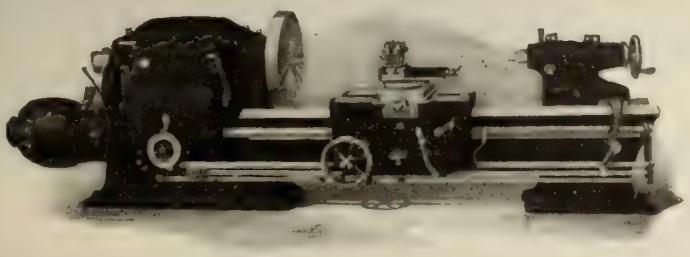
Ryerson Machinery — Service

Ryerson Machinery Service includes a complete line of machinery, comprising everything for the boiler, structural, bridge, railway and general machine shop, such as Punches, Shears, Bending Rolls, Lathes, Planers Milling Machines, Drill Presses, etc.

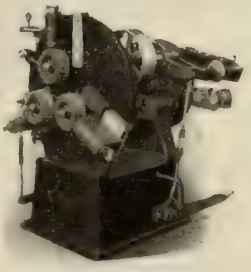
There are also many other remarkable labor-saving machines which we have developed during the last few years, including our High Speed Friction Saws, Steel Frame Combination Punching and Shearing Machines, the Ryerson-Conradson line of machine tools, etc.

We are always pleased to furnish prices and further information on all Ryerson Machinery. A bulletin on any particular machine or a complete catalogue on all Ryerson Machines will be mailed at your request.

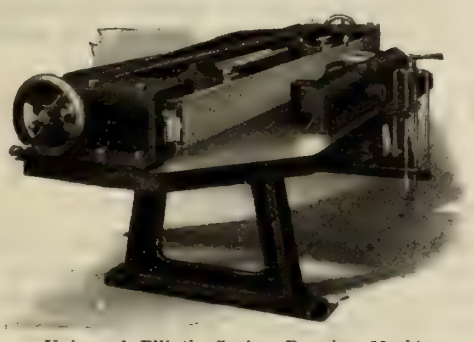
A strong staff of experienced engineers is always available for consultation



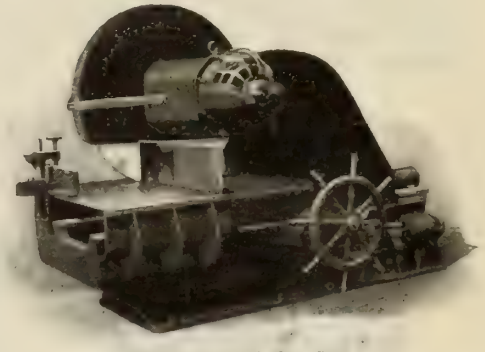
Selective Head Engine Lathe.



Universal Flue Cleaning Machine



Universal Elliptic Spring Forming Machine



High Speed Friction Saw.



View of Our Chicago Plant—The Largest Iron, Steel and Machinery Warehouse in the World.

JOSEPH T. RYERSON & SON

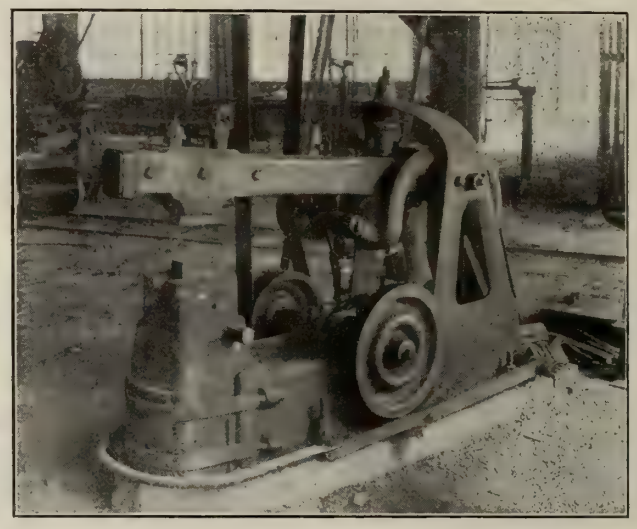
Established 1842 Incorporated 1888

CHICAGO ST. LOUIS DETROIT BUFFALO NEW YORK

Nearly Fifty Years of Strenuous Service

For this BRADLEY HAMMER

--*And it is Working Fine To-day!*



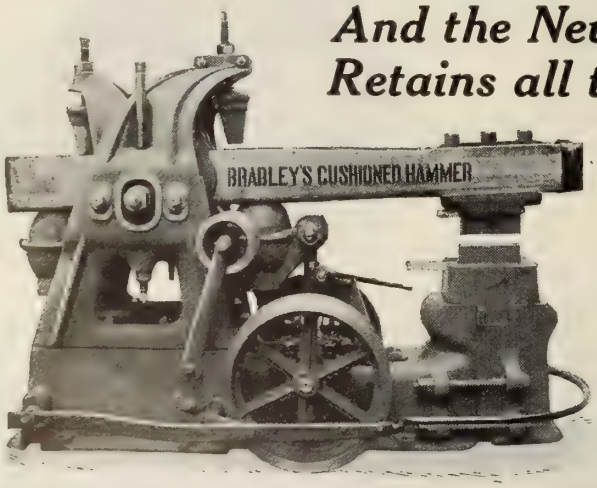
Here is one of the first Bradley Hammers ever built. This 1921 photograph shows it as it looks to-day, still going strong.

On October the 24th, way back in 1872—49 years ago to be exact—this Forty pound (Head Weight) No. 7 Bradley Hammer was sold to the Silsby Mfg. Co., Seneca Falls, N.Y. It was used in the Silsby plant for twenty-two years and then sold to the Syracuse Silver Metal Company in 1894. After being used for eleven years in the Syracuse Silver Metal Company, Smith and Caffery of Syracuse paid $50 and purchased the hammer for junk.

To their intense surprise Smith and Caffery found there was still life in the old soldier so instead of scrapping it they belted it up—and there it has been on the job every working day for almost seventeen years.

Over forty-nine years on the job and still going strong is some record for any piece of forging machinery. It clearly illustrates the remarkable durability built into all Bradley Hammers.

And the New Type Bradley Retains all the Quality of 49 Years Ago



The Modern Bradley Rubber Cushioned Helve Hammer.

Here is our modern Rubber Cushioned Helve Hammer—a type capable of the same performance as the old pioneer above but having many improvements. It has facilities for instantly changing the length of stroke. Compared with any other hammer the results show less power used, less repairs required, larger capacity and greater adaptability.

Write for circulars describing the four types of Bradley Hammers.

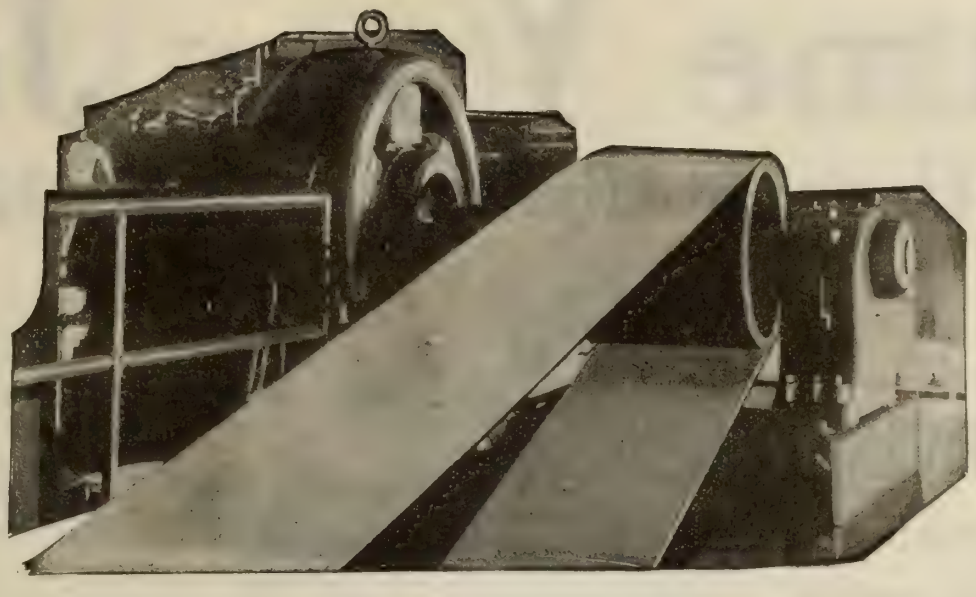
"Forge Ahead with a Bradley Hammer"

C. C. BRADLEY & SON, Inc.

SYRACUSE, N. Y.

Bradley Hammer Builders for 49 Years

FOREIGN AGENTS: England, Buck & Hickman, Ltd., London; France, Fenwick Freres & Co., Lyons, Rhone; Italy, Fenwick Freres & Co., Turin; Belgium, Fenwick Freres & Co., Liege; Brazil, Fenwick Freres & Co., Rio de Janeiro; Switzerland, Fenwick Freres & Co., Zurich; Portugal, Fenwick & Co., Lisbon; Spain, Fenwick Freres & Co., Barcelona; Alsace-Lorraine, Fenwick Freres & Co., Luxembourg; China, Anderson Meyer & Co., Ltd., Shanghai.



Dominion Friction Surface Belting

is the most dependable, and therefore the most economical, belting you can buy because it is the result of the combined experience of all our industrial rubber factories. It is the finished product of the finest materials put together with all the skill of the belt-maker's art.

It costs nothing to have one of our belting experts study your transmission problems and submit recommendations for your approval. Phone or write our nearest Service Branch.

Dominion Rubber System

Service Branches

Halifax	Ottawa	Kitchener	Brandon	Calgary
St. John	Toronto	North Bay	Regina	Lethbridge
Quebec	Hamilton	Fort William	Saskatoon	Vancouver
Montreal	London	Winnipeg	Edmonton	Victoria

DOMINION RUBBER SYSTEM PRODUCTS

Belting

Transmission: "Dominion," "Keewatin," "Para."
Conveyor: "Rockproof," "Canadian," "Hiheat"
Elevator: "Dominion," "Rockproof."
Agricultural: "Dominion," "Star."
Grain Elevator: "Metcalf Standard," "Grain King."

Hose

Air: "Kushion Kover," "4810 Airtite," "Star."
Steam: "Indestructible," "Rockproof," "Para."
Water: "Indestructible," "Para," "Kushion Kover," "Star."
Suction: "Para," "Star," "Trade."
Garden: "Canadian," "Dominion,"

Packing

Sheet: "Join-Tite," "Star," "Importers."
Rod: "Cabestos," "Valve-Bestos," "Canadian."
Valves: "Montreal," "Commercial," "Canadian."

Miscellaneous

Mats, Matting and Flooring.
Moulded Goods.
Plumbers' Specialties.
Hard Rubber Goods, Tubing.
Rubber Covered Rolls, Deckle Straps.
Friction Tape, Splicing Compound

DOMINION RUBBER SYSTEM AND ASSOCIATED COMPANIES

Name Your Job

We Undoubtedly Make the Machines

GARVIN

Dependable!

Used the world over for 50 years

The expert hand of the "old timer" can probably coax good results out of the ordinary machine tool—if you give him time.

With a Garvin he gets results instinctively and by previous training, and with a speed that weighs well against overhead.

The "comer" can pin his faith to a Garvin. Garvin Machines quickly brush all doubt away. Their unfailing performance will make the new man as proud of h's work and as proud of his speed and quality records as any Garvin user ever was.

Let us tell you the technical reasons why. Ask for the Garvin Catalog now.

The Garvin MACHINE COMPANY

Spring and Varick Streets

New York, N.Y.

THE Machine Shop operator has learned by experience to depend on Garvin Machines for all kinds of work.

He knows Garvin Milling Machines, Screw Machines, Tappers, Lathes, Slotters, Duplex Drills and Millers, Profilers, Cam Cutters, etc.

It is not a matter of **learning** about them—if he knows anything about shop equipment he **knows** Garvin.

Garvin builds—

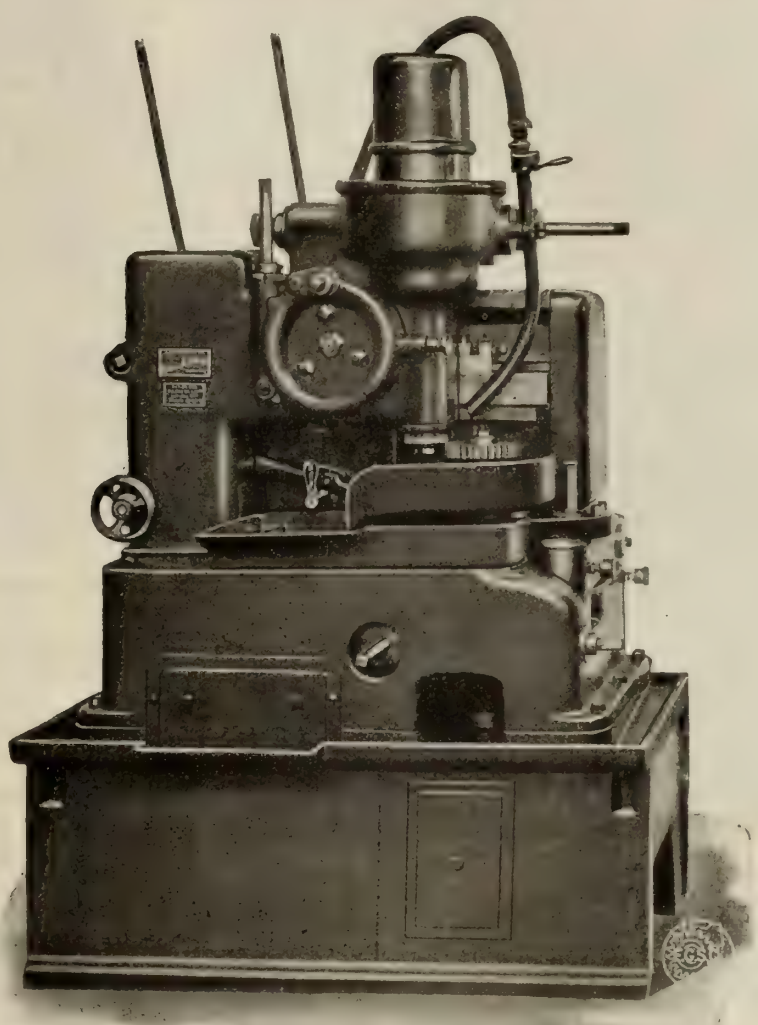
- Arbors
- Attachments—
  - (for Milling Machines)
  - Cam Cutting
  - Circular Milling
  - Swivel Spindle Rack Cutting
  - Universal Milling
  - Vertical Milling
  - Vertical Spindle
- Automatic Index Milling Machines
- Automatic Oil Groovers
- Automatic Tapping Machines
- Cam or Form Milling Machines
- Castellating Fixtures
- Centers
  - Index
  - Index, Multiple Spindle
  - Reamer
  - Spiral Index
  - Vertical
- Chucks, Wrenchless (Air)
- Coiling Machines, Spring
- Countershafts, Friction
- Cutter Grinders
- Cutting-off Machines
- Die Slotting Machines
- Dividing Heads
- Drill Presses, Gang
- Duplex Horizontal Drills
- Duplex Milling Machines
- Duplex Screw Machines
- Duplex Spline Milling Machines
- Duplex Tapping Machines
- Friction Pulleys
- Grinders
  - Cutter
  - Surface
- Hand Lathes
- Hand Milling Machines
- Horizontal Drills, Duplex
- Horizontal Tapping Machines
- Index Centers
  - Multiple Spindle
  - Reamer
  - Spiral
  - Table
  - Vertical
- Lathes, Hand
- Milling Machines
  - Automatic Index
  - Cam or Form
  - Duplex
  - Hand
  - Plain
  - Universal
  - Vises
  - Motor Driven Machines
  - Multiple Spindle Index Centers
  - Oil Pumps
  - Plain Milling Machines
  - Profiling Machines
  - Rack Cutting Attachment
  - Rack Cutting Vises
  - Rapid Screw Slotters
  - Rotary Tables
  - Screw Head Shaving Machines
  - Screw Machines, Hand
    - Duplex
    - Tools and Attachments
- Screw Slotting Machines
- Spline Milling Machines
- Spring Coiling Machines
- Surface Grinders
- Tapping Machines, Automatic
- Tapping Machines, Horizontal
- Tapping Machines, Vertical
- Vertical Milling Machines
- Vertical Tapping Machines
- Vises

G-104

GARVIN

BUILDER OF BETTER MACHINE TOOLS

CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.

It is designed to cut one gear at a time and at a speed which eclipses all other methods.

All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines.

It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.

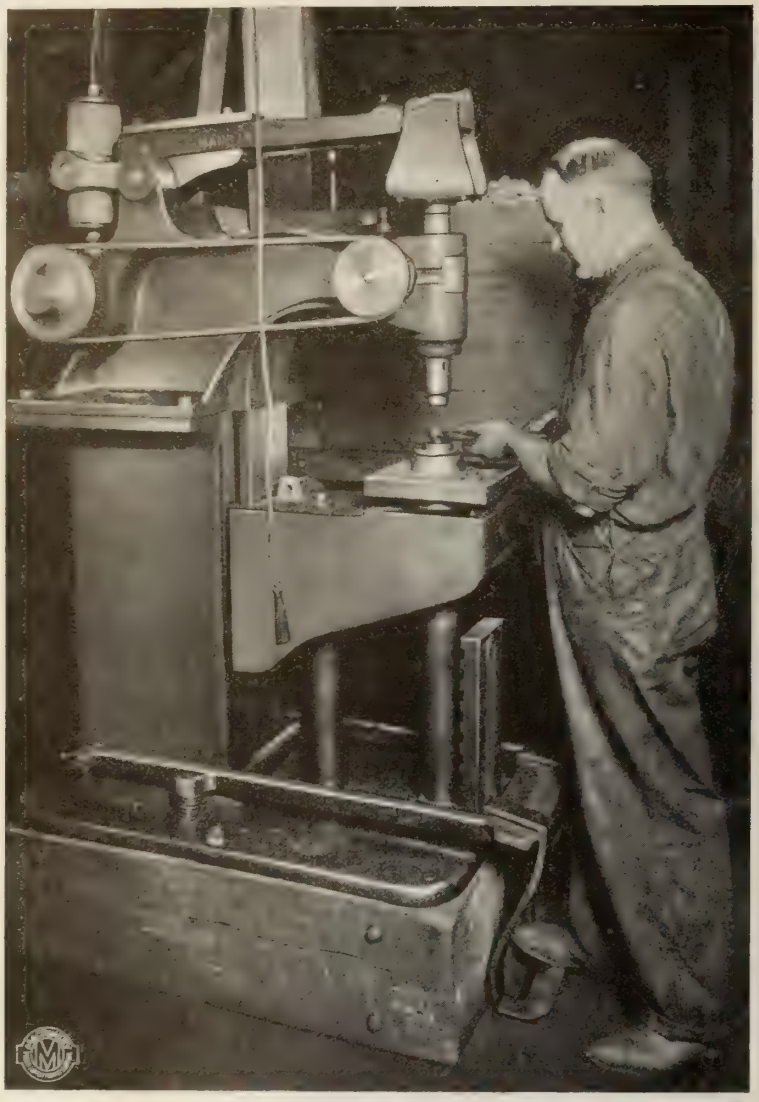
See illustrated article in all technical magazines.

Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India.



High Speed

A No. 6-B HIGH SPEED RIVETING HAMMER

(PATENTED)

Latest Product of the High Speed Hammer Company

THE New No. 6B High Speed Riveting Hammer is shown here riveting a nickel-steel ball to a forged steel pitman arm in a branch plant of the General Motors Corporation, where the famous "Jacox" steering gear is made. It has proved one of the most efficient production units in the whole works.

The nickel steel ball in this operation has a 5/8" shank and is pressed into the arm by an arbor press. About 1/8 in. stock is left to rivet and the machine turns the head over to 3/4 in. diameter.

A Record Made

On a 5-hour test run the remarkable production of 2,200 was obtained.

The No. 6-B Hammer is specially designed for heavy, cold riveting. Its capacity is full round heads on 5/8 in. to 3/4 in. stock; oval or flush heads, 7/8 in. to 1-1/2 in. stock.

Send us samples of your work and let us demonstrate our process of cold riveting on your own product.

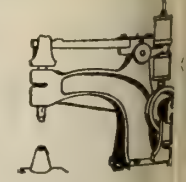


A Separate View of the Parts



THE PRINCIPLE IS RIGHT

THE HAMMER WITH THE HUMAN STROKE



Riveting Hammers



A Battery of 3 No. 5 A, High Speed Riveting Hammers

More Examples of High Speed Hammer Production



PRODUCTION of parts on a quantity and quality basis makes the Chevrolet Automobile possible as a popular priced car.

High speed Riveting Hammers play an important part in the production of the famous Chevrolet.

The example illustrated shows a battery of 3 No. 5A High Speed Riveting Hammers on the riveting of three bosses to brake flange plates: sheet steel stampings 1-8" in thickness. Two of the bosses are of cold rolled steel, and are 7-8" diameter, the third being a square. Each High Speed Hammer shown performs one operation, and in this way the very excellent production of 300 for each hammer of these large riveted bosses per hour is obtained.

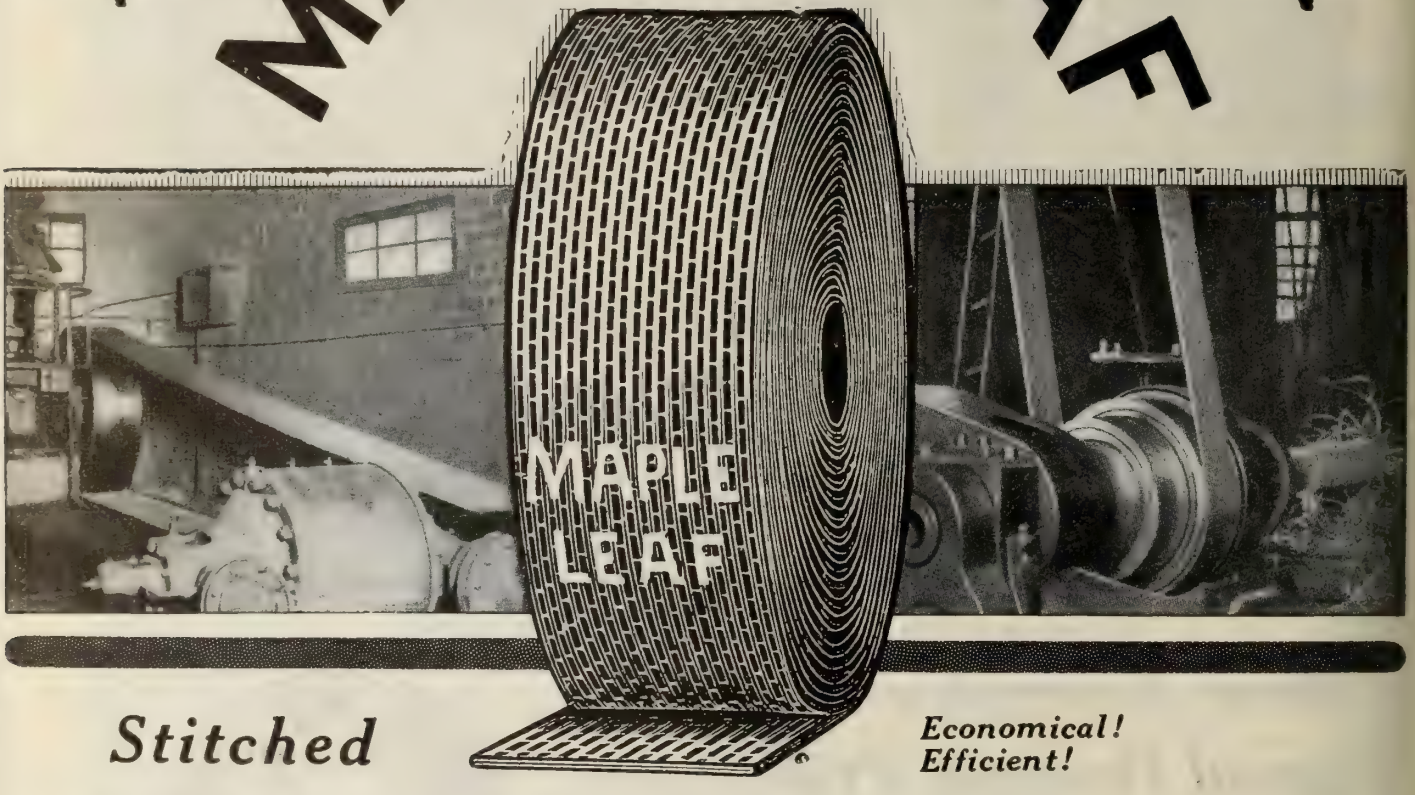
If you have riveting to do in quantities you can secure similar results. By sending sample parts to us for riveting and by getting our estimates you can prove the truth of this statement.

The High Speed Hammer Company, Inc.

Rochester **New York, U. S. A.**

CHICAGO BRANCH: C. W. Schuchardt, Mgr., 568 W. Washington Blvd.
AGENCIES: F. O. Stallman Supply Co., 500 E. Third St., Los Angeles, 167 to 173 First St., San Francisco, for the Pacific Coast. Burton, Griffiths & Co., Ltd., London, E.C., for the British Isles. Aktiebolaget Rylander & Asplund, Stockholm, Sweden, for Sweden and Finland. China, Japan and South American Trading Company, Ltd., Yokohama, Kobe and Osaka, Japan, for Japan and Dependencies.

MAPLE LEAF BRAND



Stitched

Economical!
Efficient!

Cotton Duck Belting

Cost Less Than Leather, Rubber or Balata

FOR transmission of power or conveying purposes, Maple Leaf Brand Belting is as efficient as any belting you can buy. It costs less than leather, rubber or balata. Figured on a basis of "service per dollar," it is the best belting buy on the market. It is strong, durable, economical, efficient and true running. Satisfied users throughout Canada will verify these statements. We will gladly send samples and prices on request.



MAPLE LEAF DRESSING—*Best for All Belts*

Maple Leaf Belt Dressing does not contain resin, mineral or animal oils or other ingredients harmful to belts. All belts should have an occasional application of a reliable dressing in order that the best results be obtained. We recommend Maple Leaf Belt Dressing as the safe and sane treatment.

Dominion Belting Co., Limited

HAMILTON, - - CANADA

Quebec Branch--51 Duluth Building, Montreal

SHAFTING

Flawless Products

Cold Drawn, Turned and Polished Steel Shafting



Rounds, Hexagons, Squares and Flats

Finished Machine Keys Ready to Drive.
Free Cutting Screw Stock and Piston Rods.

The Canadian Drawn Steel Co., Limited

ARTHUR STREET
HAMILTON, CANADA

ALLIGATOR

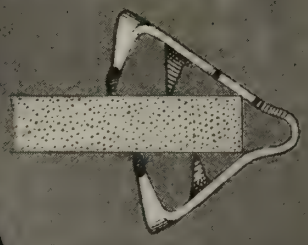
TRADE MARK REG. U.S. PAT. OFFICE

STEEL BELT LACING

Best for Every Type of Belting

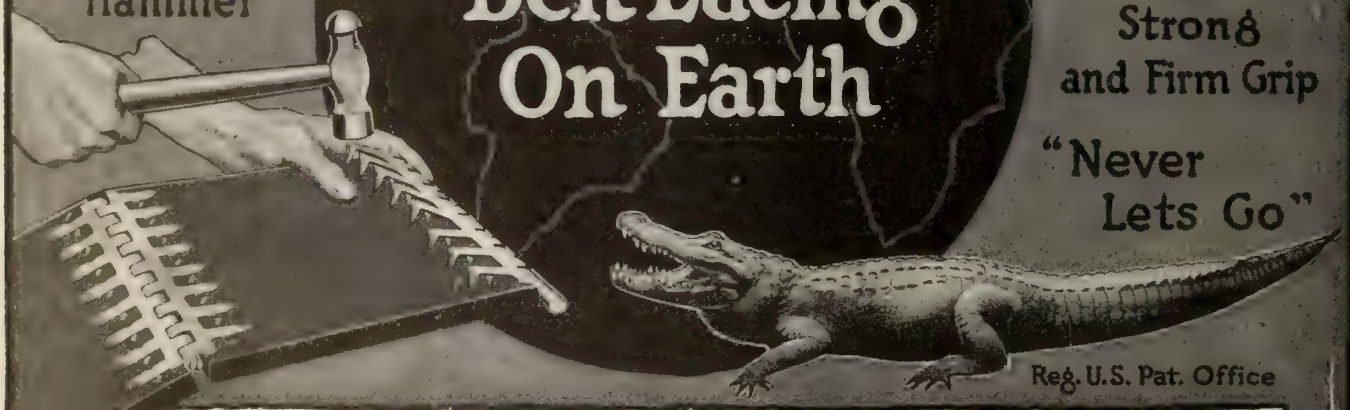
Nothing Needed But a Hammer

The Strongest Belt Lacing On Earth



Double Staggered Teeth Insures Strong and Firm Grip

"Never Lets Go"



Reg. U.S. Pat. Office

Jobbers—Dealers

Sell Satisfaction and Economy When They Sell ALLIGATOR Steel Belt Lacing

Go over these features that make "ALLIGATOR" the best belt lacing proposition for you and for your trade.

FLEXCO-LOK

Reg. U. S. Pat. Office

Steel Lamp Guards



Protects lamps from breakage and theft—property from fire. An efficient, inexpensive security against danger, losses and delays.

Made in all styles and sizes with reflectors and handles if desired. Patent lock prevents theft. Sold at a distinct economy to the purchaser. Write on letterhead for information, prices, etc. Not in stock in London.

First: National and local advertising in carefully selected general publications, trade papers and consumer class publications interests all belt users and creates a demand that has been growing for twelve years.

Second: ALLIGATOR is preferred by Master Mechanics in every industry all over the world for its ease and facility of application, long life in operation, belt saving characteristics and economical features. The decision of hundreds of thousands of belting users should influence you to stock it.

Here are other reasons:

ALLIGATOR is the most easily and quickly applied of all belt lacings. **Only a hammer needed and three minutes average time** to lace a belt. Anyone can put it on.

Besides this important feature, this belt lacing has proven the strongest and consequently the **most efficient** in every test.

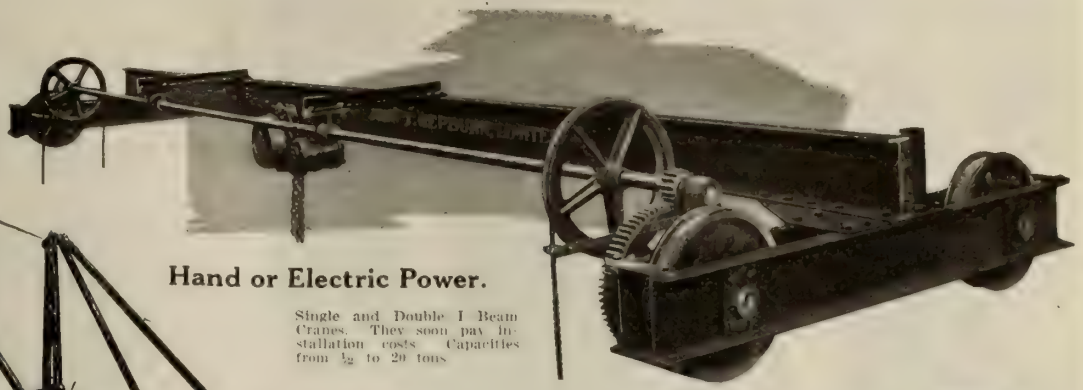
It outlasts any other type of belt lacing—and **saves the belting.** See illustration and note how the staggered teeth penetrate without injuring the belt and clinch down flat. Also note the sectional steel rocker hinge pin which makes a flexible hinge joint that hugs the pulley, is no thicker than the belt, and permits belt to be run on both surfaces.

In addition the use of ALLIGATOR Steel Belt Lacing is the most economical manner of taking up stretch on new belts and of relacing and repairing old ones. Only one end of belt need be cut off in shortening; or to lengthen, insert stub of correct length.

Can be kept handy in stockroom or tool box for immediate service thus avoiding any possible delays. Represents big saving and convenience to your customers on any kind of belting. A complete service for all thicknesses of power or conveyor belting. A size and type for every need. Write on letter head for samples and trade prices.

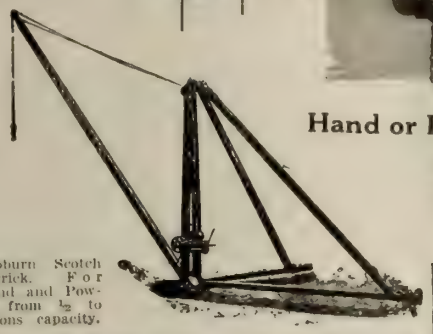
FLEXIBLE STEEL LACING CO.

4610 Lexington Street, Chicago, U. S. A. **135 Finsbury Pavement, E. C., London**



Hand or Electric Power.

Single and Double I Beam Cranes. They soon pay installation costs. Capacities from ½ to 20 tons.



Hepburn Scotch Derrick. For Hand and Power, from ½ to 6 tons capacity.

IN TWELVE SHORT YEARS the PHENOMENAL GROWTH of THE HEPBURN BUSINESS has TAKEN PLACE.

INTEGRITY and THOROUGHNESS HAVE DONE IT.

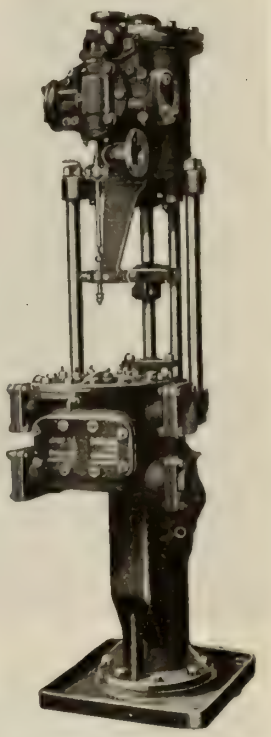
WATCH US GROW!



A powerfully constructed POWER PRESS designed for long and hard service. Cranks are made from solid forgings. Long strokes exceptionally good finish.

The Products of the HEPBURN Shops

Vertical Engines, Compressors, Winches, Cut Gears, Cranes, Derricks, Steam Pumps, Planers, Power Presses, Spinning Lathes, Elevators, Hydrants, Forgings and Grey Iron Castings all made on the policy that "quality first" pays.

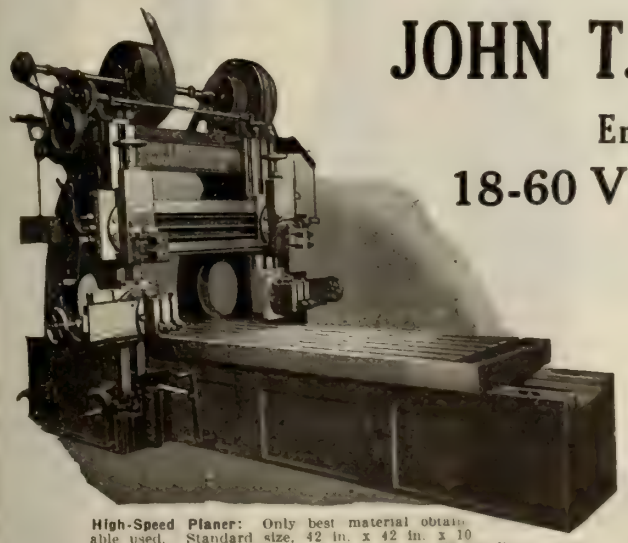


Hepburn Special Vertical Ram Feed Pump: A high pressure type with only one gland to require packing. Operates with positive Lever Valve Motion. Minimum floor space required.

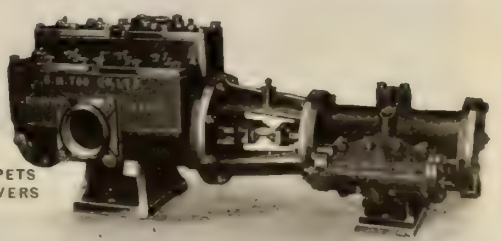
JOHN T. HEPBURN LIMITED

Engineers and Iron Founders

18-60 Van Horne St., - Toronto

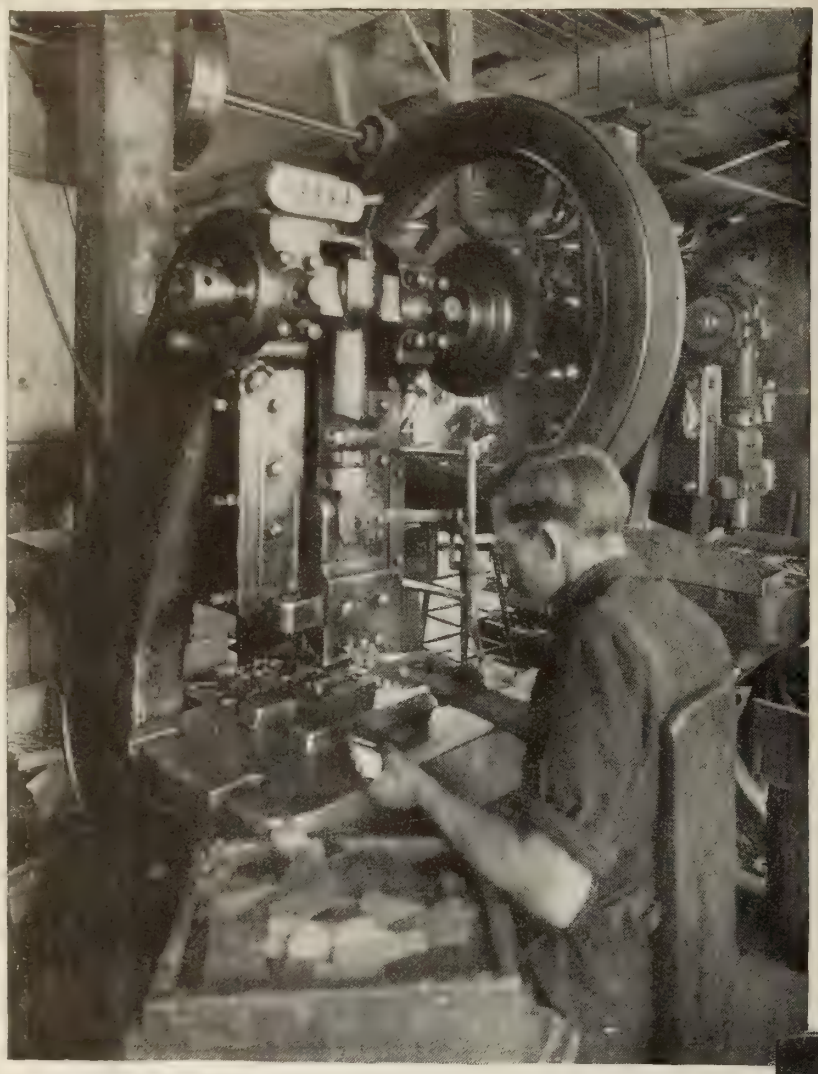


High-Speed Planer: Only best material obtainable used. Standard size, 42 in. x 42 in. x 10 ft. Two or four heads as required. Weight 22,000 lbs.



NO TAPPETS
NO LEVERS

Hepburn Patent Vacuum Pump: An improved self-draining type that makes possible great steam economy. Other valuable features are incorporated. Write for catalogue.



Kitchen and Table Cutlery

Produced Entirely on "BLISS" Presses

These photographs, taken in the plant of H. C. Hart Manufacturing Company, Unionville, Connecticut, illustrate the method of producing low-priced Kitchen Cutlery in large quantities.

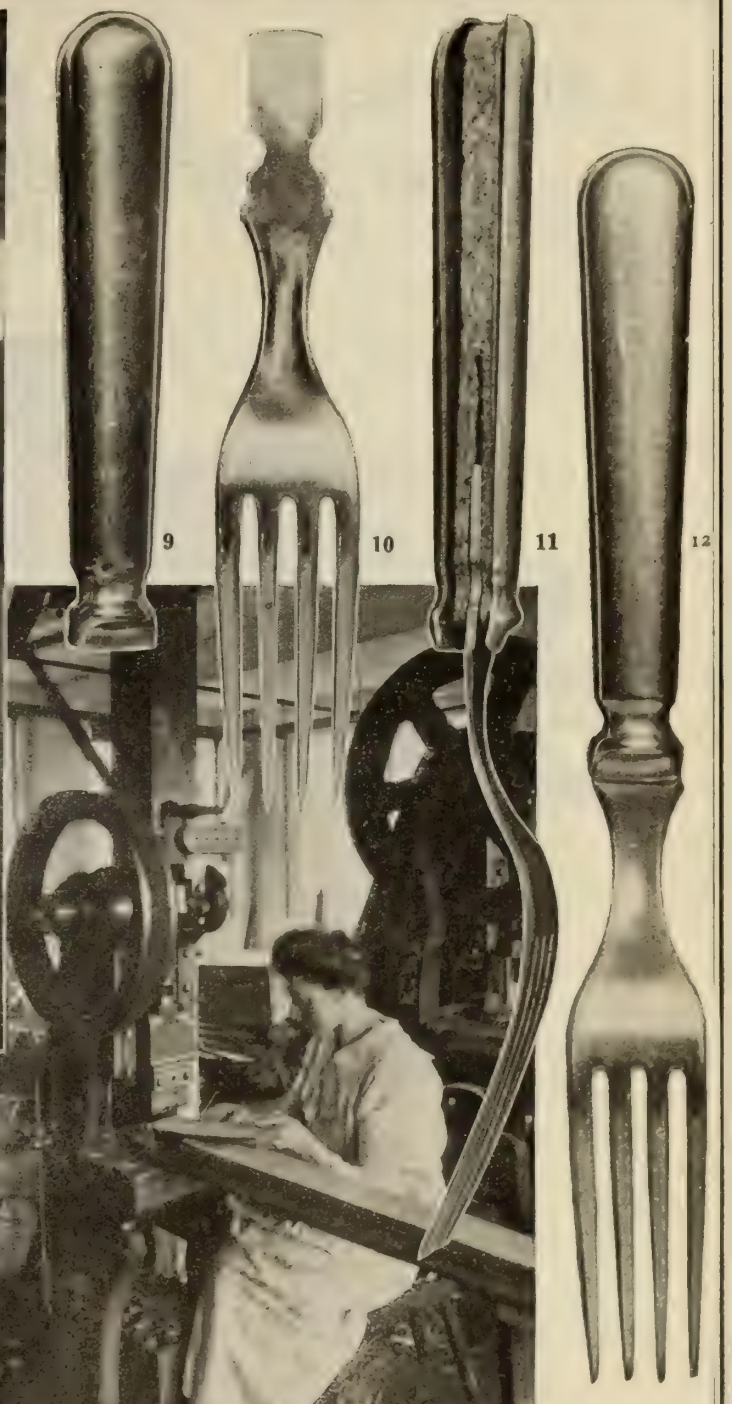
"BLISS" Presses are used for all operations excepting grinding and polishing. The first operation is cutting blanks. Fig. 1 shows blank for handle; Fig. 4, blank for knife blade, and Fig. 5, blank for fork.

The second step is panelling the handles, Fig. 3; the cork filler for the handles is blanked, Fig 2, and the two successive operations in cutting the fork tines, Figs. 6 and 7.

The final steps are bending, assembling, and closing the handles, illustrated in Figs. 9, 10, 11 and 12.









The photographs of "BLISS" Presses in operation show, on the opposite page, panelling of handles; at the top of this page, assembling and closing, and, at the bottom, blanking of cork fillers.

A very high production rate is maintained on these operations—approximately 20,000 per 9-hour day on blanking, 12,000 on panelling, and 5,000 for the assembling and closing. All figures are per machine day.

"BLISS" Presses are adapted to all kinds of Metal Stamping, increasing production and making it more economical.

E. W. BLISS CO. MAIN OFFICE AND WORKS BROOKLYN, N. Y., U. S. A.

SALES OFFICES:

BLISS 1857

DETROIT Dime Bank Bldg. CLEVELAND Union Bank Bldg. CHICAGO Peoples Gas Bldg. PITTSBURGH Keenan Bldg. ST. LOUIS Boatmen's Bank Bldg. BUFFALO Marine Bank Bldg.

CINCINNATI, Union Trust Bldg. NEW HAVEN, Second Nat'l Bank Bldg.

American Factories: BROOKLYN, N.Y.; HASTINGS, MICH.; CLEVELAND, OHIO; SALEM, OHIO.

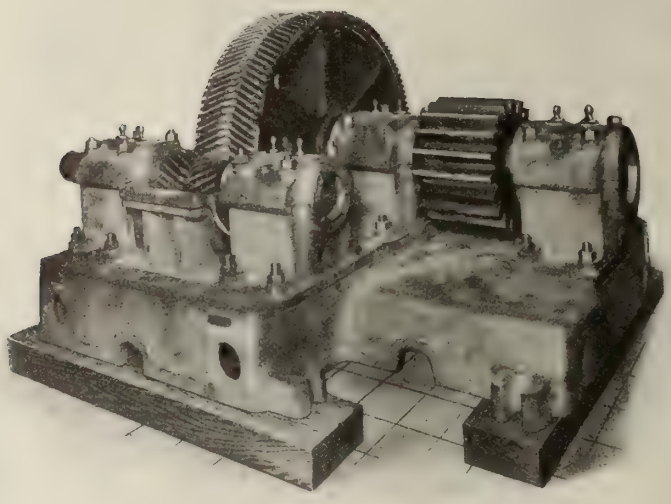
BLISS 1921

FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E. London. Norwich Union Chambers, Birmingham. FRANCE, 100 Blvd. Victor-Hugo, St. Ouen, Paris.

Let us be Your Gear Shop





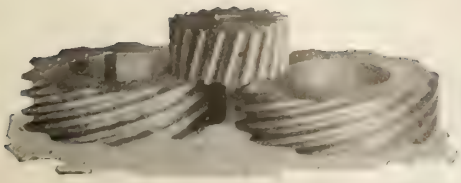
Double Helical Gear Drives

The Highest Type for Heavy Duty and High Speed

Write us for Quotations on
All Kinds of Gear Work

Hamilton Gear and Machine Co.

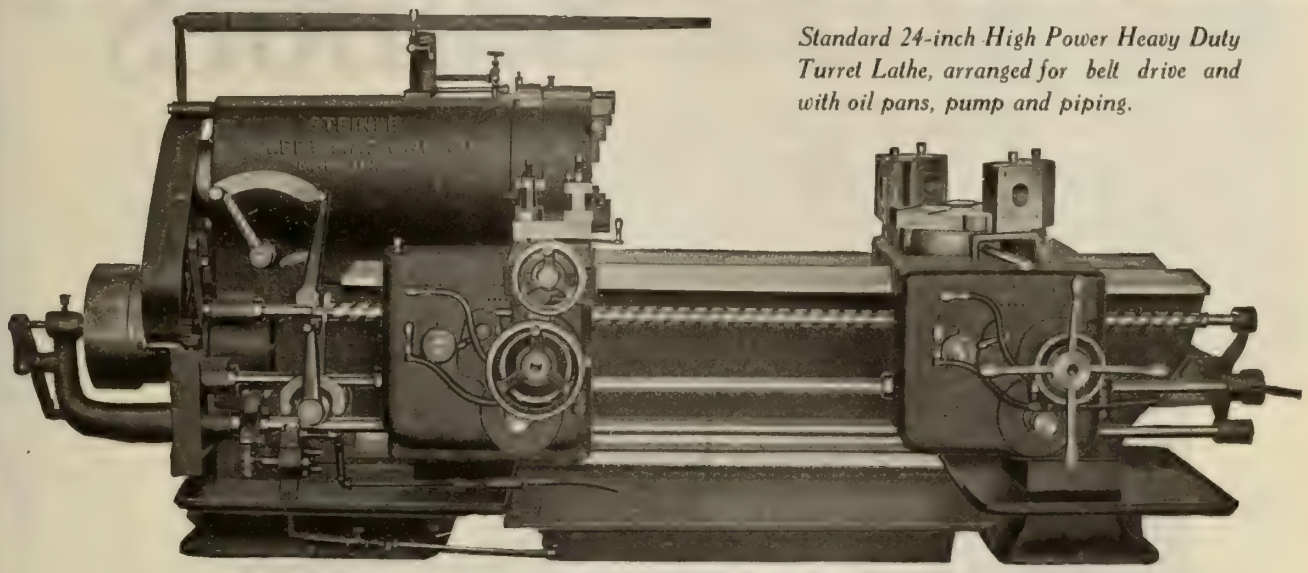
76 Van Horne Street
TORONTO





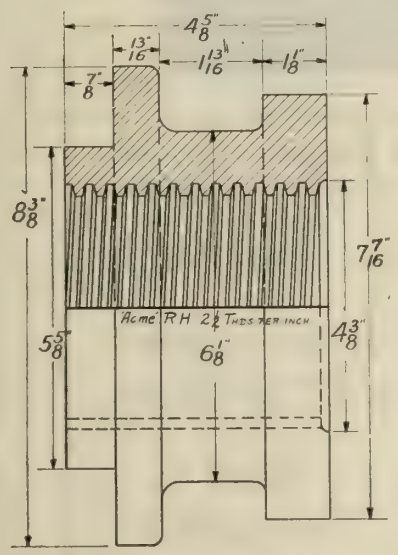
STEINLE

Full Swing Side Carriage Turret Lathes



Standard 24-inch High Power Heavy Duty Turret Lathe, arranged for belt drive and with oil pans, pump and piping.

On the Production of Oil Mill Machinery Parts

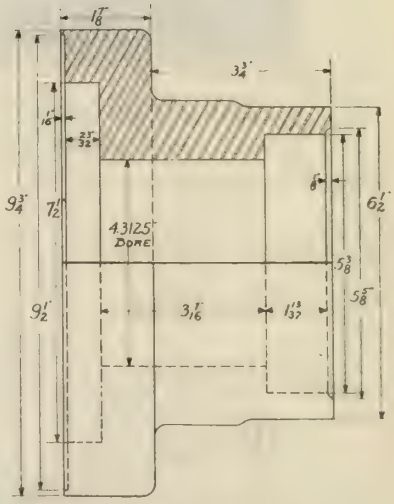


Name—Locking Gear Hub
Material—Semi-Steel
Finished all over including threading
TIME—40 MINUTES

In the plant of the V. D. Anderson Company of Cleveland, Ohio, manufacturers of oil mill machinery, separators, air and steam traps, a battery of Steinles is engaged in the production of a wide range of parts of which the two illustrations are representative.

Perhaps our Engineering Department might be of service to you in making up production estimates or tooling recommendations covering similar adaptable Turret Lathe work of your own.

Why not send us your blue prints and secure our proposition without charge or obligation whatever on your part.



Name—Cone Head
Material—Steel Forging
Finished all over
TIME—35 MINUTES

STEINLE TURRET MACHINE COMPANY

Originators of the Full Swing Side Carriage Turret Lathe

Madison, Wis., U. S. A.

AGENTS—Machine Tool Engineering Company, Singer Building, New York City; Cadillac Tool Company, Dodge Power Building, Detroit, Michigan; L. G. Henes, 75 Fremont Street, San Francisco, California, and Title Insurance Building, Los Angeles, California.—FOREIGN—Leo. C. Steinle, 53 Victoria Street, London, England.

STRUCTURAL STEEL AND STEEL BRIDGES



Steelwork for Skating Rink, Queen's University, Kingston, Fabricated and erected by The Hamilton Bridge Works Company, Limited.

Steel Railway Bridges

Steel Highway Bridges

Steel Buildings

CAPACITY

36,000 Tons

Large assortment of Beams, Channels, Angles, Plates, etc., in our yards for immediate shipment.

Inquiries Promptly Answered

Steel for Ships

Steel Trusses and Columns

Steel Turntables

THE HAMILTON BRIDGE WORKS COMPANY, LIMITED

HAMILTON ONTARIO

D. K. McLaren's

Genuine British Oak Tanned

LEATHER BELTING

Only the Back Leather—the Choicest Part of the Hide



Long Service on Every Drive

TRANSMISSION troubles due to stretch and slippage are entirely eliminated by the use of **D. K. McLaren's Leather Belting.** It is so flexible, gripping and tough that it represents a big economy by giving long service without power loss.

The British Oak Tanning process applied to all D. K. McLaren's Belts is the most approved method known for making belts that **wear.** It preserves all the natural strength of the hide.

Our nearest branch will be pleased to submit recommendations covering your transmission requirements:



We will be pleased to send you a list of the many users of this belting. Ask us about it.

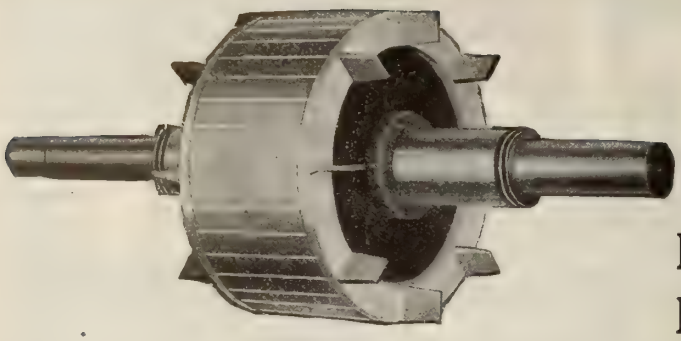
D. K. McLAREN Limited

31 St. James Street, Montreal, Canada

TORONTO, ONT. 194 King St. West

VANCOUVER, B. C. 334 Cordova St. West

ST. JOHN, N. B. 90 Germain Street



No Soldered Joints or Bolted Connections in--

Canadian Crocker - Wheeler Rotors

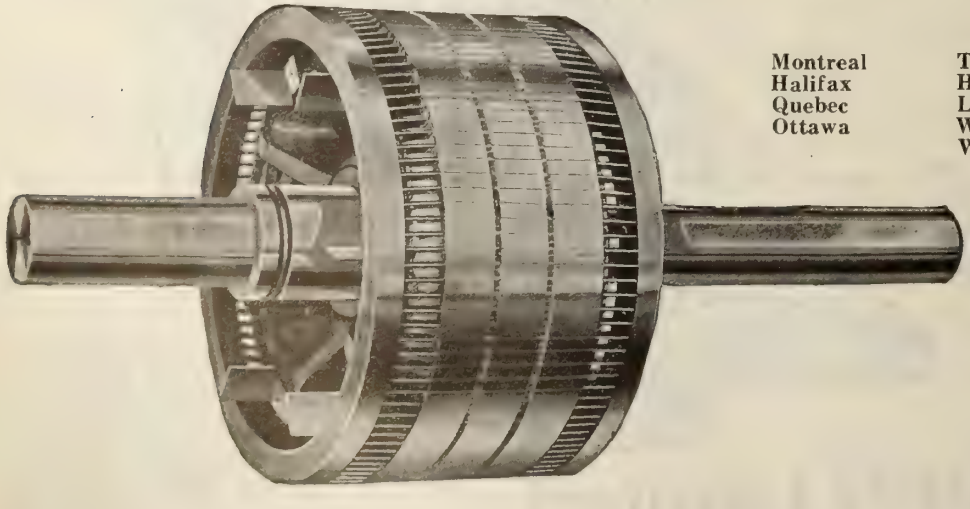
¶ The greatest improvement in modern induction motor design — no soldered joints to melt and cause arcing or open circuit and no bolted connections to work loose.

¶The entire Rotor Winding of small squirrel-cage induction motors is cast of aluminum alloy—in one operation. Thus, the complete winding is one integral structure.

¶The medium and large size Rotors have liberal section copper bars and the end rings are cast-welded, making perfect contact.

In stock at our houses, who will furnish full technical data on request

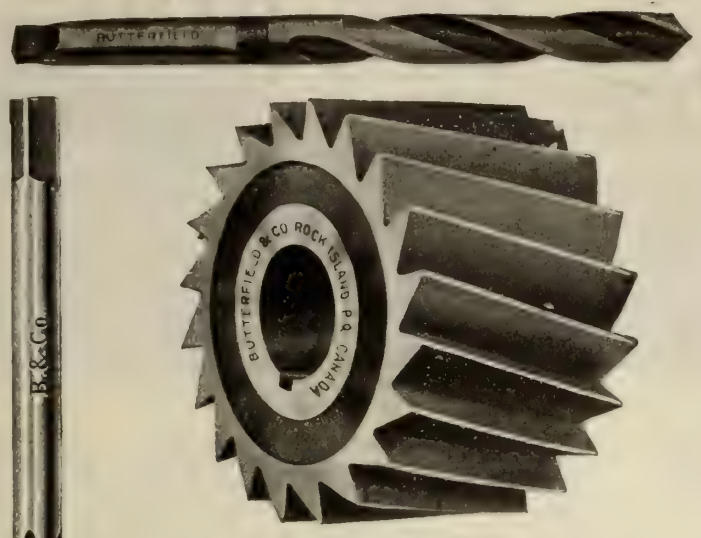
Northern Electric Company
LIMITED



Montreal
Halifax
Quebec
Ottawa

Toronto
Hamilton
London
Windsor
Winnipeg

Regina
Calgary
Edmonton
Vancouver



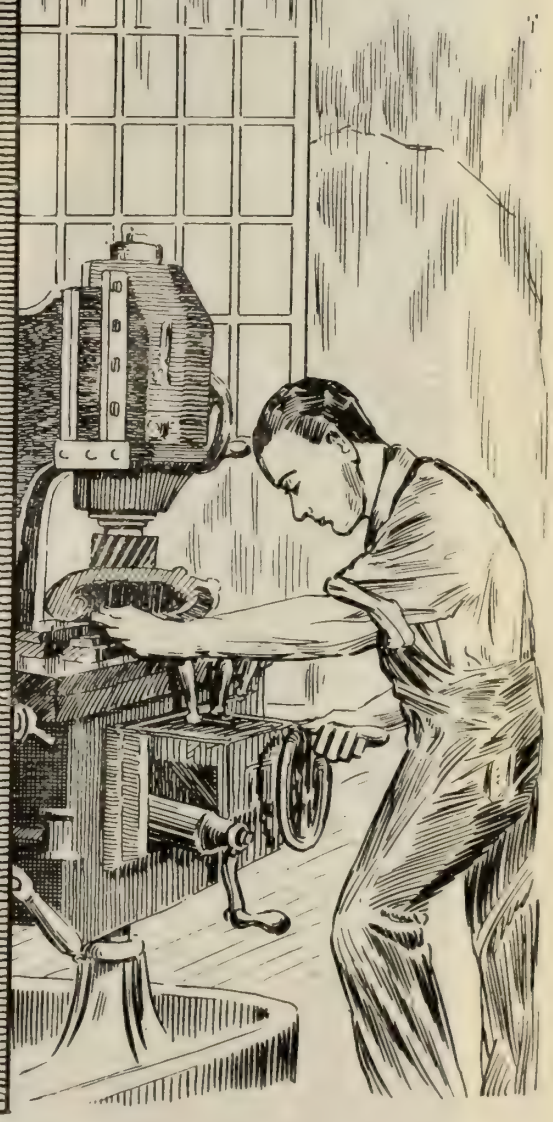
Butterfield

Taps, Dies, Drills, Reamers and Cutters

For Better Service

YOUR mechanics appreciate tools of QUALITY in their milling, drilling and reaming operations, and when provided with such tools they turn out a bigger and better day's work. Furnish your mechanics with Butterfield tools. Compared with any ordinary drills, reamers or milling cutters, the Butterfield line cuts faster, more accurately and require less regrinding. They cost no more than ordinary tools. Try them—they are "the tools you buy again."

"The Tools You Buy Again"



BUTTERFIELD & CO. DIVISION

Union Twist Drill Co.

ROCK ISLAND, QUEBEC, CANADA

Stores:

220 King Street West, Toronto.
131 St. Paul Street West, Montreal.

Agents:

D. Phillip, 138 Portage Ave., Winnipeg, Man.
Gorman's, Limited, Dominion Bank Building, Vancouver, B. C.

BUTTERFIELD

1847 to 1922



Rice Lewis & Son Building in 1847

THE House of Rice Lewis & Son is closely identified with the history of the hardware trade in Canada. The firm has kept pace with Canadian progress. From a modest beginning in 1847, as shown by the cut of the small building above, the firm has developed to its present dimensions.

Closely associated with the progress of the firm are the following well-known products, the quality of which is at all times guaranteed by the "House of the Padlock"—Morse Twist Drills; Victor Hack Saw Blades; Greenfield Tap & Die Corp.'s Taps and Dies; Globe and Imperial Canadian-made Files; Heller & Black Diamond United States-made Files; Jowett's English-made Files.

Just received a shipment of genuine "GROBET" Swiss Files for die sinking and other fine work.

Rice Lewis & Son
Limited

Victoria St. - Toronto



Foundry, Factory, Machine Shop and Construction Supplies

Bar Iron
Sheet Iron (black and galvanized)
Mild Steel
Machine Steel
Cast Steel
High Speed Steel
Carbon Steel
Cold Rolled Steel

We solicit your orders and enquiries.



Here's Where Niagara Machines are Made

THIS is an unretouched photograph of our Northland Avenue Plant, devoted exclusively to the manufacture of Niagara Machines and Tools for sheet metal working, including:

Presses—
—Inclinable
—Punching
—Straight Sided
—Double Crank
—Trimming
—Riveting
—Reducing
—Toggle

Shears—
—Foot Squaring
—Power Squaring
—Circle
—Ring and Circle
—Slitting
—Circle and Flanging

Tinners Machines—
—Folders
—Bench Machines
—Crimpers
—Beaders
—Grooversers
—Seamers
—Forming Rolls
—Stakes
—Snips
—Bench Shears
—Lever Punches
—Lever Shears

Special Equipments

We make special machines and arrangements of our regular and special machines for the manufacture of a large number of sheet metal products.

Write for catalog of the machines in which you are interested.

Castings are made in our Jefferson Avenue Plant, not shown in the illustration.

Our 42 years' experience in manufacturing machines for sheet metal working enables us to solve difficult problems. Let our experienced engineers help you.

Niagara Machine & Tool Works

Established 1879

Buffalo, N. Y., U.S.A.

NIAGARA



Tee No. 264-H

CRANE

EXTRA HEAVY HYDRAULIC

MALLEABLE IRON FITTINGS



Cross No. 266-H



Reducer No. 267 H

The fittings have a large safety factor and will safely withstand all operating strains.

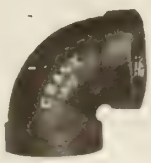


Long Sweep Elbow
No. 263-H

When galvanized these fittings are specially recommended for high pressure air lines.



45o Elbow
No 262-H



Elbow. No. 260 H

The maximum recommended working pressures are dependent upon the size of fittings.



Union No. 239 H

Manufacturers of Valves, Fittings and Piping Equipment and Distributors of Pipe, Plumbing and Heating Supplies.

CRANE
LIMITED
HEAD OFFICE & WORKS
1280 ST. PATRICK STREET
MONTREAL

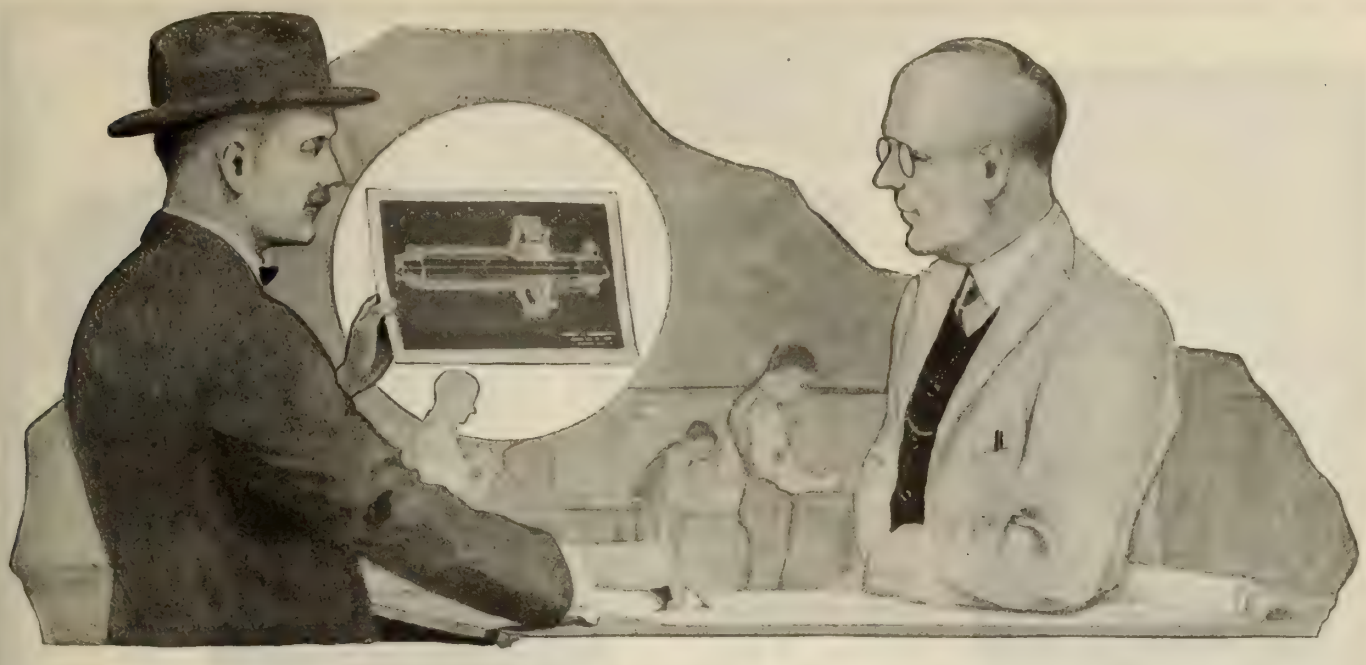
Branches and Warehouses:
HALIFAX, OTTAWA, TORONTO, WINNIPEG, REGINA, CALGARY, HAMILTON, VANCOUVER, LONDON,

Sales Offices:
QUEBEC, SHERBROOKE, ST. JOHN, VICTORIA.

CRANE-BENNETT
Limited
Head Office and Warehouse:
LONDON, ENGLAND.

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MANCHESTER, BIRMINGHAM, LEEDS, GLASGOW.

38



These PHOTOSTAT Prints Save as much as $800 a Week

A well-known mid-western tool company writes:

"As a matter of fact, thirty draftsmen would be required to handle the work that ten draftsmen and one PHOTOSTAT now accomplish, which is a direct saving in salaries alone of approximately $800 per week."

Tracing isn't necessary, because you can copy with the PHOTOSTAT in a few minutes either a drawing, a pencil sketch or a blueprint which it would take hours, and in some cases even days to trace.

Even the best draftsmen sometimes make mistakes or omissions.

The PHOTOSTAT Makes No Mistakes
(Reg. U. S. Pat. Off.)
It makes photographic facsimiles.

Any steady office boy or girl can learn to run a PHOTOSTAT in a few hours.

The Photostat is not limited to copying drawings and blueprints. It is widely used for office copying work, such as letters, telegrams, reports, shipping lists, contracts, ledger pages, insurance records, graphs, and legal documents.

In all this work the PHOTOSTAT takes minutes where other methods require hours, and with the PHOTOSTAT there is absolutely no possibility of error.

The PHOTOSTAT will copy at original, reduced or enlarged size and with the same or reversed black and white values. In the advertising department it is a great time saver and also very convenient. It shows how drawings will look when reduced to size, and whether light or dark backgrounds will be more effective. It makes all the necessary duplicates for layouts.

Just ask for our Booklet the "PHOTOSTAT and What It Will Do."

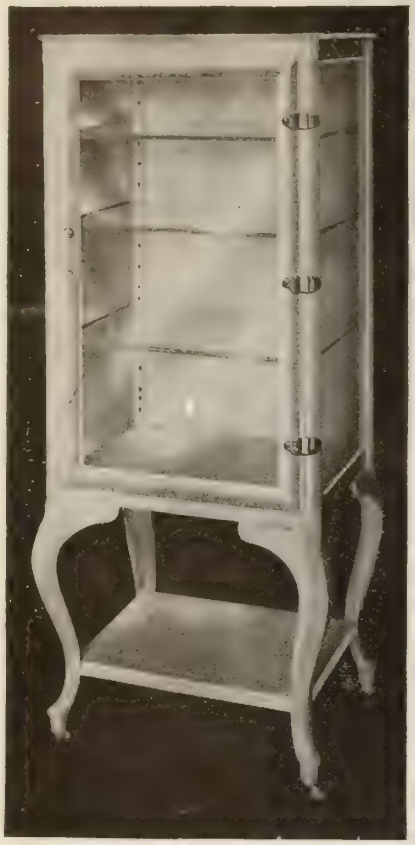
PHOTOSTAT CORPORATION
299 State Street, Rochester, N. Y.

88 Broad Street, Boston. 19 South LaSalle Street, Chicago
7 Dey Street, New York City 510 North American Bldg., Philadelphia
129 Monadnock Bldg., San Francisco 601 McLachlen Building, Washington
Executive Office: Providence, R. I.

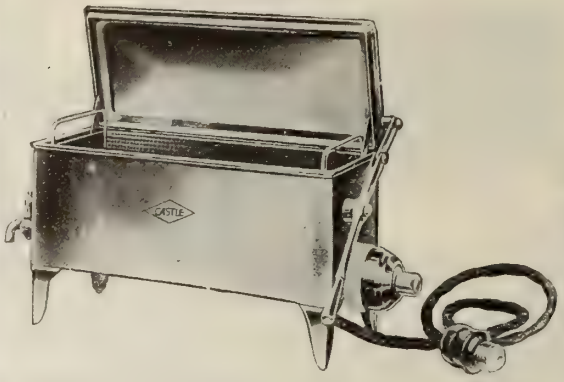
AGENCIES:

Alfred Herbert, Limited: Coventry, England; Paris Milan; Brussels Amsterdam, Calcutta, Yokohama; Sydney
Graham Brothers: Stockholm.

PHOTOSTAT



White Enamel Cabinet. Steel, baked white enamel, outside measurements 20″ x 24″ x 56″, height 27″. Three plate-glass shelves.



Sterilizer for Instruments. Electrically heated with three-heat switch. Current is automatically cut off if water becomes low. Made of copper, nickel-plated and tin lined.



Table—Surgical or Examining. May be adjusted to several positions, yet is moderate in price. Dimensions in normal position, length 40 ins., height 32 ins., width 22 ins.



Hartz Minimum First Aid Kit. Contains everything necessary to tend minor injuries.

To Help You Obtain 100% Efficiency

EMPLOYERS: Keeping your employes in good health is the common sense way of obtaining highest production in your factory. This can only be accomplished by having a hospital in connection with your plant.

We have had upwards of twenty years experience in equipping hospitals; let us furnish yours. Everything we supply is of the highest quality.

The J. F. HARTZ COMPANY, Limited

(Dept. F. A.) 24-26 Hayter St., Toronto, Ont.

HARTZ *FIRST AID* EQUIPMENT

Sixty Years of Quality



Who Makes Springs for Hard Consistent Work?

SPRINGS

WIRE
BARNES CANADIAN SPRINGS
STEEL

BARNES!

Spring makers for three generations.

And

Why is it that the name "Barnes" stands pre-eminent in the spring-making industry?

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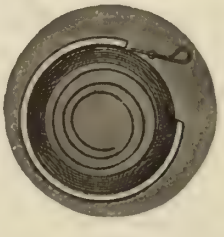
For sixty-five years they have placed the quality of their products above all other factors. Care in the selection of materials and untiring oversight of the work in process, assures superior quality of goods to their customers, and service not otherwise obtainable.

Take up the question with them of your 1922 requirements and help to make this a banner year for CANADIAN MANUFACTURED GOODS.

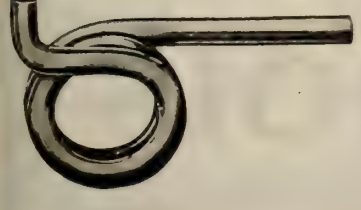
The Wallace Barnes Co.

LIMITED

Main St. W., Hamilton



Phonograph Motor, Clock, Brush Holder, and Special Flat Coil Springs.
Flat Steel Springs of all descriptions.
Valve and other compression types, extension and torsion springs; of tempered steel, brass and phosphor bronze.
Spring washers a specialty.







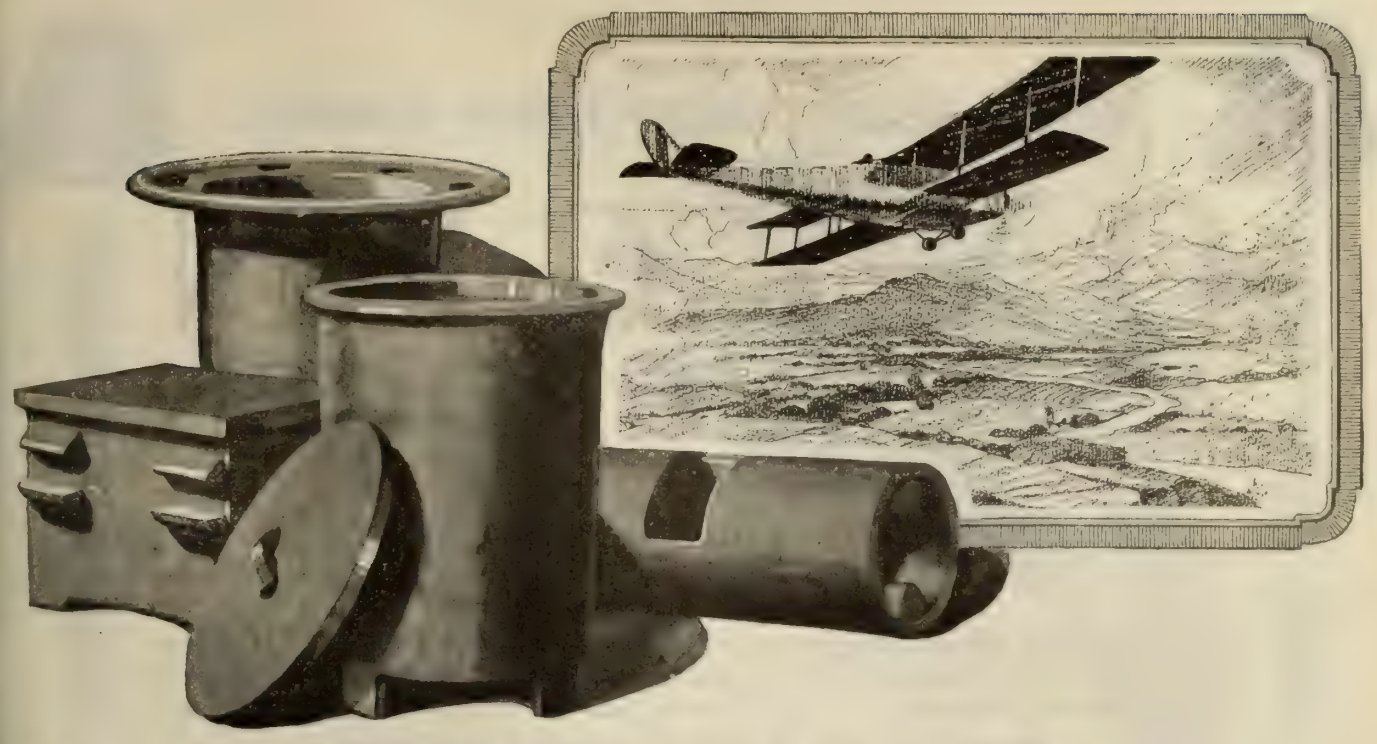
Again, The L·S·Starrett Company steadfastly, confidently facing the dawn of another year, acknowledges its obligation and renews its pledge to Industry

STARRETT TOOLS

STARRETT HACK SAWS CUT QUICKEST LAST LONGEST

42-269

Starrett Tools



"You Can Make a Barn Door Fly—

if you give it enough power"

THE man who said that was thinking merely of bare, basic principles—not of control and safety and the other indispensable factors that make flying practicable and useful.

When case-hardening is among the indispensables, Cast Nichrome Containers are more than a source of economy; they are a decided aid to quality results. The evidence exists in hundreds of plants—and in millions of machines on which the commercial world depends.

The uniform way in which Cast Nichrome Containers behave under repeated heating and cooling contributes to uniform results in the carbonized parts. Shorter heats, less fuel consumption, greater furnace capacity and less spoilage of materials are added advantages. The Nichrome economy guarantee, which is based on furnace hours at 1800 deg. F., applies to all stock patterns as well as to special designs.

Manufactured under HENDERSON Patents by

CANADIAN DRIVER-HARRIS CO.

WALKERVILLE, ONT.

American Office and Works

Chicago-Detroit Harrison, N. J. England-France





TRADE MARK REG. U. S. PAT. OFF.

Nichrome

CAST **Heat Treating Containers**

Endure in High Temperatures





OXYGEN AND HYDROGEN

(ELECTROLYTIC)

Largest Manufacturers in Canada

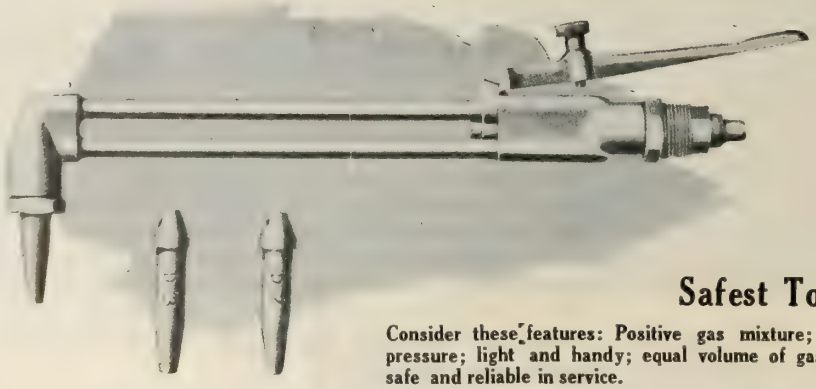
ACETYLENE

Purity is always a distinguishing feature of National Electrolytic Oxygen and Hydrogen gases, which are produced (exclusively) by us by electric decomposition of water. These gases give more efficient and economical service than gases made by any other process.

A TORCH WITH MANY SUPERIOR FEATURES

The Torch for Welders OXYGEN PUROX HYDROGEN Why Want the Best!

WELDING AND CUTTING TORCHES



Safest Torch Made

Consider these features: Positive gas mixture; evenly balanced pressure; light and handy; equal volume of gas; no flash back; safe and reliable in service.

A Complete Stock of Welding and Cutting Equipment

Our supply department carries a large and complete stock of Oxy-Hydrogen and Oxy-Acetylene welding and cutting equipment, also supplies of highest quality. All materials are made to our special analysis and specifications, and we guarantee them to be the best obtainable.

Try our New (SQUARE) Cast Iron Welding Rod

Our entire organization is at your service; submit your problems; no charge

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At The

Jumping Off Place

THE fact that uniformly pure Prest-O-Lite Dissolved Acetylene is obtainable in easily portable and instantly accessible cylinders has greatly enhanced the value of the oxy-acetylene process to Engineers and Contractors.
Not only is it feasible to quickly transport

Prest-O-Lite
DISSOLVED ACETYLENE

to any job, anywhere—but Prest-O-Lite cylinders permit the use of highly pure welding and cutting gas in any desired quantity—large or small. And Prest-O-Lite Service, functioning through a chain of centrally situated plants and warehouses, insures a never-failing supply of Prest-O-Lite Dissolved Acetylene when and where you want it.

Prest-O-Lite Company of Canada
LIMITED

HILLCREST PARK - TORONTO

Branches at Montreal, Toronto, Winnipeg.
Plants at: Toronto, Ont., St. Boniface, Man., Merritton, Ont., Shawinigan Falls, P.Q.

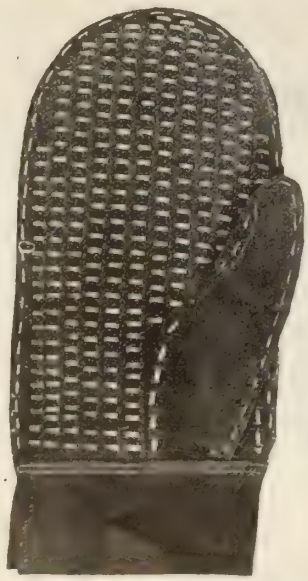
PWC 541

The Wear is All on the Steel in *STEEL GRIP*



No. 644 Four-inch Gauntlet Glove. Reinforced with Steel Ribbons over Strips of Tough Leather. Closed with Steel Thread. Extra Leather Patch on Thumb.

INDUSTRIAL WORK GLOVES *and Mittens*



No. 681 Short Mitten. Reinforced with Steel Ribbons over Strips of Tough Leather. Closed with Steel Thread.

WHEN the sparks fly and the splinters cut—wherever the job is rough and hard on the hands—it is good business to have your workmen protected by these practically impenetrable Steel Grip work gloves. And how they will dig in and work!

Steel Grip work gloves wear and wear! Patented reinforcements of steel ribbons on palm, fingers and thumb and steel-sewed seams make them the most economical gloves and mittens made. They wear like iron because they are practically made of iron.

Flexible--- and Easy to Work with.

The steel ribbon reinforcement, which lengthens the life of the glove, in no way interferes with flexibility. The gloves are soft, pliable and comfortable. The steel sewing makes them absolutely rip-proof.

Let us show you how to overcome hand protection problems and save you money on your glove purchases. Write for interesting suggestions to-day.

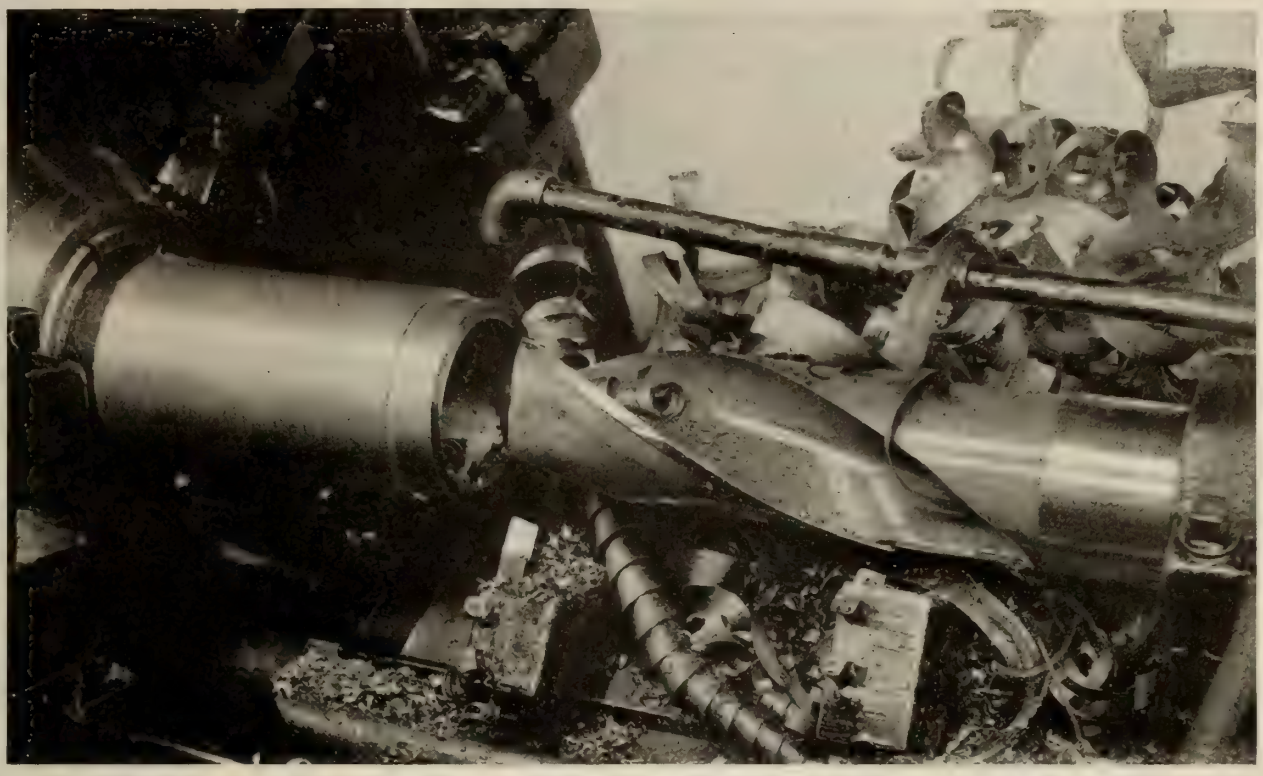


No. 605 Short Glove. Reinforced with Extra Leather Patch on Palm and Steel Ribbons. Steel sewed.

INDUSTRIAL GLOVES CORPORATION

424 Wellington Street West

TORONTO - - CANADA



Your Heavy Jobs Automatically— on a GRIDLEY

Many heavy jobs in turning, drilling and forming work formerly done the long way are being switched to the Gridley Automatic basis.

They take the fast feeds and their accuracies stand up under continuous running. They save time between cuts, reduce labor costs, conserve space.

New friends adopt Gridleys, and old users buy more of them because they **know** that they produce more, save more and earn more per dollar of investment.

Gridleys give production that will meet the competition of lowering costs—why not find out how many on your work?

THE NATIONAL ACME COMPANY

WINDSOR, VERMONT

GENERAL OFFICES, CLEVELAND, O. CANADIAN SCREW PLANT, MONTREAL, P. Q.

BRANCH OFFICES: NEW YORK BOSTON CHICAGO DETROIT BUFFALO. WAREHOUSES: NEW YORK AND CHICAGO

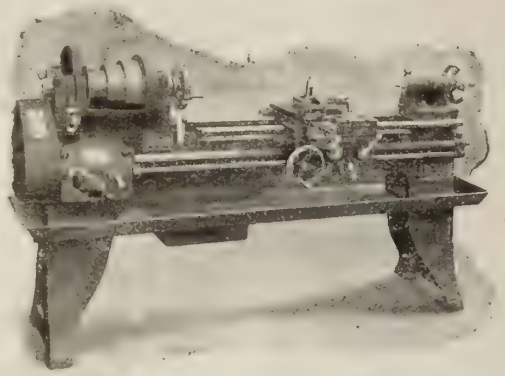
FOREIGN REPRESENTATIVES

Great Britain, Chas. W. Churchill Co.; Sweden, E. Trobeck; France, Belgium, Switzerland and Spain, Potter & Johnston, Italy, Ercole Vaghi; South Africa, D. Drury & Company. Etablissements Horstmann; Australia, Benson Brothers; Japan, Yamatake & Company.

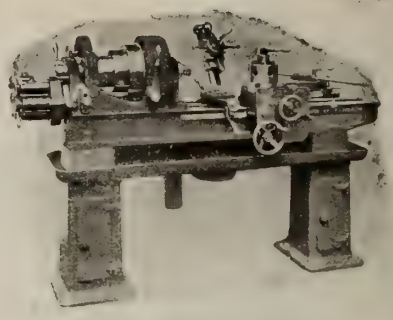
Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont; and Acme Automatics, Threading Dies, Collapsing Taps and Screw Machine Products at Cleveland, Ohio

Established 1871

THE SELSON LINE



Selson 13-in. Swing, Vee Bed, Gap Lathe



Brassfinishers' Lathe

Our fiftieth anniversary as builders of and dealers in high-grade Machine Tools and Equipment of all kinds.

Write us for complete details and prices on all your needs.

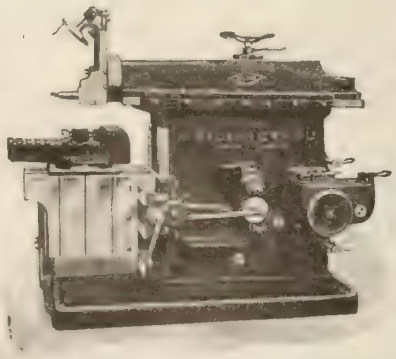
Send for Literature

The Selson Engineering Co.

24-26 Stone Street, 59 Pearl Street, NEW YORK

Headquarters
83-85 Queen Victoria Street, and Lambeth Hill,
London, E.C. 4, England

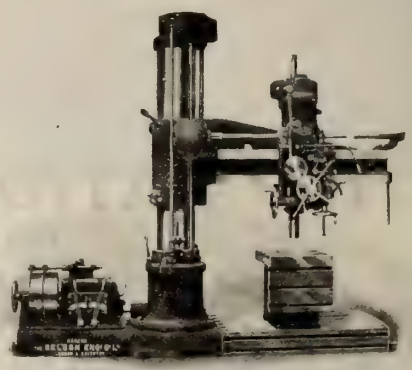
Head Works
Coventry, England



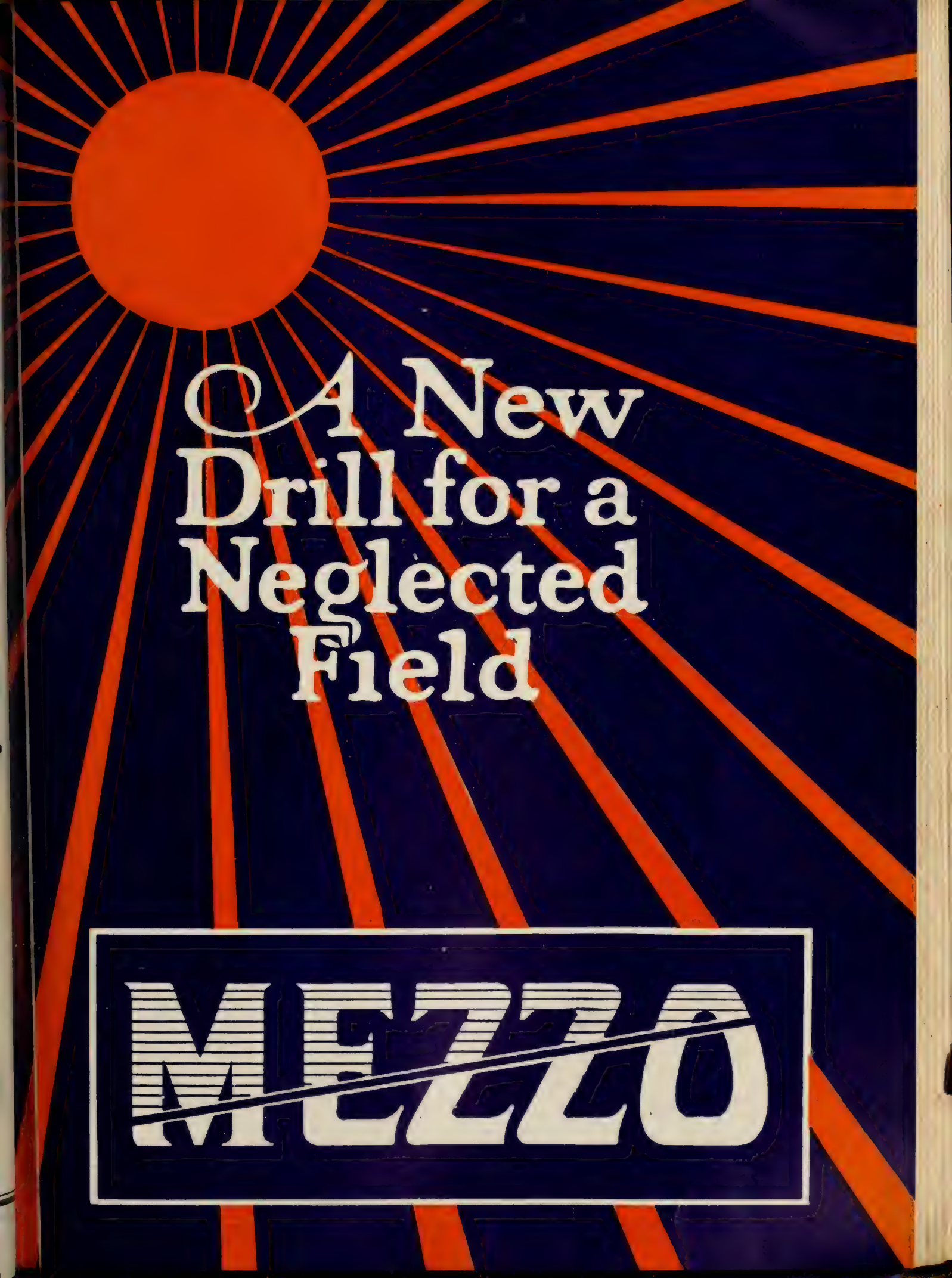
Selson Shaping Machine, 25-in. Stroke

Other Branches:

PARIS
BRUSSELS
TURIN
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MELBOURNE



Selson Central-Thrust Radial Drilling Machine


A New
Drill for a
Neglected
Field
MEZZO



A New Drill for a Neglected Field

FOR YEARS there has been a neglected field to which drill manufacturers have not given sufficient attention. This field is the shop which could not obtain production with Carbon Drills and yet was not equipped to realize full efficiency from High Speed Drills, and therefore could not use them satisfactorily.

These shops demanded a drill which would stand higher speeds and feeds, give far greater drilling capacity than Carbon Drills and still sell at a moderate price.

To meet this demand, we present

MEZZO

Heating the cutting edge of "MEZZO" even to a dark blue color will not draw its temper. "MEZZO" works at its best efficiency this way.

"MEZZO" was developed after months and months of research involving not only the use of a new steel but also new hardening and heat treating processes.

We believe that we have extended our leadership into a new field—but not with an untried product.

"MEZZO" has been tested and re-tested—a drill on which we are proud to place our name.

Write for the *"Story of Mezzo."* It is a most interesting little booklet which gives full information on "MEZZO" and its uses.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND NEW YORK - CHICAGO - LONDON

TRADE MARK REG. IN U. S. AND FOREIGN COUNTRIES

SERVICE-SALES
High-Grade Machine Tools

OUR ambition is to so conduct our business through efficient service and fair dealing as to thoroughly maintain the established prestige of the lines we represent.

REPRESENTING EXCLUSIVELY IN ONTARIO:—

KEARNEY & TRECKER CORP'N.
Milwaukee Milling Machines,
(Manufacturing, Plain, Universal and Vertical Types)
Continuous Milling Methods.

THE WARNER & SWASEY CO.
Turret Lathes & Screw Machines.
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LANDIS TOOL COMPANY
Plain Self-Contained Grinders.
Universal Grinders.
Cylinder Grinders.
Crank, Cam, and Roll Grinders.
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Horizontal Boring, Milling and Drilling Machines, (Floor Type.)

BLANCHARD MACHINE COMPANY
High-Power Vertical Surface Grinders,
No. 10 and No. 16 Rotary Types.
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"High Duty" & "Invincible" Shaper.
Gear Hobbing Machines.
Gear Cutting Machines.
Multiple Spindle Gear Cutting and Hobbing Machines.
Gear Cutter Grinders.

LUCAS MACHINE TOOL COMPANY
"Precision" Horizontal Boring, Drilling and Milling Machines.
Power Forcing Presses,
(Standard and Special Types.)

BULLARD MACHINE TOOL CO.
Vertical Turret Lathes, 24″ to 54″.
Maxi-Mills, 44″ to 61″.
Mult-Au-Matics, 8″ to 12″.

LAPOINTE MACHINE TOOL CO.
Broaching Machines and Broaches,
(Single & Double Spindle Types.)
Broaching Tools of all Kinds.

THOMAS RYDER & SON, Ltd., England
"Ryder" Forging Machines,
(High Speed Swaging Type.)

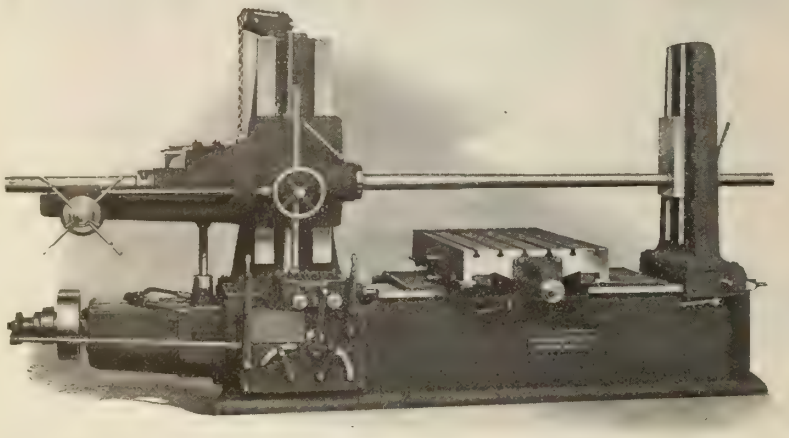
F. F. BARBER MACHINERY COMPANY
LIMITED
TORONTO · CANADA

MACHINE TOOL SALES

FOY BUILDING
32 FRONT ST. W.

THE "PRECISION" BORING DRILLING MILLING MACHINE

(*The Original* "LUCAS TYPE")



Is Made in THREE SIZES

3, 3¾ and 4½ inch spindles respectively, of the same general design and with the well-known

LUCAS

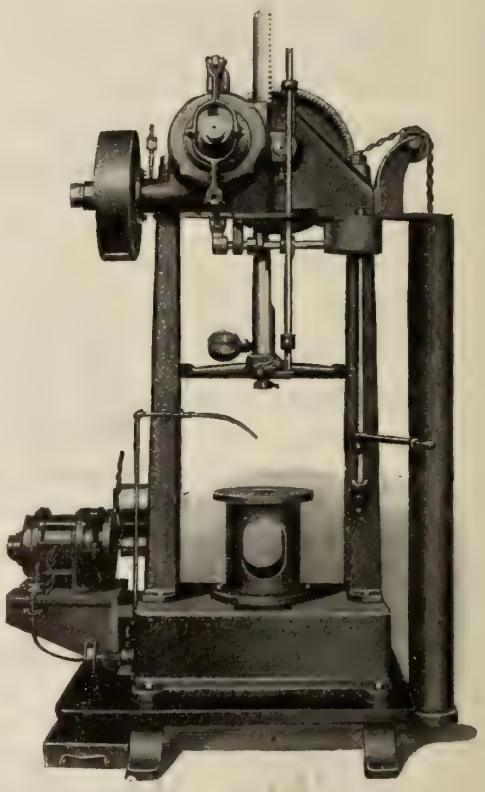
Accuracy and Efficiency

SOMETHING NEW
YET TESTED AND TRIED

THE LUCAS VERTICAL BROACHING MACHINE

(A modification of the Lucas Power Forcing Press)

Has been in successful operation for over two years on **vertical push-broaching and production assembling.**



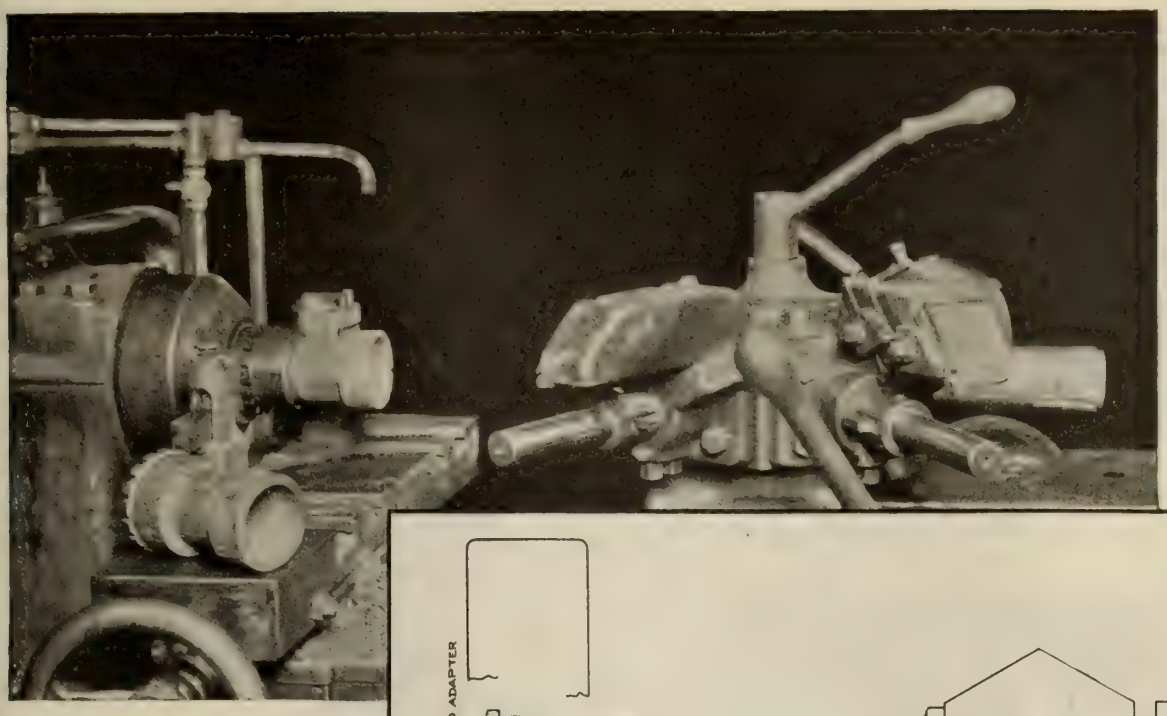
ADVANTAGES

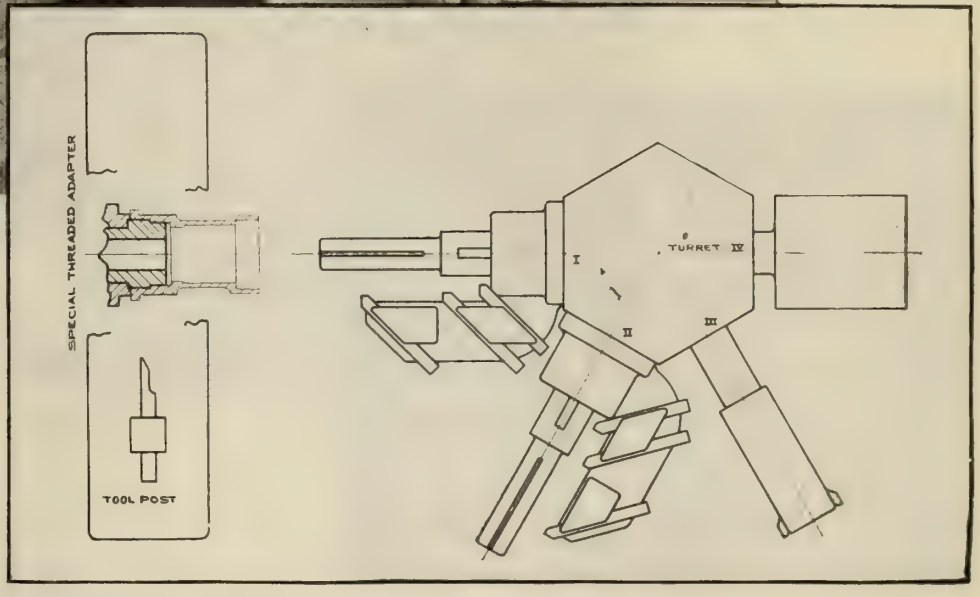
Shorter, and therefore less expensive broaches.
Better lubrication of cutting edges.
Easier setting of work, easier manipulation of broaches.
More production.
A choice of fixed positions for the operator.
LEVER CONTROL (adjustable for height).
LESS FLOOR SPACE REQUIRED.

Lucas Machine Tool Co.
Cleveland, Ohio, U.S.A.

Canadian Agents: **F. F. BARBER MACHINERY CO., Toronto; WILLIAMS & WILSON, LTD., Montreal.**

If interested tear out this page and place with letters to be answered.





The solution of an engineering problem of a prominent automobile builder.

Use Warner and Swasey Engineering Service for more and better production on your Turret Lathes

For the convenience of our Canadian friends Warner & Swasey engineers are stationed at our Branch Office in **Detroit,** 5928 Second Boulevard, and in the Iroquois Building in **Buffalo,** also in the offices of our **Canadian Agencies:**

F. F. BARBER MACHINERY COMPANY, 32 Front Street W., Toronto. A. R. WILLIAMS MACHINERY COMPANY, St. John, Vancouver, Winnipeg. WILLIAMS & WILSON, LTD., Montreal.

The Warner & Swasey Company

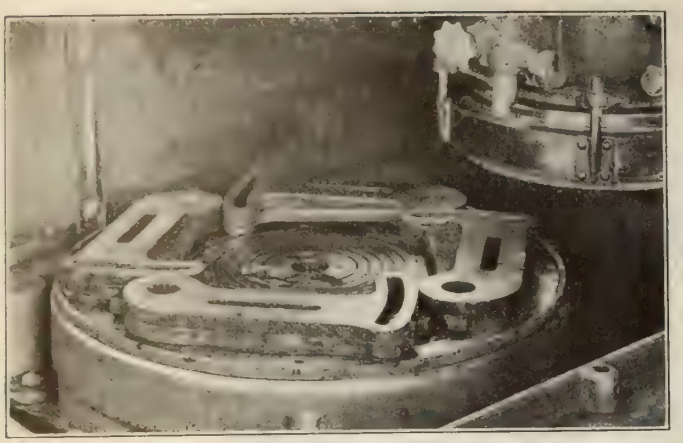
Cleveland, U. S. A.

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BLANCHARD

HIGH POWER VERTICAL SURFACE

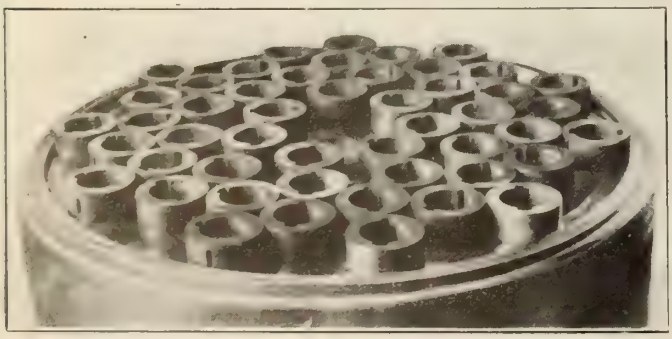
GRINDERS



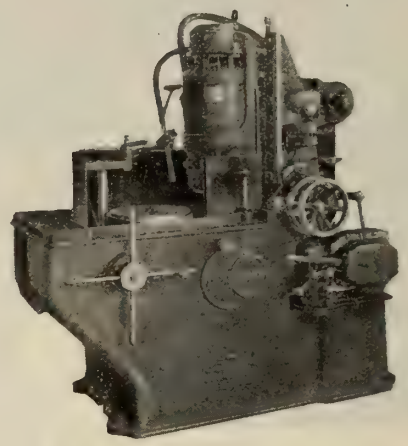
Lathe Quadrants ground on the No. 16 Blanchard Grinder at the rate of 12 pieces (24 surfaces) per hour. This piece is an iron casting 1/16 in. is removed from each side to a tolerance of ± .001 in.—the floor to floor time is **five minutes per piece.**



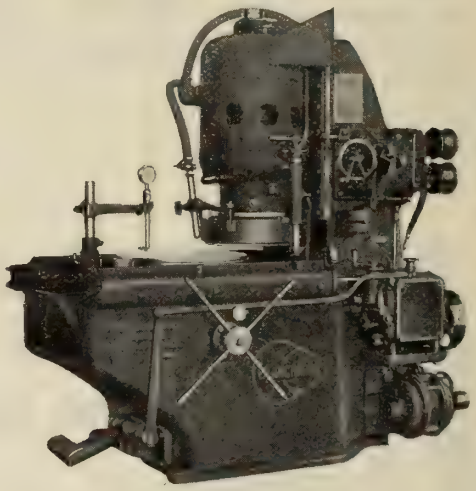
This pile of work is in a large steam pump shop, where one Blanchard was bought for only two jobs. So many other jobs for the machine were found that within two years four Blanchards were kept busy.



Bushings with key-ways for dive keys, first ground from the forging, while soft, and after hardening ground again at the rate of 175 pieces (350 surfaces) per hour, removing .010 in. per side hardened steel, to a tolerance of ± .002 in.



No. 10 Blanchard Grinder.—Direct motor drive type, 10 h.p. motor on spindle. Range: 18-in. diameter x 6-in. high under new wheel. Wheel: 10-in. diameter. Chuck: 16-in. diameter. Weight of machine, 6,000 pounds.



No. 16 Blanchard Grinder.—Direct motor drive type, 25 h.p. motor on spindle. Range: 30-in. diameter x 14-in. high under new wheel. Wheel: 18-in. diameter. Chuck: 26-in. or 30-in. diameter. Weight of machine, 9,500 lbs.

A larger size Blanchard Grinder, the No. 27, is being built and inquiries regarding work beyond the capacity of No. 16 are invited.

SEND A POSTAL FOR THE DATA BOOK

The Blanchard Machine Company

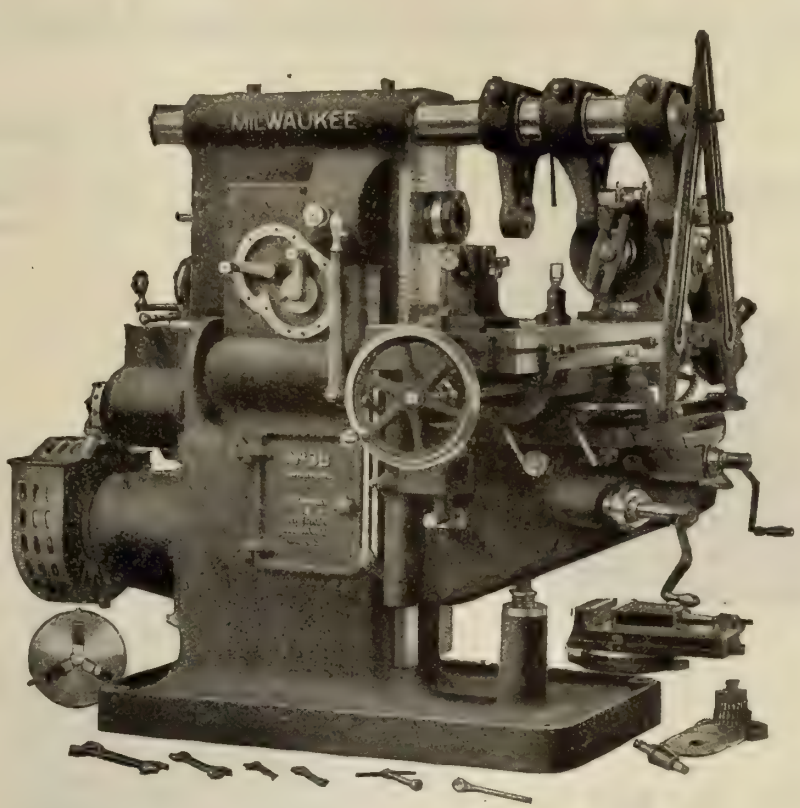
64 State Street, Cambridge, Mass.

Sole Canadian Representatives:

F. F. BARBER MACHINERY COMPANY, TORONTO
WILLIAMS AND WILSON LTD., MONTREAL P. Q.

BLANCHARD

MILWAUKEE MILLING MACHINES



Milwaukee Milling Machines are cost reducing machines and are adapted for mass or diversified production. They are scientifically designed and constructed, embodying many features that prove their value in accuracy, increased production, quality of output, low up-keep and ease of operation.

The Column is a one-piece, box-section, semi-steel casting with few and small openings and is tied together by strong, internal walls.

The Double Overarm construction consists of two parallel steel bars and with the triangular arbor supports provides positive alignment of the arbors.

The Flanged Spindle provides means for effective driving of cutters and arbors in either direction. The spindle is reversed by mechanism within the machine, no overhead apparatus being necessary.

The Solid Top Knee is a box-section, semi-steel casting without holes or slots in the top to close under pressure of the clamps or work.

The Automatic Flooded Lubrication System floods lubricant over all gears and through all bearings in the column, feed box and pulley bracket of the machines, minimizing supervision and eliminating danger of bearings being cut, shafts sticking or gears wearing away.

Milwaukee Milling Machines insure complete milling satisfaction.

KEARNEY & TRECKER
CORPORATION

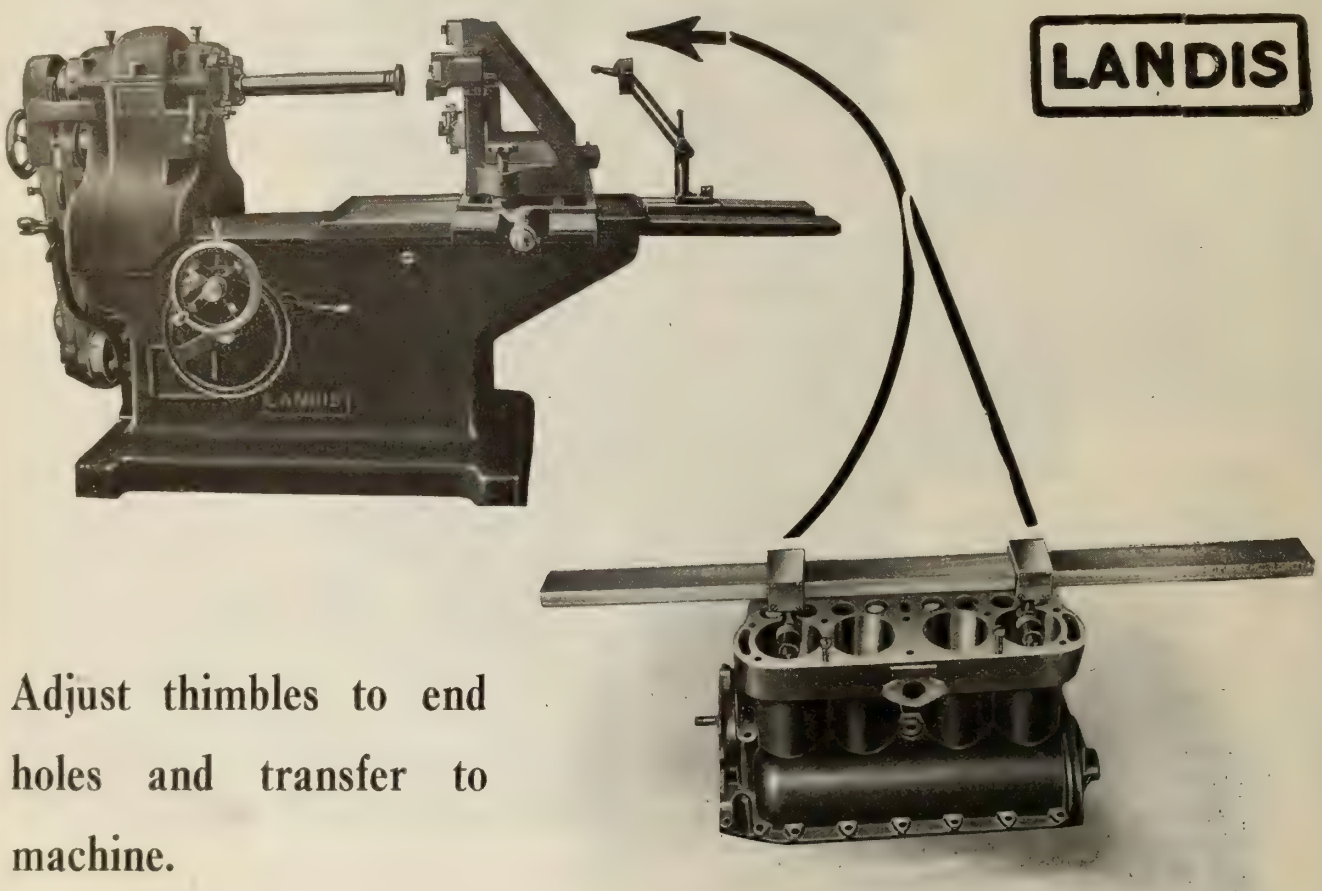
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A. R. WILLIAMS MACHINERY CO., LTD., VANCOUVER

No. 5 Cylinder Grinding Machine

With a cylinder centering fixture that is positive.



Adjust thimbles to end holes and transfer to machine.

It must come central because its position is "fixed" in relation to centre of wheel spindle rotation. No setting to scales or stops—thus the chance for error is eliminated.

Time consumed in setting up jobs is lost motion. The machine that reduces this lost motion is the profitable tool. This is only one of the many features of the LANDIS.

Write for literature.

LANDIS TOOL COMPANY, Waynesboro, Pa.

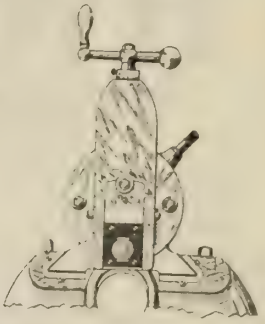
NEW YORK OFFICE: 51 CHAMBERS STREET

CANADIAN AGENTS:—F. F. Barber Machinery Company, Toronto, Ont.; Williams & Wilson, Ltd., Montreal, Que.; A. R. Williams Machinery Company, Ltd., Halifax, N.S., St. John, N.B., Winnipeg, Man., Vancouver, B.C.

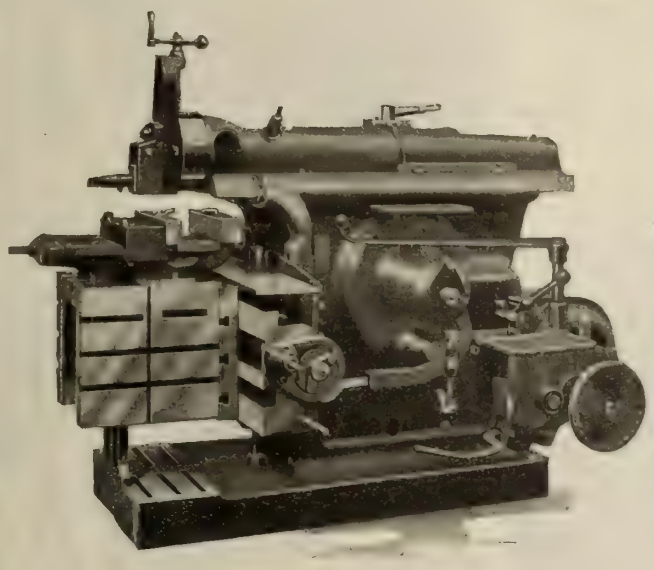
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G&E EBERHARDTS

SHAPERS *and* Automatic Gear Cutting Machines



YOU SEE THEM EVERYWHERE



G & E Shapers are regularly furnished with Single Pulley Drive and Speed Gear Box

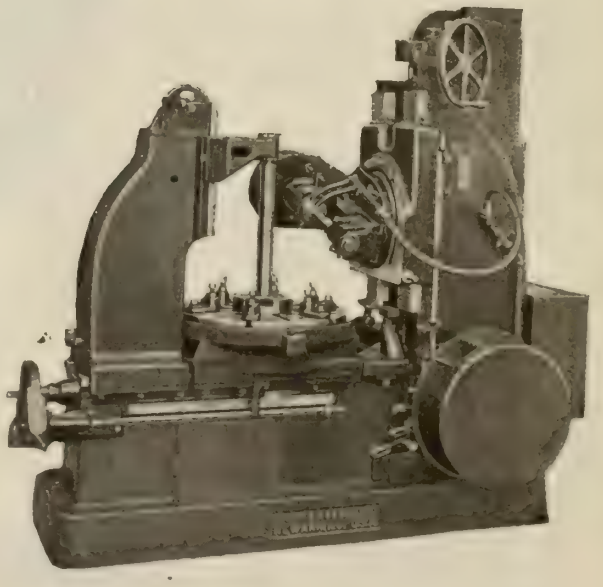
MORE STROKES PER MINUTE

CONVENIENCE OF CONTROL

There are many other features, ask for them.

16" 20" 24" and 32" STROKE

The vertical cutting principle has proven to be correct for Gear Cutting, especially with Automatic Hobbing Machines to generate the proper tooth forms of Spur and Helical Gears, Worms and Worm Wheels.



HIGH PRODUCTION
SIMPLICITY
DURABILITY

Submit Prints for Time Studies

GOULD & EBERHARDT

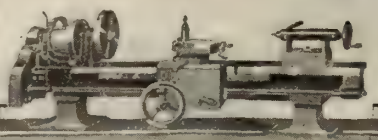
"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
ESTABLISHED 1833 NEWARK, N.J. U.S.A.

Canadian Agents: **F. F. Barber Machinery Co., Toronto, Ont.;**
A. R. Williams Machinery Co., Montreal, St. John, N.B., Halifax, N.S., Winnipeg.

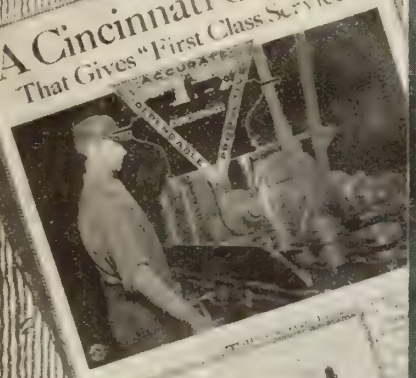
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H.W. PETRIE LIMITED

TORONTO HAMILTON



A Cincinnati Grinder That Gives "First Class Service"



"DALTON SIX"

Type B-4 Actual Swing 7¼ Inches

The Small Lathe for the Big Job

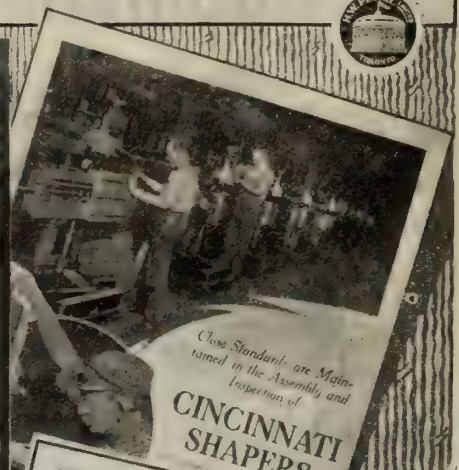


WHY order a large Lathe when so much of your work could be done on a "DALTON SIX" Type B-4

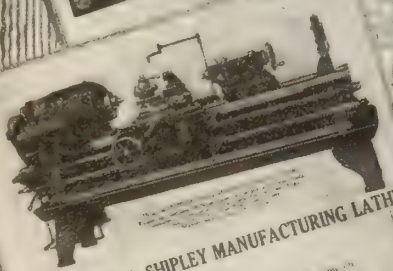
Send for Bulletin

H.W. PETRIE LIMITED

Toronto Hamilton

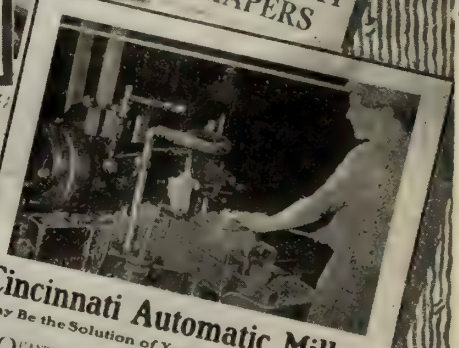


Close Standards are Maintained in the Assembly and Inspection of CINCINNATI SHAPERS



THE LODGE & SHIPLEY MANUFACTURING LATHE

The KEYSTONE to Satisfactory Service is Found in the Use of These Machine Tools ~ Sold by H.W. PETRIE Limited



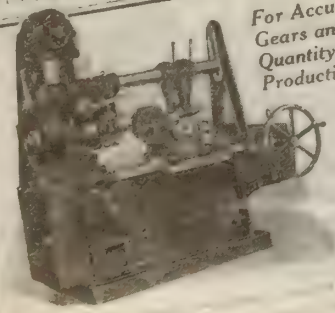
Cincinnati Automatic Millers

May Be the Solution of Your Production Problems

QUANTITY production of duplicate parts with the Cincinnati Automatic Millers is merely a matter of setting the operator ... machines trained to

CINCINNATI 16-INCH GEAR HOBBERS

For Accurate Gears and Quantity Production



The Cincinnati Gear Cutting Machine

CINCINNATI





THE CINCINNATI

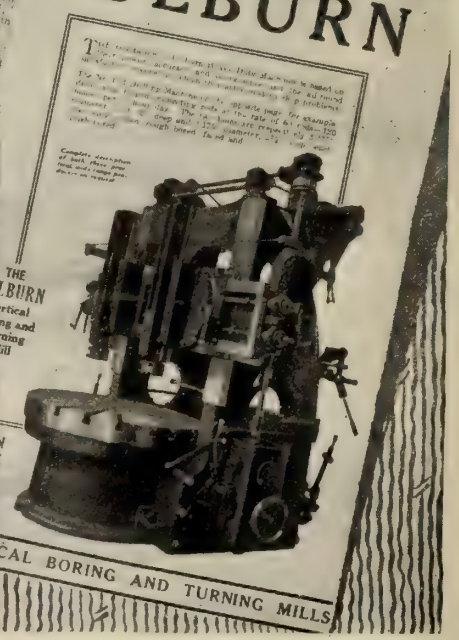
24- to 42-inch High Speed Shaft Driven Upright Drilling Machine

The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

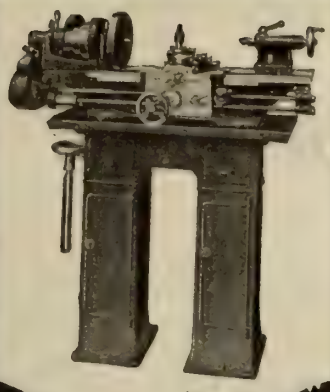


COLBURN



THE COLBURN Vertical Boring and Turning Mill

CAL BORING AND TURNING MILLS



"The Small Lathe for the Big Job"

Type B-6

Send for Catalog No. BC-10

For the tool room or experimental department the **"Dalton Six"** has no equal.

Actual Swing - -	8¼ inches
Between Centers -	18½ inches
Collet Capacity - -	¾ inch

Dalton Manufacturing Corp'n

Sound Beach, Connecticut, U. S. A.

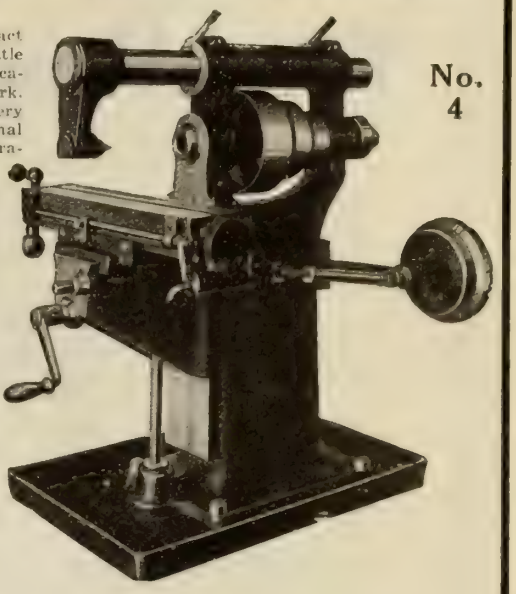
Cable Address - - - "Aledal Stamford"

Also Manufacturers of Type B-4 Lathe

"DALTON SIX"

BURKE **BURKE**

A handy, compact and efficient little miller with a capacity for big work. Should be in every shop. Longitudinal table feed 8". Traverse feed 3". Maximum distance between centre of spindle and table 8". Attachments same as furnished with No. 3 machine.



No. 4

Bench Type $220

With Pedestal $236

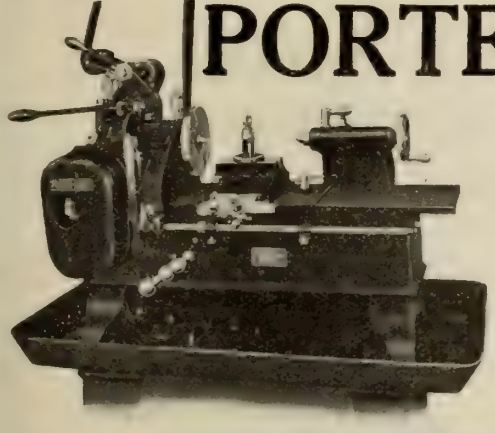
Canadian Money

THE BURKE MACHINE TOOL CO.

520 Sandusky St., Conneaut, Ohio, U. S. A.

Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons

PORTER-CABLE LATHES



Production Lathe

This machine requires no skill and but little attention to operate, occupies minimum floor space and as a **production booster** it has made records well worth investigating.

9 in. swing

14 in. or **20 in.** between centers

PORTER-CABLE LATHES

Tool Room Lathe

Combines extreme accuracy with simplicity.

12 in. and 14 in. swing

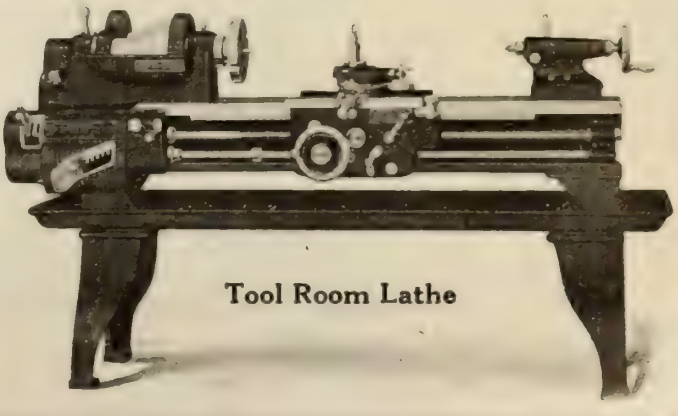
4-5-6-8 ft. beds

Ask for bulletins describing either machine.

SYRACUSE, N.Y.

THE PORTER-CABLE MACHINE CO.

SYRACUSE, N. Y.



Tool Room Lathe

What About Your Plans for 1922?

The impulse towards better business is in the air. The evidence of returning sanity to a world disrupted by war's alarms is everywhere.

The past restricted period of business has served to increase our knowledge of economic fundamentals. We are better equipped mentally to get Business, and Business in 1922 is there for those who will go and get.

Our Service Department is able by improved facilities, up-to-date equipment, and wide experience to help you to get your share.

If It's Machinery—Write "Williams."

THE A. R. WILLIAMS MACHINERY Company, Limited

TORONTO CANADA

Halifax St. John Montreal Winnipeg Vancouver

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New Hisey

Patents Pending

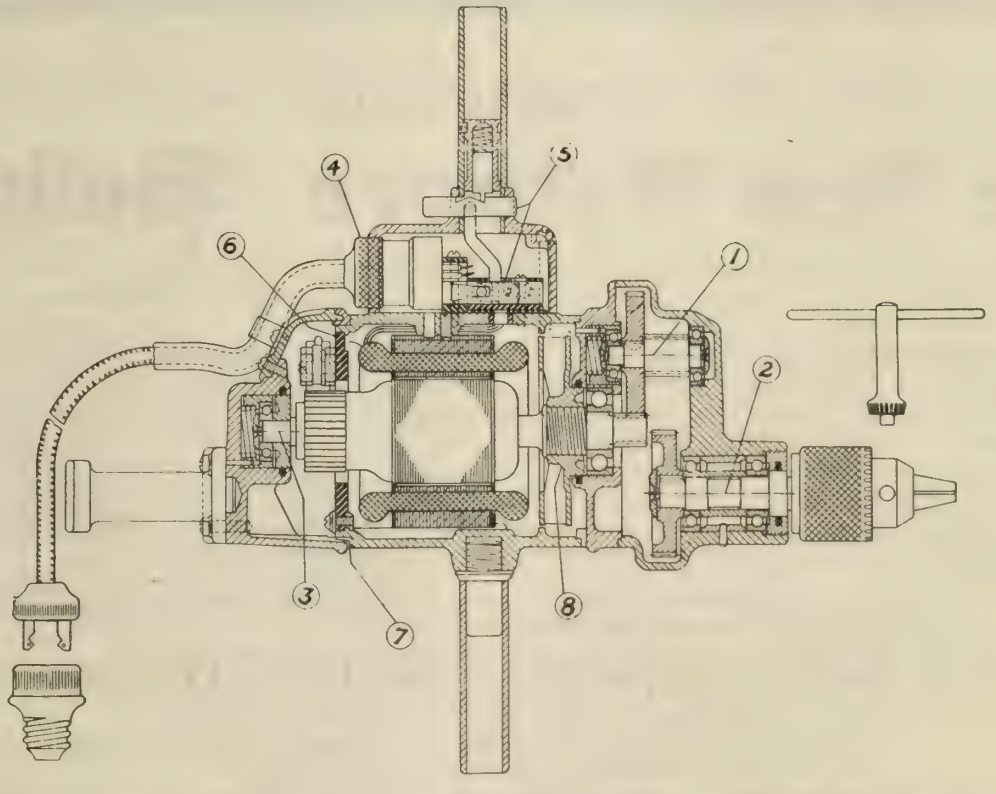
SUPER *Universal Drills*

POWER is very essential, and there is an abundance of this in the new Hisey Super Universal Drill, and some to spare. It is not an assembled machine with an ordinary stock power motor, but a product scientifically designed and manufactured by an organization with nineteen (19) years' experience.

Equipped with Super motor of our own design and manufacture and guaranteed to do more work at a lower operating cost (Current consumption) than any drill of same rated capacity.

Mechanical construction of Hisey machine is of the highest grade as can be seen from sectional drawing.

1. **Ball Bearing Gear Spindle**
2. **Ball Bearing Chuck Spindle**
3. **Ball Bearing Motor Shaft**
4. **Quick Cable Connector**
5. **Famous Hisey Patented Switch**
6. **Adjustable Brush Holder Yoke**
7. **Improved Vent Openings, Safeguard the Motor and Interior Parts Against Accidental and Wilful Abuse.**
8. **Improved Ventilating Fan**



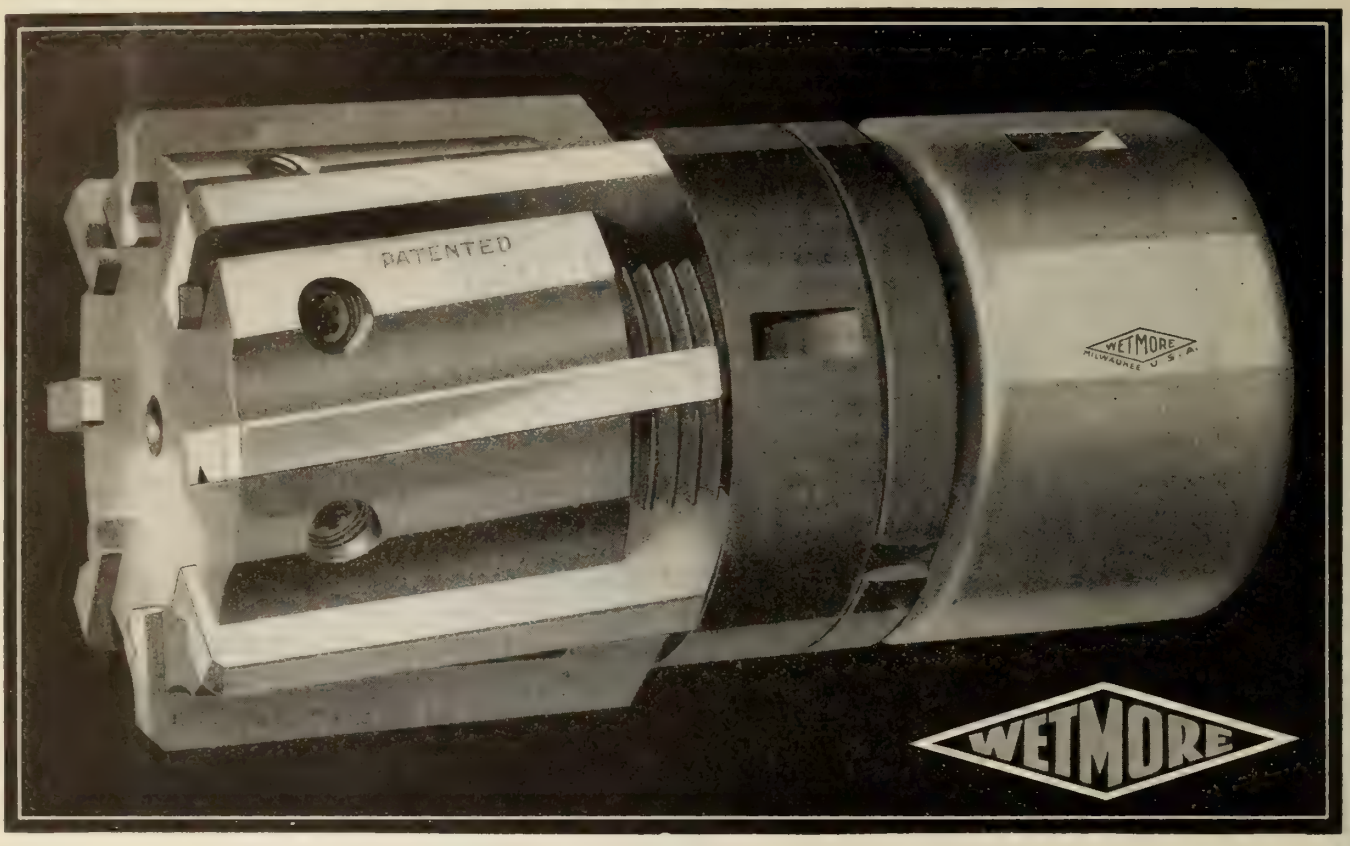
A high-grade product built to meet the most trying and exacting conditions. The installation of a new Hisey Super Drill is a real investment, and a guarantee to your satisfaction; is the best proof that the first cost represents but a meager portion of real economy.
⅜-in. and ½-in. sizes can now be shipped from stock.

Hisey Super Universal Drills are particularly adapted for 25 cycle, alternating current service

THE HISEY-WOLF MACHINE CO., Cincinnati, Ohio

Canadian Agents:—A. R. Williams Machinery Co., Toronto.

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Announcing

The New Wetmore "Bulldog"

Combining all the advantages of both solid and adjustable reamers, this new Wetmore Expanding Heavy-Duty Reamer (6, 8 or 10 blades) represents the highest development of quantity-production precision tools.

No huskier or more enduring reamer has ever been produced for heavy duty work than this Wetmore "Bull-dog." The body is **guaranteed** against breakage, even under severest reaming tests. Its new tongue drive relieves the strain on the coupling nut. Assures perfect alignment between arbor and body. Large adjustment provides for wear and regrinding, so that the "Bull-dog" with its original blades will outlast several solid, non-adjustable reamers.

In every detail—design, quality of materials, workmanship, finish—the "Bull-dog" is typical of Wetmore standards of manufacturing. And the more carefully you compare it with other good reamers, the more you will appreciate these advantages of Wetmore Expanding Reamers:

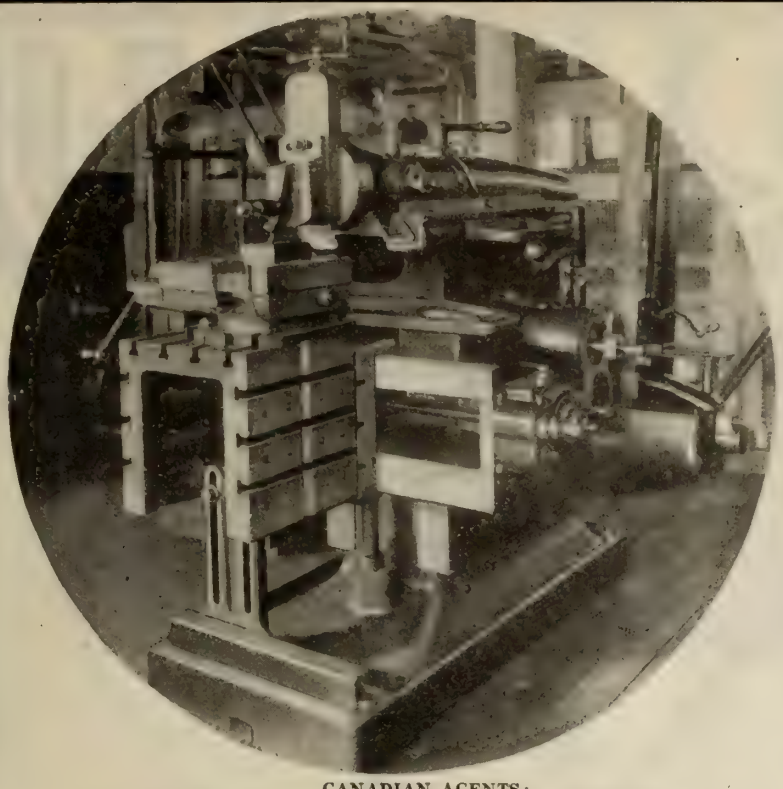
Left Hand Angle Cutting Blades that prevent digging in, chattering, and scoring of the reamer while backing out.
Solid, heat-treated alloy steel body—guaranteed against breakage.
Adjustments to the thousandth of an inch can be made in less than a minute. In fact, the Wetmore is the quickest and easiest adjusting reamer made. Cone expansion nut keeps blades always parallel with axis.
No grinding arbor required for regrinding. Wetmore Reamers can be reground on their original centers.

The above are just a few of many features of Wetmore Expanding Reamers. Let us send you our 1922 Catalog—just off the press. No better "hand-book" on reamers was ever published, we believe. Write for your copy.

Wetmore Reamer Company, Milwaukee, Wisconsin, U. S. A.
Manufacturers of Expanding Reamers and Cylinder Reaming Sets, Arbors and Thread Gauges

WETMORE REAMERS

Exclusive Canadian Agents: A. R. WILLIAMS MACHINERY CO. LTD., TORONTO.



HENDEY SHAPERS

Boss the Job!

A machine which is not the easy boss of every job which it is required to handle, is not worth the floor space it occupies. Far better sell it and invest the money in a really efficient machine.

Hendey Shapers are proving daily to shops throughout the entire continent that a good versatile shaper can be successfully adapted to a large variety of work—and prove itself the "boss of them all."

The Hendey Machine Co.

Torrington, Conn., U.S.A.

CANADIAN AGENTS:
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LATHES—SHAPERS—MILLERS AND CENTERING MACHINES

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited

PEMBROKE, ONT., CANADA

HIGH GRADE COAL AND COKE

Representing
WASHINGTON GAS COAL CO.
CANONSBURG GAS COAL CO.
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WEST PENN BY-PRODUCTS CO.

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BRITISH-AMERICAN FUEL & METALS LIMITED

McKINNON BUILDING TEL. MAIN 7815 TORONTO

WRIGHT HOIST

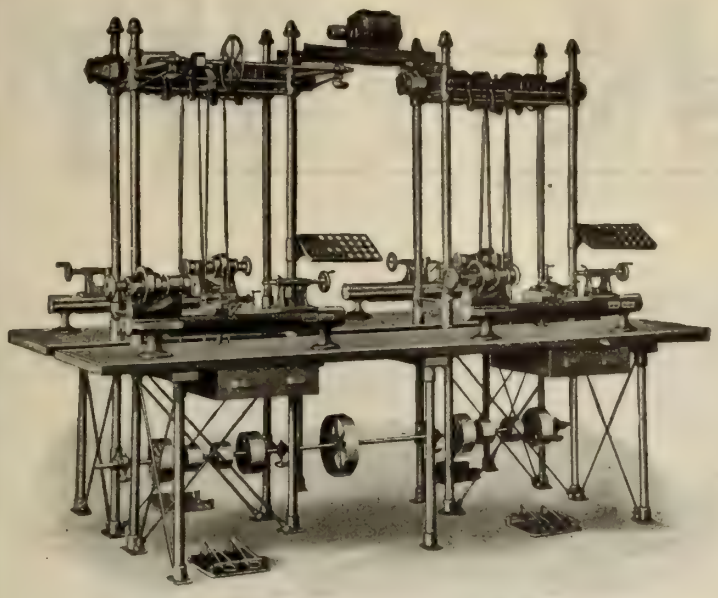
THE HOIST INDUSTRY DEPENDS ON



Canadian Distribution
THE A. R. WILLIAMS MACHINERY CO.
St. John, Halifax, Toronto, Winnipeg, Vancouver, Montreal

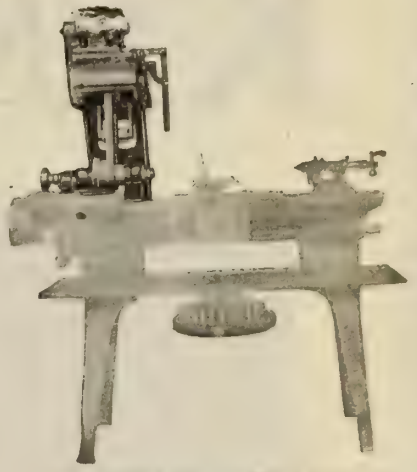
WRIGHT MANUFACTURING COMPANY
LISBON, OHIO

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Cataract R-4 Double Bench Unit with Under-Drive.
(Details in No. 15 Catalogue.)

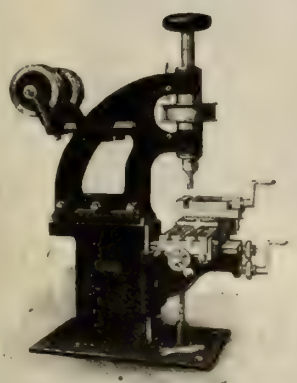
The equipment shown to the left being self-contained, is particularly well adapted for tool room work, or manufacturing of duplicate parts both in first and second operations.



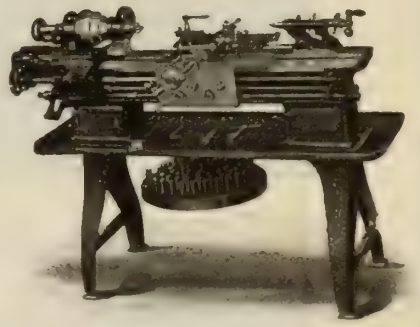
Cataract Quick Change Swing Precision Lathe, with Motor Drive.
(Special Catalogue for Details.)

CATARACT
MACHINE TOOLS

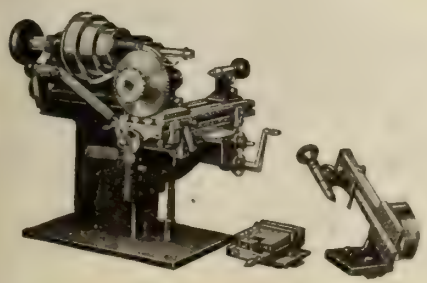
Best quality material, first-class workmanship, unexcelled finish, accuracy and interchangeability of fixtures that really interchange—these are the features that make Cataract Machines the first choice of the careful buyer.



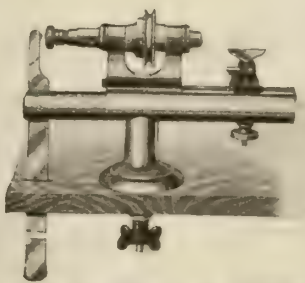
Cataract Bench Miller, with Vertical Head.
(Details in No. 5 Catalogue.)



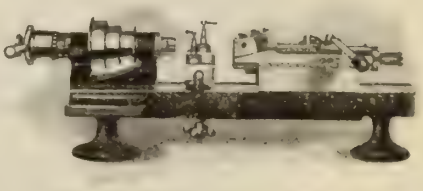
Cataract Quick Change Swing Precision Lathe, with Cone Drive.
(Details in Special Catalogue.)



Cataract Bench Miller, with Horizontal Head.
(Details in No. 15 Catalogue.)



Cataract Filing and Polishing Head, with Lever Chuck Operating Device.



Cataract Bench Lathe with Turret Double Tool Cross Slide and Chuck Closer for the Manufacture of Duplicate Parts.

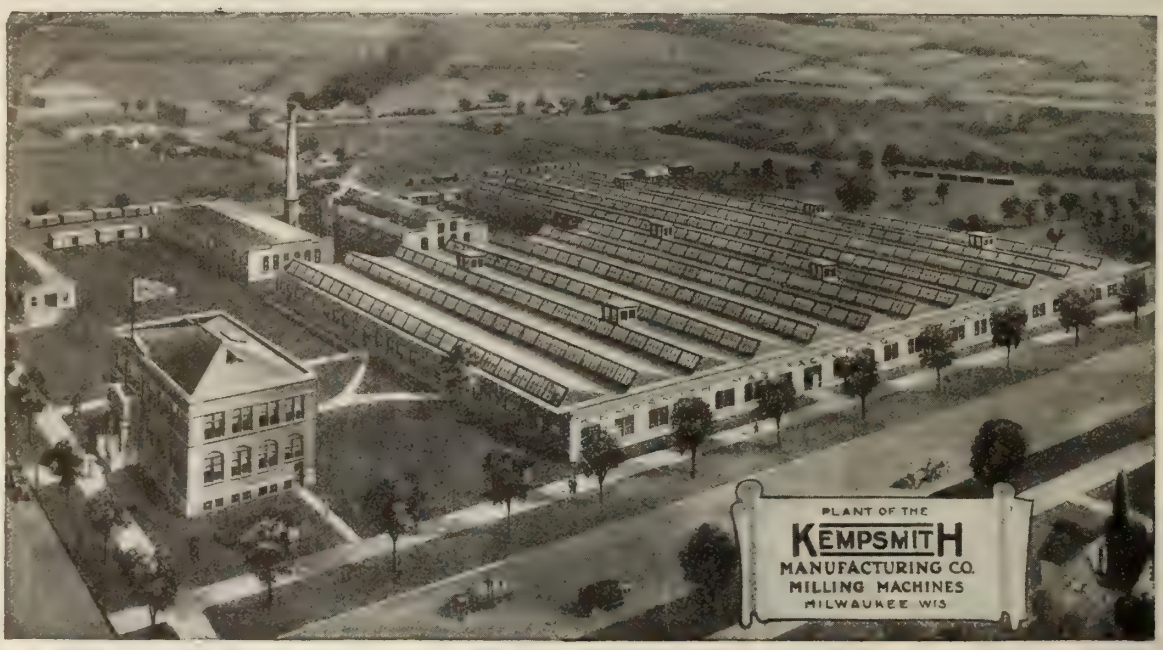
Our Special Catalogue No. 15 contains full details and specifications of these and other Cataract Tools. Write for it now.

HARDINGE BROS., 1770 Bertau Avenue, Chicago, Ill.

Canadian Representatives: GARLOCK MACHINERY LIMITED
MONTREAL TORONTO WINNIPEG

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KEMPSMITH



A Tool is Judged by its Makers!

We don't buy machine tools these days without finding out something about the firm that makes them; for a machine tool cannot be efficient unless the parent plant is efficient. Hence it follows logically that the greater plant efficiency means greater tool efficiency. Canadian buyers in investigating our tools will do well to consider the **KEMPSMITH plant.**

The Ideal Plant for Specialized Tool Construction

It is located in a new and rapidly developing section of West Allis, where the ten acres we own give abundant room for expansion. There are four buildings, aggregating 90,000 sq. ft. of floor area; Machine Shop, 250x300 ft., the model shop of its kind; Pattern Shop absolutely fireproof; Power Plant a neat and complete direct connected power unit; three story Office Building. Every detail of system and equipment in the shop is carefully planned for its function in the advantageous construction of this specialized line.

All machines and parts are built in multiple lots, under a complete system of jigs, and templates, and all parts are completely interchangeable at any time. A spacious tool room is centrally located in the shop. There are also separate enclosures for rough stock, finished stock and stores, and for finishing and shipping, so planned that the parts in ordinary course of manufacture shall make an automatic circuit of the shop to the assembling and shipping floors. Recognized experts have planned our lighting systems (natural and artificial) sanitary systems, etc. Consequently the work is done under the best conditions.

THE KEMPSMITH

MILWAUKEE

CANADIAN AGENTS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

Milling Machines

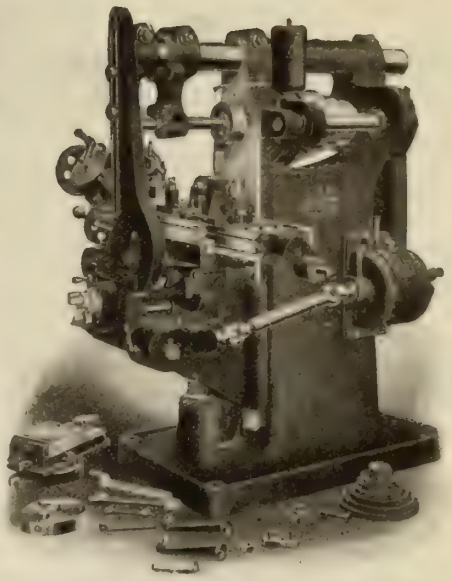
and Attachments

How Durability is Tested

Every machine, whatever size or type, is put to test under cuts and conditions purposely more severe than it will encounter in even the most progressive shops.

Why They Are Guaranteed

So confident are we after this test that every machine carries our definite guarantee. Note the massive proportions of the column, knee, table, etc.; the wide range of feeds; liberal bearings; the excellence of our entire feeding mechanism; the centralized location of operation at front of knee.



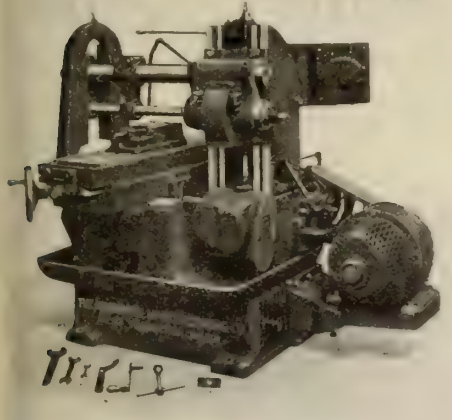
Cone Type Miller: A true reflection of our ideal —highest quality only.

The Three Essential Points

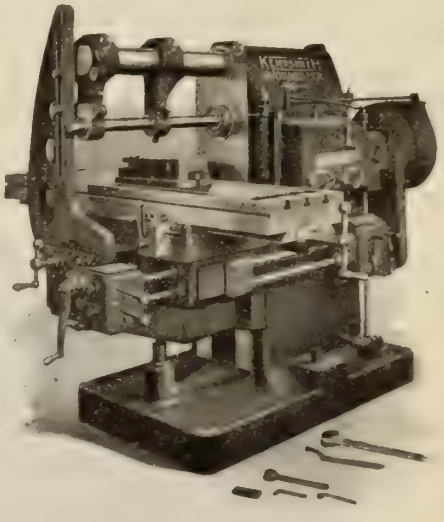
Summing up the foregoing you will see that KEMPSMITH MILLERS represent:

1. A machine design of established excellence.
2. A highly modern factory and equipment with specialized systems.
3. Trained and specialized mechanics under the most favorable conditions and under a system of rigid inspection.

Our line embraces plain and universal milling machines and attachments of all kinds. Write for our latest catalogue.



No. 33 Production Type Miller: For rapid and accurate production.



Maxmiller: A design which is undoubtedly the acme of present milling development.

MANUFACTURING CO.

WISCONSIN, U. S. A.

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SIDNEY
for SERVICE

HIGH DUTY ENGINE LATHE

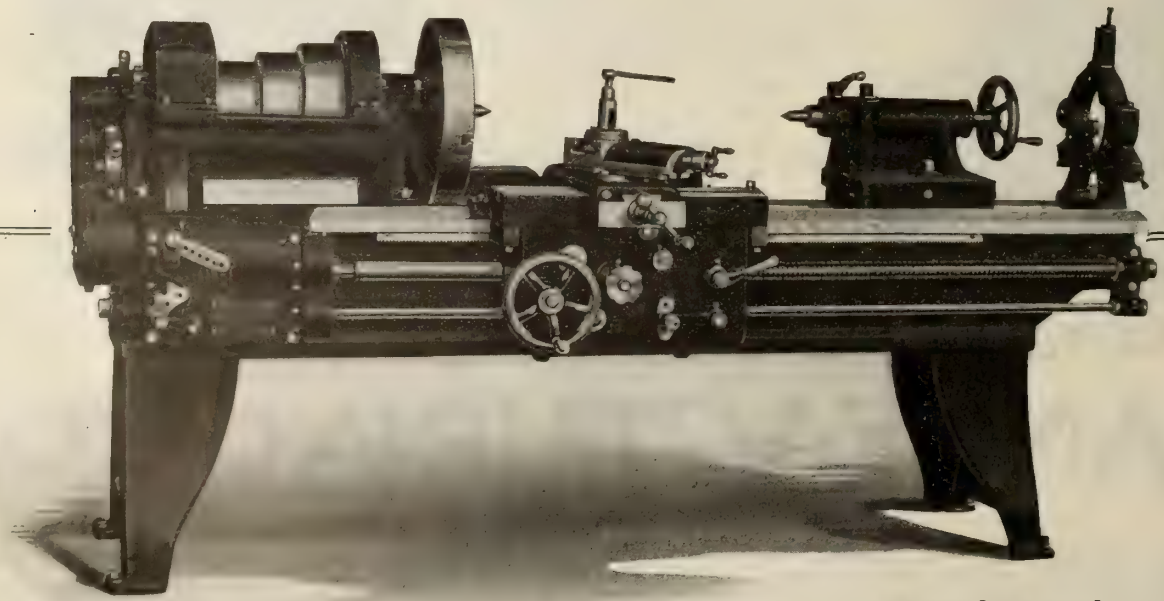
THIS is a machine tool of extraordinary build. The entire quick change gear mechanism is mounted on the front of the bed. It is fixed permanently in accurate alignment by a tongue and groove, and is a complete unit, in which every gear is made from high carbon steel. The cone gears, because cut with improved 22½ degree angle cutters have pointed teeth slightly rounded at the top—the only gear in tumbler gear mechanism that can and does make instantaneous engagement without interference.

Bed of 25 per cent. steel mixture has heavy double wall cross girts, two feet apart. Its rigidity is great, because ordinary construction would not stand up under strain of such speed and deep cuts as this Sidney Lathe is capable of making.

Fast, efficient, economical tools are necessary to meet the intensive competition of today—Write for more information regarding Sidney tools.

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: Yeates Machinery & Supply Co., Montreal, Que.
H. W. Petrie, Limited, Toronto, Ontario.



17 and 19 inch

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During 1921 MACLEAN'S, Canada's National Magazine, has published the whole or major portion of the following fifteen books, which have since been published in book form—or are shortly to be published:

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The recollections of Canada's premier story teller, the C.P.R.'s knight of wit and wisdom, who has known every person worth knowing in Canada during the past half century.

(2) Masques of Ottawa—"Domino"
A series of brilliant, biographical sketches of Canadians prominent in politics and business; analogous to "The Mirrors of Downing Street."

(3) Canada at the Cross-Roads
—Agnes C. Laut
A series of vigorous, inspirational articles showing how Canada is standing on the threshold of nationhood; constructive criticism indicating how full national status is being achieved.

(4) Policing the Plains
—Rev. R. G. MacBeth
The latest and most authoritative history of the Royal North West Mounted Police, by a padre who himself took part in the Riel Rebellion and has associated with many of the leading characters in Canada's famous frontier force.

(5) The Drama of Our Great Forests
—Arthur Heming
The pulsating, throbbing, human-interest story of Canada's great northern fastnesses, told by the man who will go five hundred miles to get a fact; authentic, enthralling.

(6) The City of Peril—Arthur Stringer
An up-to-date narrative of a Bolshevistic plot which was nipped in the bud by an adventurous young millionaire; including a delightful Stringer-like romance.

(7) Pawned—Frank Packard
A fast-moving story of a triple regeneration, shifting with kaleidoscopic speed from the South Sea Islands to this continent—novel, intense, gripping, mystifying.

(8) The Valley of Gold—David Howarth
The first novel from the pen of an athletic Methodist parson now resident in Miami, Manitoba—a true-to-life account of the Qu'Appelle Valley of Saskatchewan as it was twenty years ago; vigorously, thoroughly Canadian.

(9) Mostly Sally
—Pelham Grenville Wodehouse
A worthy successor to "The Little Warrior," told in the inimitably facetious and whimsical vein of this English master-craftsman.

(10) The Yellow Streak
—Valentine Williams
The story of a murder mystery solved by real human beings: from the pen of the author who wrote "The Man With the Club Foot."

(11) The Gates of Tien T'ze
—Leslie Howard Gordon
An enthralling book which ran in MACLEAN'S as a five-part serial; dealing with life in London when Anglo-Saxons and Chinese met at cross purposes.

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—Archie McKishnie
A dozen short stories about the typical Canadian negro of Western Ontario; a forthcoming volume from the pen of one of Canada's foremost fiction writers.

(13) Prince Renine—Maurice Le Blanc
Eight more stories in which the leading character is the thinly disguised Arsene Lupin, one of the world's famous characters in detective fiction.

(14) A Series of Short Stories
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MACLEAN'S readers got all this immense value in 1921—in 1922 they will get bigger value still. And you get all this for $3.00—the price of a year's subscription—24 twice-a-month issues of

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The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

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HIGH SPEED STEEL

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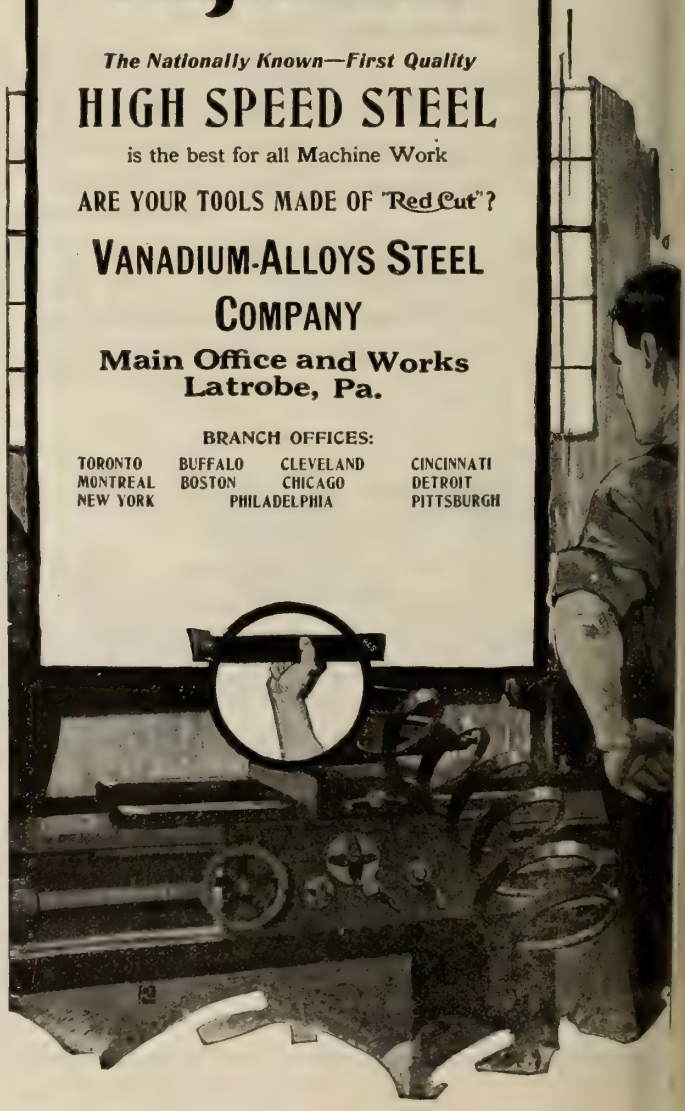
ARE YOUR TOOLS MADE OF "Red Cut"?

VANADIUM-ALLOYS STEEL COMPANY

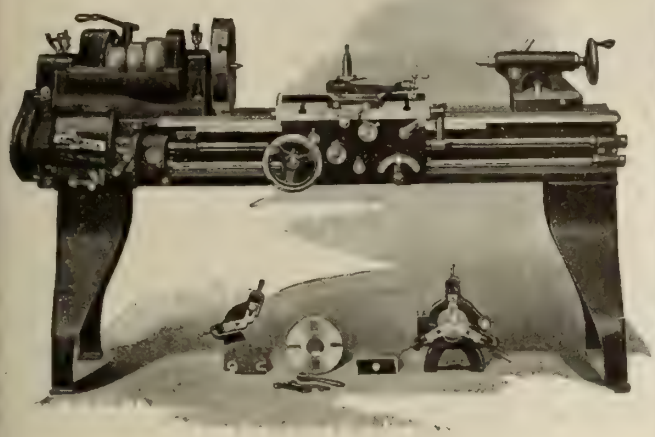
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A Little (Big) Lathe



The Rockford ECONOMY

is exactly that—"a little, big lathe." Sounds paradoxical doesn't it? It is little in **size,** but big in **capacity.** In the modern shop its heavy rigid carriage and extreme accuracy place it foremost for rapid production at the same time reducing overhead.

Back Geared Quick Change construction made in 12-in., 14-in., 18-in. and 22-in. swing. Features for accuracy and convenience are highly developed.

A precision lathe of universal application. Possesses rigidity and durability unusual in a machine of its size. Lowers costs from the start.

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ROCKFORD LATHE & DRILL CO.

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COVERS ALL BEARING NEEDS



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For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



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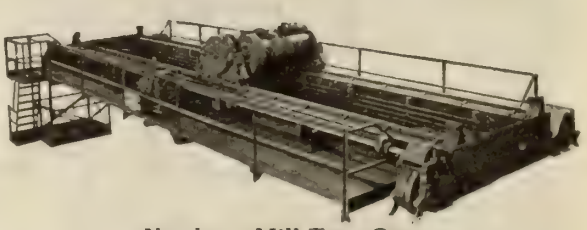
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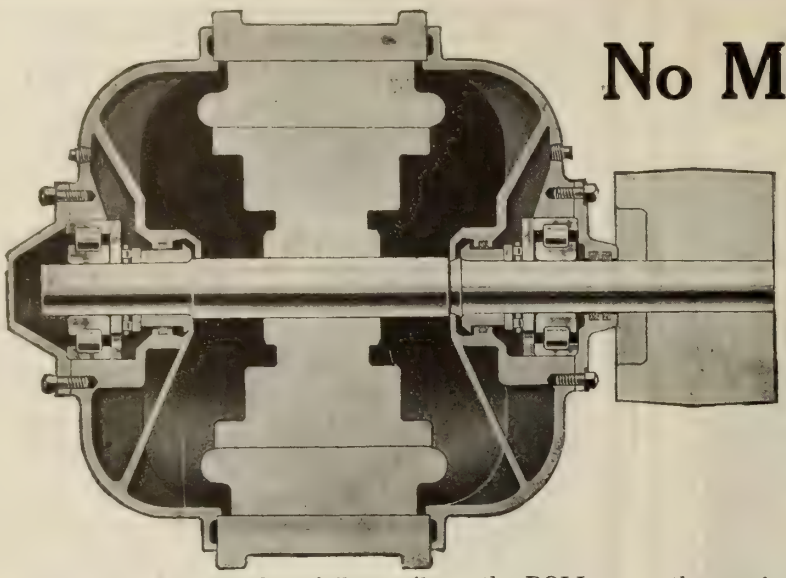
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Rollway Heavy Duty Bearings

Even if your motor attendant fails to oil up, the ROLLWAYS do not fail but keep the motor going just the same.

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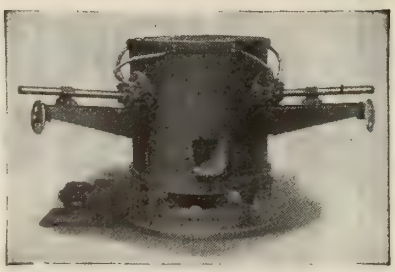
Every motor from 5 h.p. up should be equipped with ROLLWAY HEAVY DUTY BEARINGS for your own protection.

Would a 60-day trial on your hardest worked motor, with guaranteed results, interest you?

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RAILWAY ROLLER BEARING CO., Syracuse, N.Y.

Electric Water Heaters
For Glue Pots Etc.





Portable Babbitt Melting Pots

Extreme Left Illustration—Brass Furnace. Adjacent Illustration—Steel Furnace.

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Cost-Cutting Electrical Equipment

Steel Furnaces (Heroult Type) in 100 lbs. to 15 tons capacity. Grey Iron and Ferro-Alloy Furnaces in sizes to suit customer.

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Electric Water Heaters—the simple and time-saving way of quickly heating water. Cheaper than coal or gas. Made in all sizes.

Portable Babbitt Melting Pots—save time and fuel. Turn off the switch when metal is ready. In suitable sizes for every plant.

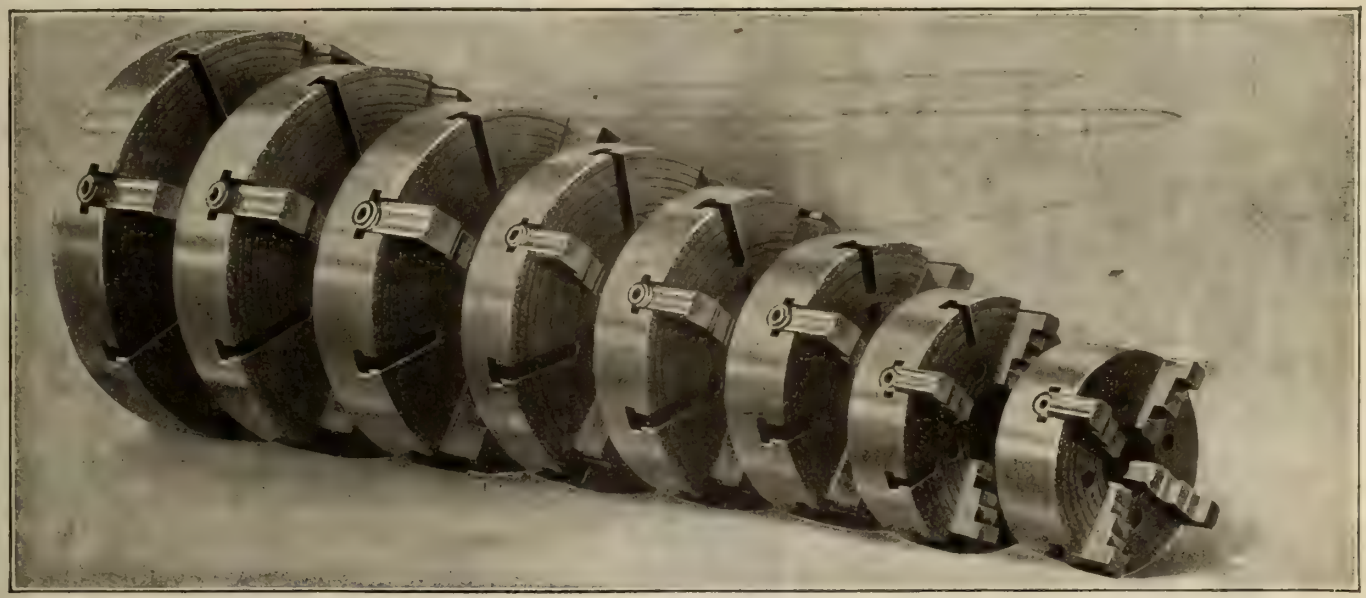
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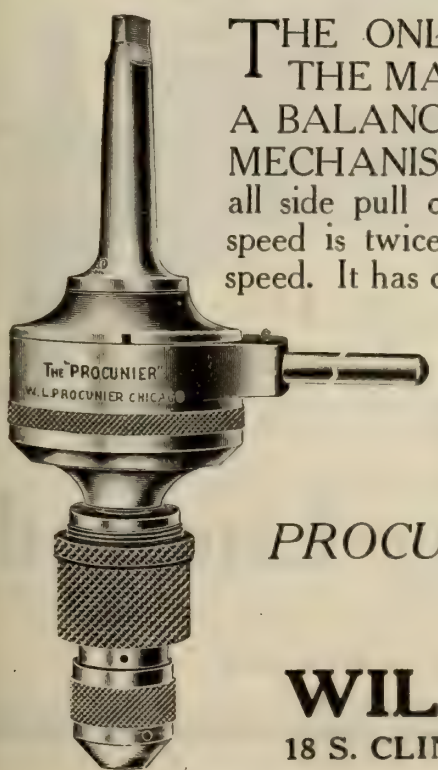
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THE ONLY DEVICE ON THE MARKET HAVING A BALANCED REVERSING MECHANISM, thus eliminating all side pull or torsion. Its reverse speed is twice that of the forward speed. It has other features too we would like to bring to your attention. *Send for illustrated circular showing the*

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With the turn of the tide remember that the newly organized firm of *Garlock Machinery Limited,* is ready to completely furnish your plant. A large variety of machine tools of the most approved design are constantly kept in stock for general machine shops, boiler shops, structural steel works, railroad shops and flue shops—our line in fact meets every demand of the woodworking and metal-working industry.

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HIGH SPEED STEEL

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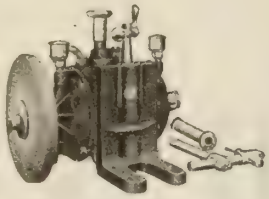
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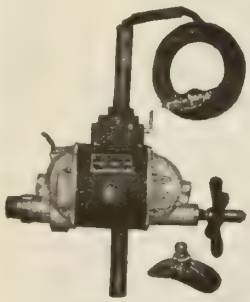
U. S. Electrical Tools



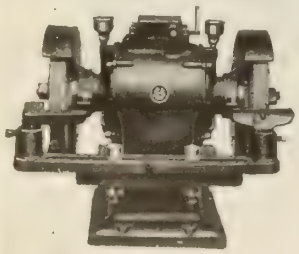
Angle Plate Grinder
4 sizes, ½—1 2 and 3 H.P.
Wheels 8 to 14 in.



Type R Center Grinder
Wheel 6 x ⅜ x ½ in.



Three Sizes
½ in 1 in. 1¼ in.
Drills these sizes in holes in steel.

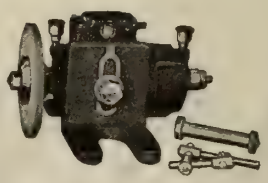


Type K. Bench Grinder
4 sizes, ¼ ½—1 2 H.P.
Wheels 6 to 10 in.



Come 'round and meet the Family

These are just a selection of U.S. Electrical Tools starting with the "daddy" of them, the famous U.S. Floor Grinder, self-contained and like all U.S. Tools only waiting to be coupled up to the "juice" so that it can start work at once. There are many other members of the "family." Get one of our catalogs and make their acquaintance. It will pay you.



Type HB. Center Grinder
with Angle Plate.



Universal Motor Drill
For either A.C. or D.C.
3-16" and ¼" capacity in metal.



Combination Hand and Bench Drill

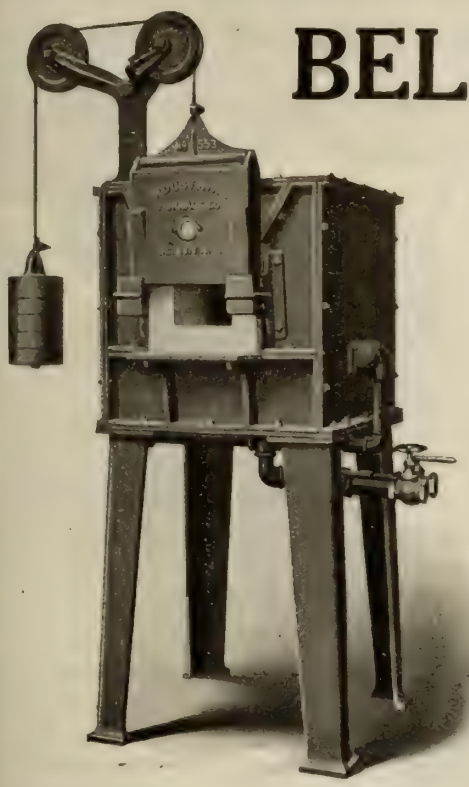
The United States Electrical Tool Company

8th and Burns Street - - Cincinnati, Ohio

CANADIAN AGENTS:

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Enable the Operator to Speedily Obtain an Intense, Uniform Heat.

A distinctive feature of Bellevue Furnaces is the accurate way they respond to the will of the operator. They speedily develop an intense heat and are always under accurate control. Bellevue Furnaces are simple and economical to operate. Combustion is perfect and no flames come in contact with material. For oil or gas in seventy-nine different styles or to your order.

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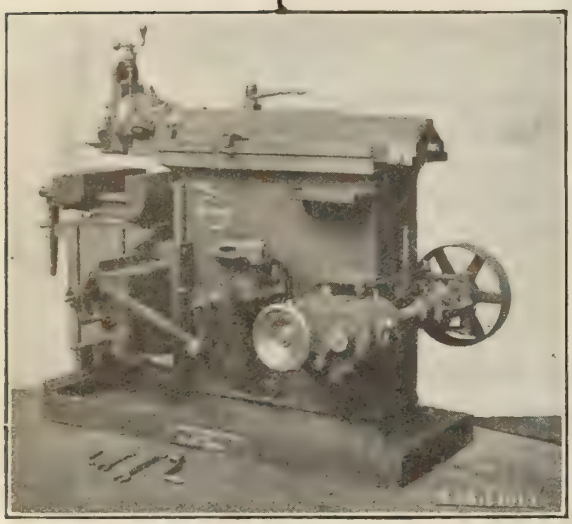
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THE JOHNSON FRICTION CLUTCH

The Bertram Crank Shaper is started and stopped with a Johnson Clutch





John Bertram & Sons, Ltd., Dundas, Ontario, are building a shaper that is designed *right* from the practical standpoint of the user. Countershaft and tight and loose pulleys have been abolished in favor of friction clutch control—control that is immediate, and placed right under the operator's hand.

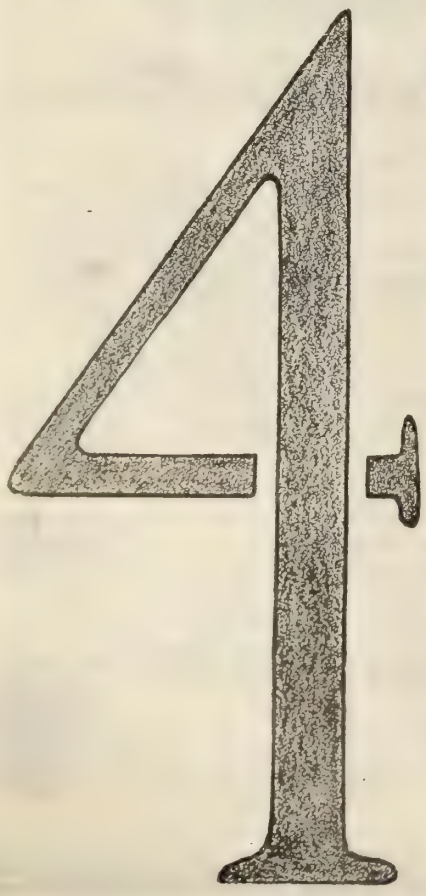
And Bertram has wisely selected the Johnson Clutch.

On a shaper, especially, convenient control is a valuable feature. But a good clutch is an essential on any machine —and there is none that will equal the Johnson.

Write for our Yellow Catalog.

Canadian Agents:
Williams & Wilson, Ltd., 84 Inspector St., Montreal.
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THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.



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"The Valve With A Backbone"

4 GRADES



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For Boiler Feed Oil, Acid, Ammonia Vacuum Returns, Locomotive Boiler Washing, Marine Air Pumps, Gasoline—highest temperature within 250 degrees.

Red Condenser
For Highest Vacuum, Excessive Grit, Pottery Slip, Soda Ash, Condensing and Brine Pumps where moderate pressure is applied and heat is within 110 degrees.

Standard
For Elevators, Water Department services and Clear Water not exceeding 160 degrees. Wherever high pressure is applied without excessive temperature.

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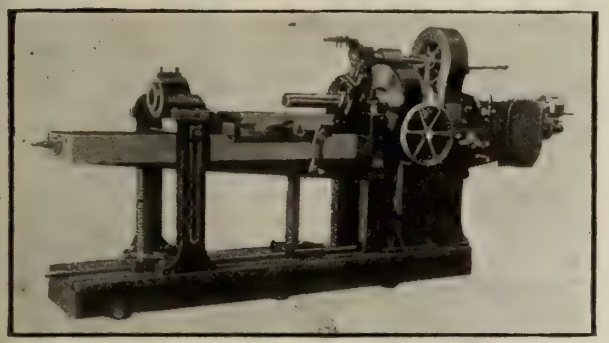
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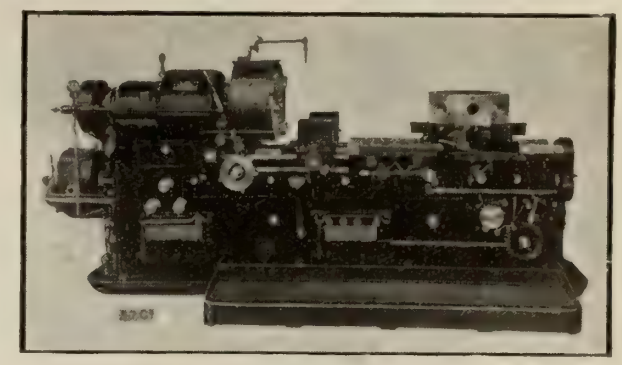
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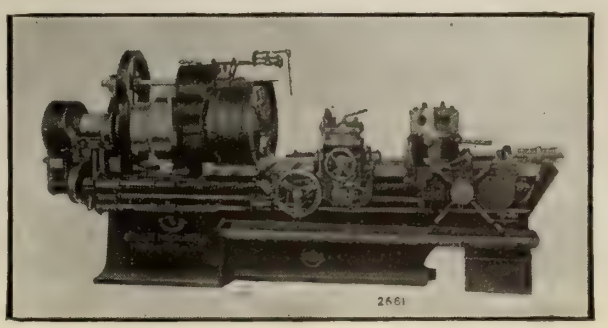


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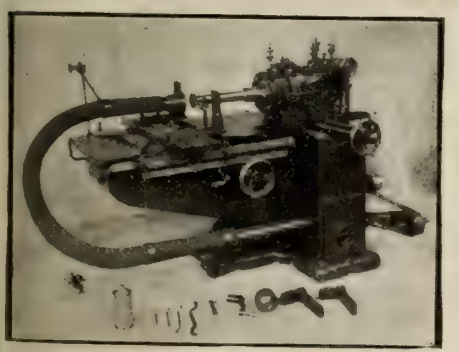
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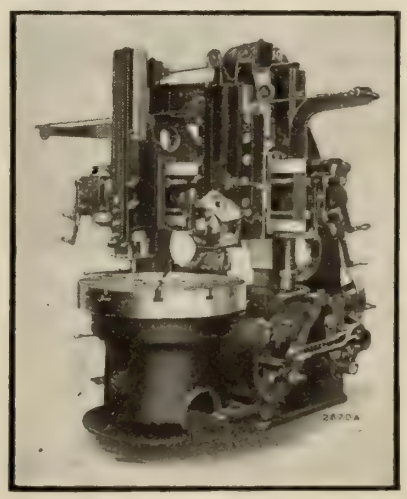


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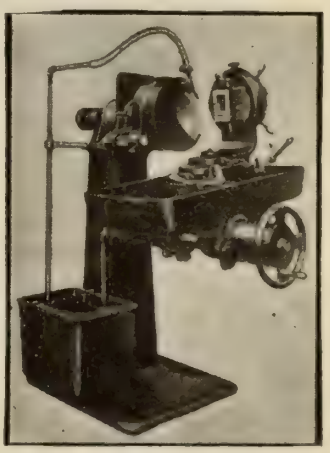
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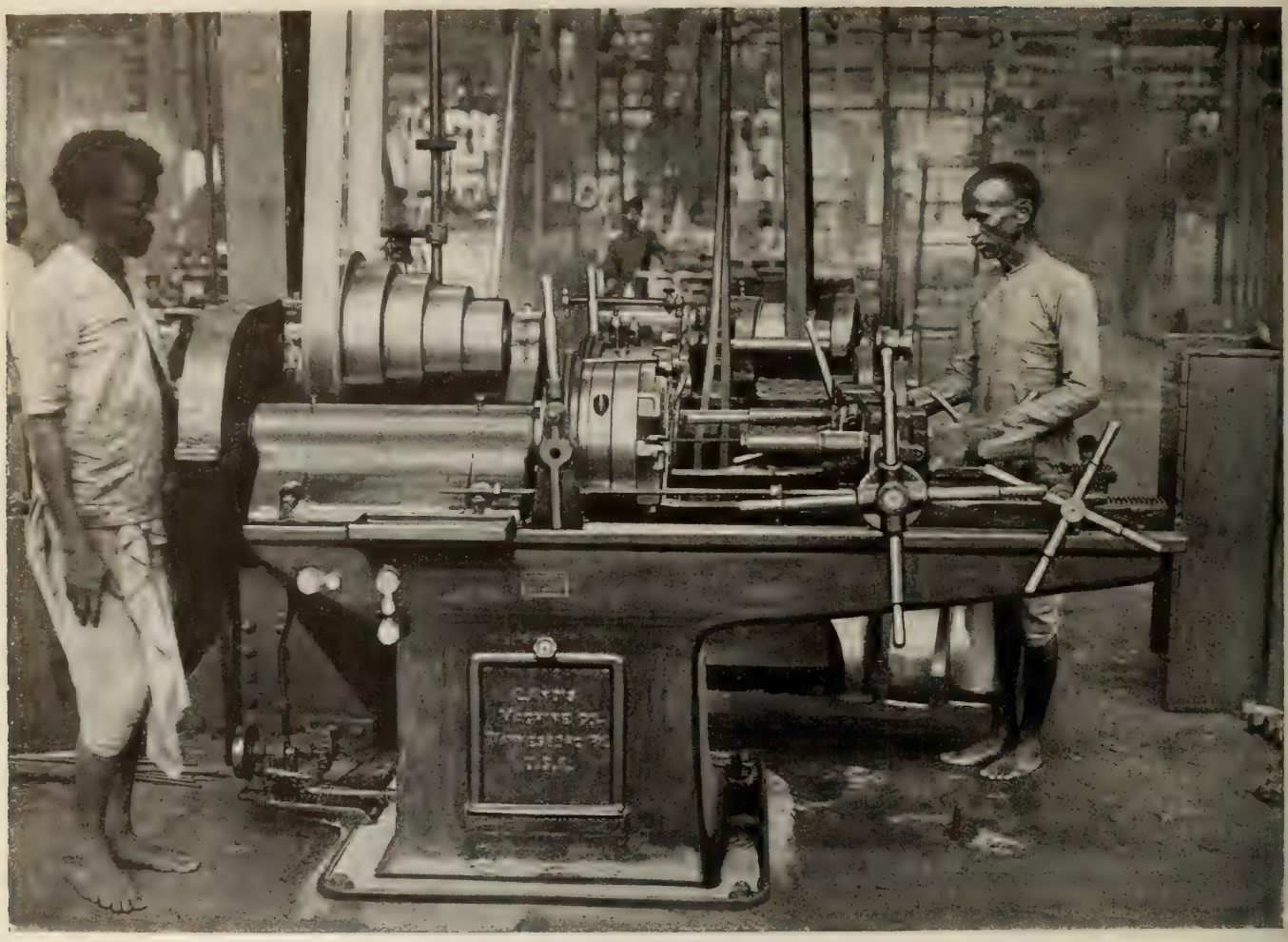


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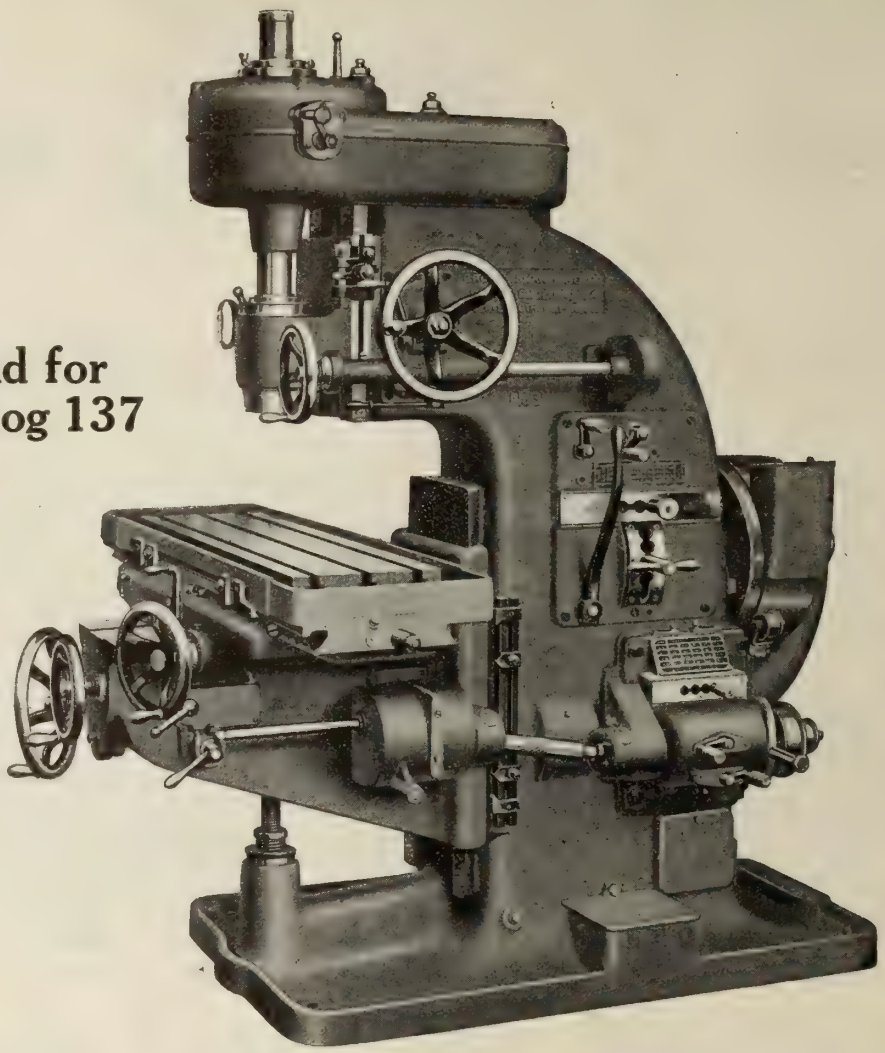
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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVI No. 26 DECEMBER 29th, 1921

Business Can be Secured-If we go After It

THE YEAR 1922 will be a successful one for Canada, if we as Canadians do our very best to make it so. Occasionally you will run across some pessimist who will tell you **"hard times are coming."** Don't believe him. Give such a foolish and erroneous statement the death blow by replying that **"hard times are not coming, but soft times are going."**

Canada is too big a country to sit down and wait for **so called** better times. **"If we sit back and wait for business, business will likewise sit back and wait for us."** Times are what we make them. If you don't believe this statement, read over the various articles in the present issue. Every industry has a stirring story of achievement to tell. Great progress has been made. Developments almost undreamed of have taken place, and a spirit of optimism exists among manufacturers in general, that greater things are yet in store.

Two important factors in Canada's progress will be her Immigration policy, and her efforts to secure additional export business. The article by Mr. Stead, director of publicity, on Immigration and Colonization, contained in this issue, should have a far-reaching effect; Mr. Rankine's story of Canada's progress during the past decade should fill our hearts with pride; Mr. Hanna's tale of an uphill fight, with success in the end, should inspire us with enthusiasm, while on the other hand, the points brought out by Mr. O'Hara, Deputy Minister of Trade and Commerce, should be read and remembered by every manufacturer in Canada. Mr. O'Hara particularly emphasizes the need of **"thoroughness."** This advice could well be given to every one of our industries. If Canada's reputation is to be maintained we must, above all other things **"be thorough in our methods."**

A few pessimists may tell you that there is no chance to be **"thorough"** in the present state of depression, and that there is no use trying to get business today because there is none to be secured. **Don't believe such a foolish story.** Whatever deflation exists today is not so much the result of people refusing to buy, as it is **"that sellers have slackened up in their efforts to sell."** Competition is once more with us, and anyone who thinks otherwise need only look around him to prove this statement. Don't sit back and say there is no business to be secured, for there is—**"and the man who will land such business is the one who will go out and get it."** The day when buyers actually entreated you to accept their orders is gone. You now have to tell them **why** they should buy. Business **can** be secured by energetic salesmanship, coupled with judicious advertising. Selling the public is more important to-day than ever before.

If we as much as admit by our attitude that we do not expect our salesmen to secure business, then they most assuredly **"will not land any orders."** On the other hand, if we fire them with our own enthusiasm, at the same time adopting an aggressive selling policy, the result will more than surpass our fondest expectations. Let your salesmen understand they **must** secure business—**then watch them get it.**

We have passed through some rough industrial weather during the past year, yet while many firms were grumbling at the small sales, and threatening to give up the ship, others in similar lines were plowing into the waves, and are now sailing in the calmer waters of increased orders and prosperity, thanks to their individual and aggressive methods. **"Where there is a will there is a way"** is more than an idle saying. Get the will power, and even though the outlook may appear dark, you will be sure to find a way.

Canada is a **wonderful** country, and it has a **wonderful** future. Pin your faith to these facts, then **go-get** the business that is waiting for you, if you go after it hard enough.

The Year 1922 is going to be a **go-get-it** year, and the sooner you make up your mind to this fact the better. Get out and bring in the business instead of being content to sit still and await the coming of better times. **Times are what we make them.** Decide to eliminate all deadwood. Keep only the Go-Getters. Let every employee understand you demand and actually need business, then **go get some yourself,** just to show them how it's done.

Tracing the *Development* of the Year

In Spite of Depression Canadian Cities Have Prospered—Many U.S. Firms Locate in Canada — Extensions to Existing Plants Have Taken Place Generally.

HAMILTON ENJOYS PROSPERITY

Nineteen New Industries Have Located in Hamilton, Several Being Canadian Branches of American Concerns

By C. W. KIRKPATRICK, Commissioner of Industries and Publicity, Hamilton

HAMILTON.—While the abnormal conditions existing during the past year have militated against industrial expansion, Hamilton has enjoyed a fair measure of industrial prosperity, nineteen new industries, several of them Canadian branches of American concerns, having located here since the beginning of the present year. With but few exceptions, however, the new-comers are occupying buildings formerly occupied by other industries, there having been less industrial building during the past year than in any twelve months since the close of the war. This has been due largely to the unsettled conditions throughout, not only the continent of America, but practically the entire world. With the future somewhat beclouded, the manufacturer has shown, and is still showing, a tendency to move more cautiously than was the case during the prosperous war years and the two years immediately following and wherever possible he has secured a short term lease on an existing building rather than tie up considerable capital in building to suit his own requirement, when there is so much uncertainty regarding what the future holds in store.

Unsettled building conditions have also had a detrimental effect, there being a feeling common to all classes that building costs, both labor and material, are bound to take a drop. There has already been a considerable decline in building costs, but it has been so gradual that it has scarcely been noticed, although very substantial in the aggregate, and, at least so far as Hamilton is concerned, there are unmistakable signs that if the decrease is maintained until next spring, the next year is going to be an exceptionally busy one for the building trades.

While there are no indications of an early industrial boom, there is no reason to doubt Hamilton's continued industrial advancement. During the past year the local industrial department has been in touch, by correspondence or otherwise, with upwards of 300 British and American manufacturers who are interested in the Canadian and export markets and who have in mind the establishment of Canadian branches of their industries, some in the immediate future and others at more distant dates. The announcement of a general election caused a noticeable falling off in the number of industrial inquiries, more especially from the United States, indicating that Canada's future tariff policy is an important consideration with many prospective locators. There is, however, no reason to think that the lull is more than temporary.

Among the new industries to commence operations during 1921 were:—

Chadwick-Carroll Brass Co., Ltd., brass goods; Canadian Coffield Motor Washer Co., washing machines; Canadian Chick Hatcheries, incubator chickens; Canadian Oakville Fastener Co., dome fasteners; E. B. Ratcliffe, Ltd., cement products; Fuller Brush Co., twisted-in-wire brushes; Superior Engraving Co., half-tone cuts; Soy Products Co., artificial milk; Universal Milking Machine Co., milking machines; Wallace Barnes Steel Spring Co., steel springs; Canadian Horseshoe Co., horseshoes; National Slag Products Co., tiles; Ace Chains, Ltd., automobile chains; Cooperage Co., of Canada, barrels and kegs; McIntosh Granite Co., tombstones; Coulter Wood Products Co., wooden specialties; Cyclone Fence Co., wire fences; Eley Bros., knitted goods, and the Rexhide Leather Products, leather products.

One promising sign for the immediate future is the fact that several large industries that decided on Hamilton as the location for their Canadian plants during 1919 and 1920 but discontinued building operations when the period of depression commenced, have recently actively resumed the carrying out of their original programs. Notable among these is the Firestone Tire & Rubber Company, which is erecting a $5,000,000 plant here. This Company, after a year of comparative inactivity, recently put upwards of 150 men at work on its buildings with a view to their completion in time for manufacturing operations to be started early in the new year, so as to be in a position to take care of the spring trade from their Canadian factory. The Libbey-Owens Sheet Glass Company has also just about completed its $2,000,000 plant, and will be in active manufacturing operation before the beginning of the new year.

EXPECT MANY NEW INDUSTRIES TO LOCATE

Modern Harbor When Completed Will Have Cost $25,000,000—Waste Land Has Been Made Into Manufacturing and Storage Districts

By E. L. COUSINS, Manager Industrial Commission, Toronto

TORONTO.—A very decided increase in business optimism is noticeable in the interviews given by American and Canadian Industrial leaders. The general feeling is that the depression is over, and busy times just a block ahead. Unless some, at present, unforseeen conditions prevent, it is generally believed that the early months of 1922 will see a return to prosperous times.

Mr. G. D. P. Harding, Governor of the Federal Reserve Banks of the U. S., when addressing a convention of Canadian and American manufacturers and business men said: "I want to give you this message, and that is, that there is now no danger of any general financial trouble in this country. The time has come for renewed courage and confidence. We can take comfort in the thought that we have passed through the worst and that the problems ahead of us are all solvable."

That conditions in Canada are also becoming stabilized, is attested by the volume of building that has taken place this year ($122,000,000). Of this amount $19,000,000 was expended in Toronto. In spite of the depression in trade more than a score of new industries located in our city. During the past two years high construction costs have been responsible for many firms enduring much inconvenience through leasing floor space, instead of erecting their own building. To our knowledge several American companies have postponed entry into the Canadian market with branch factories, on account of high building costs. With the return of material and wages to a stable level it is easy to see that a distinct revival of industrial building will take place the coming year.

During this year an active campaign has been carried on by Toronto's Department of Industries having for its object the presentation to British and American industrial chiefs the exceptional economic advantages enjoyed by manufacturers who locate plants here. That this campaign has produced results is vouched for by the letters on file in our office. Personal relationships have been established with the executives of many industries, who will, because of the nature of the products they manufacture, become sooner or later prospects for settlement in Toronto.

The Toronto Harbor Commissioners have undertaken to build a modern harbor which when completed will have cost $25,000,000. In addition to the work of developing a deep water harbor, the Harbor Commissioners have created out of what was practically waste land, two districts, one especially suited to the requirements of heavy industrial processes and known as the Eastern Harbor Terminal District, and the other set aside for light manufacturing and storage warehouse purposes, known as the Central Harbor Terminal District.

In one of these two districts manufacturers of any product can be accommodated. Each industry is served by a private railway siding, exclusive dock facilities may be secured if desired or shipments made and goods received at a public dock conveniently situated to minimize freight handling. Freight and passenger stations of a publicly-owned long distance rapid interurban electric line will be located in or near the district, affording frequent opportunities for the distribution of goods to Ontario towns and cities.

Supplementing steam and electric railways and water transportation facilities, excellent concrete roads are laid throughout the district connecting with the well-paved main roads of the city affording easy and rapid trucking between the various industries and any point in the city or vicinity within trucking range. With the above modern facilities which Toronto now has to offer, and with the new stimulus business is now receiving, 1922 should without doubt see more branch plants of American and British industries located in this city, and expansion of many of our present factories than any previous year.

CALGARY HAD A BIG YEAR

Building Permits For the Months of 1921 Reached Over Two Million Dollars—Irrigation Receives Attention

By JOHN H. HANNA, Secretary Calgary Board of Trade

CALGARY, Alta.—Calgary's building operations for the year 1921 compare very favorably with a year ago, and in fact are somewhat gratifying in the face of the general decline in business all over the world. While the total figures are not as large as in 1920, it must be kept in mind that the prices of material and to some extent the rate of wages, were lower in 1921, so that the volume of building in Calgary during the present year was equal to that of the previous year, although the total value was not so large.

The building permits January 1st to October 31st, 1921, amounted to $2,020,800 as against $2,532,200 for the same period in 1920. The chief items making up this total are: 133 houses, improvements to Royal Bank, new warehouse for Vernon Fruit Co., several new coal sheds, new warehouse for Lake of the Woods Milling Co., new show-rooms and garage for Maclin Motors Ltd., a number of retail stores and several schools and churches.

The Alberta Flour Mills, Ltd., added considerable to their building which has been under construction for some time and upon which a large amount of work is still to be done before it is completed.

The largest single items were the rebuilding of the Royal Crown Soap Works, partially destroyed by fire recently, and the Institute of Technology and Normal School, upon which considerable progress has been made, but which will take several months more to complete.

Efforts are being made to increase the activity in the building trade and a convention will be held in Calgary during the first week in March, at which representatives from all over Western Canada will be present. Calgary contractors and the various supply houses located in the city are joining heartily to make this gathering a great success.

The exceptionally dry summer, particularly in the southern part of the Province, resulted in a comparatively light crop and this, with the low prices now prevailing on all kinds of grain, has of course, curtailed the purchasing power of the farming community. On the other hand it has compelled attention to the importance of irrigation in certain districts and considerable progress has been made in this matter. The Lethbridge Northern Irrigation scheme is now well under way with every prospect that it will be completed and in operation by 1923. The new Alberta government are not only giving attention to irrigation, but recently appointed a survey board of well-qualified men to study the whole question of the conditions in Southern Alberta, including soil, soil drifting, irrigation, etc., and, if possible, find a solution for the difficulties.

So far as general industrial conditions are concerned, the factories in Calgary have been pretty well employed throughout the year, although during the past couple of months trade has not been as good as in the earlier part of the year.

SHERBROOKE HAS GREAT ACTIVITY

Improvement in Business Which Set in Last Summer Still Continues—Unemployment is Decreasing—Development Very Satisfactory

By J. H. BROSSEAU, Secretary-Treasurer Sherbrooke Board of Trade

SHERBROOKE.—It is not necessary to look far afield for evidence of increasing activity of business. Though opinions regarding the business outlook vary considerably, there is no question that the improvement in business which set in last summer still continues. Industrial and commercial activity is growing and unemployment is decreasing. That is the local condition but improvement in general can never continue unless it is backed by national and international improvement.

The industrial development during the year 1921 in Sherbrooke has been satisfactory from many points of view. The completion of the new plant of the Canadian Connecticut Cotton Mills; manufacturers of tire cotton fabrics, represents an investment of over $5,000,000, and in normal times will give employment to over 2,000 employees. The new plant of the Julius Kayser Company was completed this year. Their production consists of silk gloves, hosiery and underwear and represents an investment of over $3,000,000, and gives em-



A section of the Eastern Harbor Terminal District being developed by the Toronto Harbor Commissioners comprising approximately 700 acres available for new industries.

ployment to about 1,000 employees. The Superheater Co., Ltd., manufacturers of superheaters for locomotives, marine and stationary boilers; number of employees 150, cost of plant $250,000. The extension of the Sherbrooke Machinery Company, manufacturers of pulp and paper machinery, was erected at a cost of $100,000, and will enable this concern to double its production; number of employees, 100.

J. H. Bryant, Ltd., manufacturers of aerated waters, is one of the most modern plants of its kind in the country, which was erected at a cost of $75,000. This concern is doing good business. They give employment to over 50 employees. The new plant of the Canadian Sturdy Chain Company, manufacturers of gold, silver and platinum jewelry, was erected at a cost of $50,000. This new organization will give employment to a personnel of 150. Goupil, Ltd., manufacturers of chocolate, candy and ice-cream, have erected a modern plant of brick construction at a cost of $50,000 and give employment to about 50 employees.

The Office Requirements, Ltd., manufacturers of blank books, loose-leaf system, rubber stamps, etc., purchased a three-storey building at a cost of $50,000 on the main business thoroughfare. This concern is doing good business, and gives employment to 50 employees. The new plant of the Pressure Proof Rings, Ltd., manufacturers of piston rings was also completed this year at a cost of $25,000. Number of employees, 25. Another new industry for Sherbrooke is the Canadian Vesta Battery Company, Ltd., manufacturers of automobile batteries and is an additional link in making Sherbrooke an automobile manufacturing centre. At present, we have large factories manufacturing automobile tires, tire cotton fabric, rubber accessories and piston rings.

In reference to the industrial situation in Sherbrooke at the present time, we can say with satisfaction that during the last depression, not one of our plants has been shut down, although some had to curtail production, but to-day we find all our industries busy and increasing their production. The increase in incoming orders is in evidence more and more as we are nearing the new year.

The Board of Trade at the present time is in negotiations with two firms, manufacturing accessories of the automobile industry. It is also in negotiations with two large concerns, manufacturers of asbestos products. If these four concerns can be located in Sherbrooke, it will have the effect of revolutionizing its industries and should cause a boom in all lines of business. In all principal industries, conditions appear to be steadily improving and prospects are brighter. I believe a reduction of freight rates would lead to greater confidence in business revival. Therefore, we are confident that within a short period, the local industrial situation will be again on a normal basis.

ST. JOHN HAS MANY EXTENSIONS

Although Few New Industries Have Located in St. John The Established Ones Have Built Extensions

By R. E. ARMSTRONG, Secretary-Treasurer St. John Board of Trade

ST. JOHN.—The past year has been a comparatively quiet one in this vicinity, so far as new industries are concerned. Some of the older industrial firms have been extending or improving their plants. The Cornwall & York Cotton Mills Co., have just completed an extensive power house, alongside their York mill. T. McAvity & Sons, are making preparations for the carrying on of an extended business in brass work, valve, pipe and machine construction at their new plant.

Mr. Allan McAvity has also established an oil bunkering tank with a 55,000 barrel capacity to supply shipping with fuel oil. The wharf facilities are not yet completed, but it is intended that the plant shall begin operations when the winter shipping season opens within the next few weeks. The old foundry firm of James Fleming have added the handling and repair of automobiles to their machine plant and have been functioning along that line the past summer.

Clarke Bros., of Bear River, N.S., have established a paper and fibre manufacturing plant at Glen Falls, in the suburbs of the city. Up to the present their manufacturing has been confined to fibre cases. The Stephen Construction Co. have just recently acquired the old Lee brick yard, East St. John, and will resume the manufacture of bricks in a short time. This plant has not been operating for several years.

Spice manufacturing on an extended scale is being carried on by the Canada Spice and Specialty Mills, who have taken over the building formerly used by the Dearborn Spice Co. G. E. Barbour Co., who have been in the spice business for several years, have acquired the Ready Beverages buildings in the centre of the city, and have greatly extended their plant.

Two large ice cream plants have been added to the industries of the city within the past year. These are the Purity Ice Cream Co., and the Pacific Dairies, who have just completed a modern brick factory in the heart of the city. The former Smith foundry has within the past year been acquired by the firm of Harrigan and Howard, who are carrying on under the firm name of the Courtenay Iron and Brass Works.

The Campbell and Fowler edge tool manufacturing plants have within the past year become merged together and are now functioning as Campbell & Fowler, Ltd., manufacturing auto springs and edge tools. The Murray Co., of Canada, and the Wilson Chemical Co. are carrying on a joint and growing business in the manufacture of fruit extracts. Among recent additions to metal working plants of the city are the Peerless Motor and Machine Shop; Murphy Bros., edge tool makers; Dick & Dodge, machinists.

GALT HAS STEADY GROWTH

Several New Industries Find Accommodation—Season Has Been Active in the Building Trades

By HENRY J. FOSTER, Secretary of Galt Board of Trade

GALT, Ont.—During the year 1921 this city has witnessed considerable activity in the building trades, the largest building under construction being a three storey steel, brick and stone structure for the Public Utilities Commission. It will house the sub-station equipment, sales room and business office of the Hydro Department, and also the business office and warehouse of the waterworks department. The estimated cost of the building with its equipment is $200,000. Another large structure under construction is an arena which is of steel and brick and will cost $90,000. A new building for the Royal Bank of Canada and a four-roomed addition to St. Andrew's School, are two large jobs finished this year.

There have been few additions to industrial plants. Among those that have been put up is a two storey brick extension 112 x 96 feet to the plant of P. W. Gardiner & Son, sash and door manufacturers. W. A. Dixon has erected a new two storey brick bakery capable of producing 20,000 loaves a day.

New industries which have started this year, having found accommodation in existing buildings, include the Arrow Signal Lamp Company, Beaver Saw Works, Galt Chemical Products Limited, Galt Wood Products Company, Gill Brass Goods Mfg. Co., Hi-Speed Tools Company, A. E. Johnston, manufacturer of wicker furniture, and the Stevens Pattern Company.

The corporation has spent about half-a-million dollars on municipal improvements. New pavements alone will cost approximately $350,000. This will provide for about six miles of pavements. Some $150,000 has been expended on sewers, sidewalks, curbs and gutters.

OSHAWA HAS FORGED AHEAD

Although Feeling Pressure of Times Expansions Have Taken Place Along Various Industrial Lines

By J. A. McGIBBON, Secretary of Oshawa Board of Trade

OSHAWA.—The industrial situation in Oshawa has like other manufacturing centres felt the pressure of the present hard times, but in spite even of that it has managed to forge ahead to a considerable extent and to expand along various industrial lines.

The General Motors of Canada are to make Oshawa their export centre and for this purpose great changes will be necessary. The Felspar Glass Co. have located here and a new factory is now in course of erection. The McCulloch Auto Body Co. have moved into new and more spacious quarters; The Pedlar People are now located in their new plant and trade conditions in their line are looking better.

Several new buildings have been erected during the year including the new Bradley Block, Bank of Montreal, Union Bank and a large addition to the Dominion Bank, the old Queens Hotel has been turned into an up-to-date suite of stores, while Messrs. Jury and Lovall, druggists, have added two new buildings in the business section of the town. Other new buildings are The Engle Block, C. M. Anderson, T. H. Everson, R. S. Virtue, Oshawa House and Land Co., and the Bassett and McLeese Block. Several fine residences have been erected during the year.

WOODSTOCK SECURES PLANTS

Four New Industries Locate During Year—Textile Trades Have Been Active But Woodworking Quiet

By H. SYKES, Secretary-Treasurer Woodstock Board of Trade

WOODSTOCK, Ont.—This city is a woodworking and textile centre. It was fairly busy during the summer months in textile production and of late has been advertising for girls. These industries are operating to capacity and some, in fact, are working overtime. Prospects in this business are that the different factories will be busy till spring.

The woodworking industries were very quiet throughout the summer months. Several of them were shut down for short periods and now are operating on short time with reduced staffs. However, during recent weeks orders have been coming in a little more freely and the outlook seems to be that business will be fairly good up to the end of January.

A rather unusual feature of the labor situation here is the fact that during the summer months a large number of men who were laid off found other kinds of work to do, and few indeed were unable to get employment of some sort.

The metal trades are busy. Particularly is this so in the stove industry.

During the year four new industries established themselves in this city. They were the Kirsch Mfg. Company, of Sturgis, Mich., manufacturers of curtain rods and house furnishings; Canadian Ironing Machine Company, manufacturers of the Simplex Ironing Machine; Lewis E. Myers & Company, of Valparaiso, Ind., manufacturers of desks; and also a local organization, the Milko Company, Ltd., manufacturers of milk products.

Municipally the city has been very active this year in carrying out permanent improvements. The corporation's area of permanent streets has doubled in the past ten months at a cost of $162,539, with a total expense for permanent local improvements of $214,035. Generally speaking the merchants had a fairly good year, and are looking forward to a prosperous trade throughout the holiday season.

NOTHING WRONG WITH EDMONTON

Crops Have Been Good, Grain Has Been Sold, and Returns Are Reflected in Improved Collections

By J. BLUE, Secretary Edmonton Board of Trade

EDMONTON.—Speaking on the keynote in the business community of Edmonton, Frank Pike, in his address before the annual meeting of the Edmonton Board of Trade, hit the nail on the head when he said: "There is nothing wrong with Edmonton and the great district surrounding the city, though it cannot be denied that conditions in Edmonton are reflected by conditions on the outside. Crops have been good in the country, and notwithstanding comparatively low prices, the grain has been sold. The returns are reflected in improved collections and payment of outstanding obligations."

Industrial plants in Edmonton are working well up to capacity, and a number report that they are behind with their orders. During the year two new enterprises have been established in the city, namely, the Dominion Furniture Co., and the Dominion Carton & Printing Co. Both are making satisfactory progress and increasing their output every month. The North West Biscuit Co. has within the last few weeks moved into a new factory costing over $200,000. A few others have enlarged their premises and increased their equipment. There are no idle factories or stores in the city. If a new firm should decide to commence business in Edmonton, it would have to build its own premises. During the building season of 1921 over two hundred homes have been built, mostly by the owners at an average cost of over $4,000. This has done much to relieve the housing problem as well as unemployment. The best proof that Edmonton is not losing any sleep over the future, is that their population has increased 88 per cent. in ten years.

BRANTFORD NOT DISCOURAGED IN SPITE OF DIFFICULTIES

Agricultural Factories Have Been Hit Hard—Additions to Factories Have Not Been Very Active—Better Times Ahead

By W. H. WOOD, Secretary Brantford Chamber of Commerce

BRANTFORD, Ont.—Unfortunately you place us in a rather embarrassing position when you ask what developments have taken place during 1921, because at the present time Brantford has considerable unemployment, due to the fact that the bulk of her industries are engaged in the manufacturing of agricultural implements.

Additions to factories this year have been few and far between. A number however have taken advantage of the opportunity presented through the unemployment period of thoroughly renovating and repairing their plants. This has given work to quite a number of men. A few of the larger establishments are working short time and on the relay system, that is, one group of men may work three days, and another group of men carry on for the next three days and so on. The effort has been made to provide employment first for married men with families.

During the year the Dominion Flour Mills erected an elevator with a capacity of 100,000 bushels. Recently a successful campaign was held during which funds were collected to care for women, children and invalids, who being unable to work may be in need.

Following is a list of the names of recently established industries. Bradley's Machine Shop, Brantford Brass Foundry, Brantford Felt Novelty Co., Brantford Pattern Works, Brantford Washing Machine Co., Canadian Cutlery Co., Canadian Electrical Products Co., Charlton & Hoag Co., Ruddy Mfg. Co., Lockwood Textile Co., Moyer Printing Co., Parisian Knitting Mills, Williams Tool Corporation, Waltham Grinding Wheel Co., Schuler Button Co., and Brant Foundries.

We are not feeling pessimistic, however, because we are hopeful that the situation will soon show signs of improvement, when Brantford can once more show that it is Canada's export manufacturing city.

STRATFORD CANNOT COMPLAIN

No New Factories Have Located in Stratford During 1921, But Several Plants Have Enlarged Their Premises

By A. W. DEACON, Secretary-Manager Stratford Chamber of Commerce

STRATFORD.—Although having no entirely new factories commence operations in 1921, Stratford has progressed in other ways. The Kindel Bed Co., Ltd., and Duftons' Ltd., both enlarged their plants, and are at present working over normal capacity. A new foundry also started operations during the year, and is reported to be making good progress. The textile industry is somewhat quiet, but the remaining industries are all working fairly well to normal conditions.

NEW INDUSTRIES FOR WALKERVILLE

Several Industries Have Started Up During 1921—Cover Quite a Varied Field—Business Outlook is Good

By F. MACLURE SCLANDERS, Commissioner of Border Chamber of Commerce

WALKERVILLE.—Several new industries have started up in Walkerville during 1921. These cover quite a varied field, and the following list gives the names of these new firms and their lines of manufacture.

Canadian Name Plate Co., manufacturers of all sorts of name plates, etc.; Crown Battery Service, this firm handling batteries and service in connection with the same; Dodge Bros., where the Dodge car will be partly made and assembled; Fournier Mfg. Co., manufacturers of gas heaters, sink valves, etc.; McLennan Chemical Co., washing fluids; J. D. McMullan, proto engraver; Reo Motor Car Co., also a part manufacture and part assembly proposition; Atlas Chemical Co., various sorts of chemicals; Peter Smith Heater Co., street car heaters, etc.; Frontenac Pattern Works, makers of all sorts of patterns; Canadian Automatic Barrel Machinery Co.; also the Universal Metal Products Co., makers of bath tubs, etc.

Two of the above concerns, while not actually in Walkerville, are in the surrounding districts, and come under the same heading.

GUELPH HAS BEEN GOING NICELY

Various Additions to Existing Plants Have Taken Place—Two New Industries Have Located in Guelph

By H. WESTOBY, Secretary Guelph Chamber of Commerce

GUELPH.—Although there have not been many new additions to Guelph industries during the current year, things have been going along nicely.

The Schnarr Screw and Bolt Co., and J. T. Arnold & Sons are the only two new industries actually secured. The Canada Ingot Iron Co. completed in the spring of this year its new factory, and is now occupying it. The Gilson Mfg. Co. also completed in the spring of this year a large addition to their premises, which they occupied during the summer. We have at the present time 129 industries in Guelph, employing 3,005 employees, and manufacturing some thirteen million dollars' worth of material of different kinds in each year. The industrial situation in this city is exceptionally good, and president E. W. Beattie of the C.P.R. during a recent visit, stated that Guelph was the one bright spot in Ontario. The textile industries are exceptionally busy, as are also the rubber companies, but the iron and steel industries are showing a tendency to slacken off.

We are doing a large amount of work at the present time, such as reconstructing the street railway, and during this summer an unusually large amount of street paving has been gone on with, and as a consequence there is practically no unemployment in the city, and we are all looking forward to the incoming winter with complacency.

BRANDON'S BUILDING ACTIVE

Permits For Year Have Totalled Close to $1,000,000—Several Firms Establish Offices

By H. L. CRAWFORD, Secretary Brandon Board of Trade

BRANDON, Man.—The past year in this city has been noted for its great building activity, and for the fact that building permits during the year totalled close to $1,000,000. Several large firms have established offices here during the past twelve months, the Imperial Oil, Massey-Harris Co. Ltd., and the Western Grocers Ltd., being among the largest of the firms to locate. The Imperial Oil Company erected a plant costing $350,000, while the Massey-Harris people took over the large Gordon Mackay building, and are using Brandon's advantageous position as a distributing point for the company's machinery in the west.

A large iron foundry will probably open here within a few months' time, arrangements being made for the purchase of the Manitoba Engines Ltd. The Hanbury box factory will also open at the commencement of the new year, and many smaller firms have moved to this city and have commenced business. Prominent among the extensions made by large local firms, were the additions to the Massin Fur Company, and Nation and Shewan's Ltd.

Realizing the importance of Brandon's position as an agricultural centre, the provincial government rendered assistance to the Winter Fair Association, and the result is a new winter fair arena costing in the neighborhood of $150,000. The L. R. Steel Company has purchased a site in this city, but their offices have not been opened, although it is stated that the company intends starting business early in the new year.

WINNIPEG REPORTS GOOD PROGRESS

Various Important Undertakings Have Been Gone On With—Large Power Plant Activities Are Under Way

By W. E. MILNER, Managing Secretary Winnipeg Board of Trade

WINNIPEG.—Two important undertakings linked up with the industrial expansion of Winnipeg are the extension to the City of Winnipeg Power plant on the Winnipeg River, giving an additional capacity of 30,000 h.p. and increasing the capacity to 60,000 h.p. The Manitoba Power Co. have also commenced operations on a power plant on the Winnipeg River which will have an ultimate capacity of 168,000 h.p. and will cost $10,000. The first unit to be constructed this year, will be capable of producing 28,000 h.p., although the work to be carried on will complete the plant to a stage where additional expansion will only necessitate the installation of machinery.

Among the largest contracts of the year in downtown Winnipeg are: the addition to the Olympia Hotel, $200,000; the Manitoba Medical College, costing $175,000; Aberdeen School, $190,000; addition to the Union Bank of Canada, $120,000; warehouse, costing $100,000. Following are several of the largest undertakings of the year:

Olympia Hotel at cost of $200,000; school work, $645,000; stores erected, $78,000; warehouses built, $314,000; garages, $84,000; alteration to large restaurant, $75,000; club houses, $38,000; mission hall, $29,000; theatre, $260,000, and a bank building at $120,000. Of course these are only a few items, and comprise but twenty- seven projects.

SASKATOON ADDS TO SIZE

Number of New Shops and Industries Have Opened During Past Two Years, Showing Healthy Growth

By CHAS. T. STACEY, Commissioner of Chamber of Commerce

SASKATOON, Sask.—During the years 1920 and 1921 a number of new industries and shops have been opened, showing a healthy growth despite adverse trade conditions generally in recent months. The following is a list of the new business places opened:

Automobile Clearing House, Ltd.—Garage and repair shop; Canadian Motors Ltd.—Auto sales; Saskatchewan Motors Ltd., garage and repair shop; B. Jerd, auto repair shop; Louis Mons & J. E. Faulkner, electric shop and work shop; Wm. Malcolm, shoe repair; W. J. Davis, machine shop; Simmons Ltd., wholesale beds and bedding; R. G. Godfrey, plumbing and heating; Warren Mfg. Co., sash and door factory; Western Granite and Marble Co., Ltd., stone cutters; Hennesay Three Star Garage, auto repairs and garage; A. Stanley Jones Co. Ltd., agricultural implements; Stewart Sheaf Loader Co. Ltd., manufacturing sheaf loaders; E. S. Farewell, candy manufacturing; Consolidated Optical Co. Ltd., optical works; Chas. Lutes & H. I. Sherwood, radiator repair shop; J. C. Comrie, steam laundry; O. Faille, candy manufacturer.

FORT WILLIAM YEAR GOOD

Most of Industrial Plants Have Been Going Fairly Well—Improvements and Extensions Have Been Made

By W. WEBSTER, Secretary Fort William Board of Trade

FORT WILLIAM, Ont.—All industrial plants have been operating constantly during 1921 with the exception of the Canadian Car & Foundry Co. It, too, will be running on car repair orders at an early date. Material is being assembled now.

During the year a pulp plant has been erected by the Fort William Paper Company, with a capacity of 250 tons of dry pulp per day. Operations commenced on April 30th and the plant has been operating continuously ever since. An addition to the grain storage and cleaning elevator, owned by the Northwestern Elevator Company, is at present under construction. The contractors are Barnett & McQueen. There is now being built 1200 feet more or less of break water revetment wall, protecting the water front of the Mission industrial area. The erection of the coal unloading bridge at the plant of the Fort William Coal Dock Company on the Mission Industrial area has been completed.

The live stock industry has been inaugurated here during this fall, 8,000 sheep being housed and fed at present with more to follow. The inducement is that there is an abundance of elevator screenings which can be had for the hauling from elevators.

EXPERIENCE FAIR BUSINESS

Belleville, Owen Sound and Brampton Report Mod erate Conditions — Sydney, C.B. Has Been Quiet But Has Eye on Future.

OWEN SOUND, Ont.—Mr. R. D. Little, secretary of the Owen Sound Board of Trade, reports that there has been very little activity this year. Some of the manufacturing concerns are running to full capacity but others are not employing over 50% of their usual staff. No new industries have started during the past twelve months but it is hoped that the coming year will see some developments.

Belleville.—Mr. Jamieson Bone, President of the Chamber of Commerce, states that there have been no particular developments in Belleville during the past year. It is gratifying, however, that arrangements have almost been completed for a couple of new industries. Some of the manufacturers during the past two or three months have experienced a renewal of export business in machinery connected with the building trade and also in evaporated and canned foods. The hardware manufacturing companies have not as yet experienced any of the depression so common to other trades Two such industries are employing about 100 hands each. They have been running full time for several years and are today fully occupied. They have business in sight to keep them running steadily through the winter.

On behalf of Sydney, Cape Breton, Mr. F. C. Kimber, secretary of the Board of Trade, reports that things have been quiet there. Industrial activity has been quiet during 1921. "All we can say," remarks Mr. Kimber, "is that we have been marking time as cheerfully as we know how and look for better times which we confidently hope are not far away in the future."

Replying from Brampton, Ont., Mr. A. R. Hewetson, secretary-treasurer of J. W. Hewetson Co., Ltd., states that he is not able to report much activity for that town during 1921. In common with other places things have been quiet. At the present time shoe factories are very busy, as is also the rubber factory which is running two shifts. The rest of the industries in Brampton are holding their own under existing conditions.

REGINA IS WELL SATISFIED

Building Permit Record Totalled Close to Two Million Dollars Up to October—Extensions Are Made

By CHAS. A. COOKE, Secretary-Manager Regina Board of Trade

REGINA.—While industrial expansion in Regina during the current year has not been spectacular, the situation as revealed by the building permit record has been eminently satisfactory. To the end of October permits totalled within a few dollars of two millions, and for the complete calendar year will exceed that mark.

Residential construction has been the predominant factor, though several commercial and educational enterprises have helped to swell the total. New business premises have been erected by Bowman Bros., Ltd., for the distribution of auto accessories. Campion College, erected by the Catholic community, entailed a cost of $200,000. The stone-cutting plant of Alex Young, Ltd., has been rebuilt.

Extensive changes have been effected in the refining plant of Imperial Oil, Ltd., some $750,000 having been expended in the conversion of the system into a continuous operation plant, and in the perfecting of the condenser system. Over four hundred residences have also been added to the city during the year.

PETERBOROUGH IN GOOD HUMOR

Three New Industries Have Been Added and Three Others Recently Started Operations—Outlook For 1922

By LEON FRAZER, Secretary of Peterborough Chamber of Commerce

PETERBOROUGH, Ont.—The general trade depression has had a direct effect on the establishment of new industries in this city, but nevertheless we are pleased that during 1921 several industries have been added to our list and are now in operation. They are the Canadian Tent and Awning Company, canvas goods; Canadian Sanitary Ice Supply, manufactured ice; Elliot Mfg. Company, Ellico Wool. The following companies have also just recently commenced operations:—

The Red Arrow Tires, Limited, cord and fabric tires and inner tubes; Birmingham Motors, non-axle cars; Alliance Brass Company, Ltd., brass castings.

During the year the Canadian General Electric Company

and the Canadian Packing Company have made considerable extensions to their plants. It is our firm belief that with the general trend towards normalcy a marked increase in the location of manufacturing concerns will be the experience of 1922.

ST. CATHARINES GETS INDUSTRIES

Locates Two During Past Year — While Older Firms Are Quiet—Indications Point to Increased Activity

By M. M. MAXWELL, Manager Chamber of Commerce

ST. CATHARINES, Ont.—As to industrial development we can report that during 1921 two industries have located here. They are the Guaranty Dyeing & Finishing Co., Ltd., whose line of work is the dyeing and finishing of silk fabrics including broad silks, piece goods and artificial silks, etc., and a motor truck industry who expect to commence operations soon.

With regard to the older industries, most of these are operating with a reduced staff but indications point to an increased activity in the near future. One firm is expecting to operate at full capacity very soon.

SEVERAL DEVELOPMENTS IN SARNIA

Air Pumps For Automobiles Now Manufactured—Artificial Ice Plant Opened Up—Other Moves of Interest

By GEO. P. FRANCE, Managing Director Sarnia Chamber of Commerce

SARNIA.—During 1921 several developments have taken place in Sarnia. The National Engineering Co., manufacturers of air pumps for automobiles and creamery equipment started operations during this year, and the Holmes Foundry Co., who produce grey iron castings for automobiles, almost doubled their capacity.

The W. D. Ferguson, artificial ice, opened up in 1921; the Sarnia Cement Products, makers of cement blocks, tiles, etc., commenced operations, and the Hayne Cooperage Co. moved their plant from Brigden to Point Edward, and commenced work during this year.

CHATHAM SEES FEW CHANGES

Although No New Industries of Note Have Opened Up the Regular Plants Have Been Working Steadily

By W. R. LONDON, Chatham Chamber of Commerce

CHATHAM.—Although the regular industries have been going in good fashion, the year 1921 has brought only the following changes:

The Mack Furnace Co. are now making a line of hot air furnaces, and the International Harvester Co. of Canada have taken on at their local plant the manufacture of speed trucks. This line will now be made in Canada and distributed from Chatham instead of being manufactured in the United States as heretofore.

NEW ENTERPRISES FOR VICTORIA

Varied Lines Have Started Up, These Including Fish—Toys—Gramophones—Concrete Blocks, etc.

By A. GORDON SCOTT, Secretary of Victoria Chamber of Commerce

VICTORIA.—Several new enterprises have been established in Victoria during the current year. Following are the firms which have commenced operations in 1921, together with their lines of manufacture:—

The Wholesale Fish Co., fish canning; Veterans' Product Co., fish fertilizer; Henson & Dyson, concrete blocks; Canadian Abrasive Paper Co., sandpaper; B. C. Yacht & Boat Builders, boat building; Hiker Manufacturing Co., mechanical toys; P. E. George, gramophones; Victory Attachable Rubber Soles and Heels Co., rubber soles and heels; Canadian Western Woodworkers, wood-working; Henshall Fish Products (Sooke, B.C.), fish by-products; and the Sidney Roofing and Paper Co., roofing paper, etc.

SOME FEATURES OF THE PRESENT BANKING SITUATION IN CANADA

Canadian Banks Have Been Very Fortunate When Compared With Those of Other Countries —Premium on New York Funds Will Not Disappear Immediately

By SIR FREDERICK WILLIAMS TAYLOR, President of Bank of Montreal

THE BANKING world is passing through the most troubled period in its history, but it is fortunate that this state of affairs has been unattended by financial panic. Inevitably, losses brought about through the unprecedented drop in the price of commodities and the heavy decline in the market value of securities have in many instances fallen indirectly upon the banks.

More money has been lost by foreign banking institutions operating in certain directions abroad than ever before in a similar period in any country. I think it may be asserted that in Canada banks generally have been fortunate when compared with those of other countries, and while doubtless all Canadian banks have lost money in loan accounts that have "gone bad" during the past year, no disaster has developed.

A year ago the inflation in trade was at its height, as is demonstrated by the fact that the aggregate loans in Canada of Canadian banks were 80.8 per cent. of their total deposits within the Dominion. The latest figures available show the ratio as 77.5 per cent.

Trade Deflation

The subject of trade deflation has become a world-wide theme, but the trouble is that many of our merchants and manufacturers simply cannot deflate at present. The demand for their goods has disappeared, while money borrowed from the banks in anticipation of sales cannot be repaid—hence what are termed "frozen credits." Bank loans in many cases have thus become fixed, and the liquid surplus in mercantile balance sheets represented by inventories has, for the time being, lost its true meaning. As usual, the banks have come to the rescue, and, speaking for the institution which the writer has the honor to represent, we have maintained to the limit of prudence our well known and century-old policy of carrying deserving customers in difficult times.

The premium on New York funds is still with us, with little prospect of departure in the near future. The rate is but 8 per cent. as compared with 15 per cent. on the 5th December, 1920. The fact that Canadians have become accustomed to the penalty of doing business abroad with an inferior domestic dollar, does not alter the fact that Canada is at a very serious disadvantage indeed in its monetary dealings with the United States of America.

I shall not go into the matter except to say that the premium on New York funds will not disappear until we buy many millions less of goods and materials abroad or increase our exports. The premium would have been higher had it not been that Canada, as stated elsewhere, has borrowed in the United States this year $144,000,000, which sum, so far as exchange is concerned, must be added to our exports or deducted from our imports.

Every Canadian should understand, however, that this is merely alleviation, not cure. Economically, it would be far better than we should borrow within our own borders. By borrowing abroad we add steadily to the already great sum of interest on our foreign obligations annually sent out of the country, the capital amount aggregating nearly $3,500,000,000.

Canada's Immigration Outlook

by

Robert J. C. Stead
DIRECTOR OF PUBLICITY
DEPARTMENT OF IMMIGRATION AND COLONIZATION



FREDERICK A. WALLIS, United States Commissioner of Immigration for the port of New York, in a recent article has the following to say about world immigration conditions:—"Europe, with 3,312,613 square miles of land, has 120 persons to the square mile; Asia, with 17,206,000 square miles, has 50.7 persons to the square mile; Africa with 11,622,619 square miles of territory, has 12.3 persons to the square mile; Australia, with 3,312,613 square miles, has 4.9 inhabitants to the square mile; the Polar Regions have 5,081,935 square miles with no population; North America, with 8,589,527 square miles of land, has a population of 150,000,000, or 16.3 inhabitants to the square mile, and South America, with 7,570,015 square miles, has 7.4 persons to the square mile.

"In the contemplation of this distribution of the earth's population, two conclusions may be drawn, which lead directly to the lesson of immigration in the modern world. Europe has 91 persons to the square mile more than the world's average, while North America, peculiarly blessed with earthly resources of great wealth, has 13 persons to the square mile less than the earth's average.

"Belgium has 637 people to the square mile, while many of our Western states are so sparsley populated as to be amusing by comparison.

"The records of the last few weeks show that Texas has 17.5 people to the square mile, Washington only 19.6, Oregon 8.1, and Arizona 2.92.

"It takes no prophet to foretell that in the operation of Nature's great law of equalization, the trend of immigration will continue, as it has been for many years past, to be from Europe to the Americas.

"It requires no science of logarithms and differential calculus to estimate that, even should immigrants come to this country at the rate of a million per annum, it would require centuries to bring about an equality with Europe in the matter of population to the square mile."

All that Mr. Wallis says about world conditions in the immigration movement applies to Canada, only more so. If the United States, with about thirty-three persons per square mile, must expect a continued movement of population from the more densely settled countries of the world, how much more so shall Canada, with less than three persons to the square mile, expect such a movement? The point of this argument is not dulled by suggesting that a considerable portion of Canada's area is unsuitable for habitation. It is not so generally accepted as it used to be that there is a very considerable portion of Canada's area unsuitable for habitation; certainly the area incapable of supporting human life is very much smaller than was at one time supposed. Within a short lifetime we have seen the wheat growing centre move from the international boundary northward until in the present year probably the greatest wheat crops in Canada were harvested in the Peace River and Grande Prairie districts, and far beyond the utmost range of wheat-growing the cultivation of fodder crops, the dairying and livestock industries, can be carried on with success.

Land For Farming

A conservative estimate places the amount of land in Canada fit for farming purposes at 300,000,000 acres, of which only about 50,000,000 acres are as yet under cultivation. It is therefore apparent that Canada can support an agricultural population six times as great as at present even without making allowance for the greater intensity of agriculture which always accompanies population.

If these facts are facts, if Canada can support six times



A group of immigrants arriving at Quebec.

as many farmers as at present—with, of course, a proportionate increase in urban population—it is apparent that the immigration problem is one which we have with us whether we wish it or not. The people of the congested areas of the world, where life can be maintained only by the most unceasing effort and even then on a comparatively low plane, are not going to look uncovetously toward a land where the opportunities for making a livelihood have as yet been developed to only, let us say, about one-sixth of their possibilities. Canada must face an immigration problem whether she wishes it or not.

But there is no reason why Canada should not face such a problem with confidence and optimism. In that problem lies the solution of most of her other problems. Let her solve the immigration problem and the other problems in a large degree disappear of their own accord. It is perhaps not necessary to elaborate that in this article, but two brief but authoritative quotations may be made.

Mr. E. W. Beatty, President of the Canadian Pacific Railway: "It is I think a fact that the two great necessities for this country's advancement, namely, the obtaining of suitable settlers in as large numbers as possible and the attraction of capital for the extension of Canadian enterprise, should be given the most serious consideration now, and not later."

Sir Joseph Flavelle to the Toronto Board of Trade, as reported in the press October 5th, 1921: "I confess to a sense of deep surprise that there is so little aroused public opinion either in government or trade circles or in the press that the one and only remedy for this situation which takes millions of dollars of good money every week and pitches it away is more people, greater production, greater tonnage, more passengers."

From the excerpts which have just been quoted as the opinions of prominent students of Canadian conditions it is evident that not only Canada's future prosperity but the solution of a number of problems which this country now has on its hands is inseparably tied up with the immigration problem. Now, what, exactly, is Canada's immigration problem?

It may be stated in a word that Canada's immigration problem is assimilation. If we could imagine a state in which assimilation was unnecessary then we would have little or no immigration problem, but where there is immigration there can be no united and homogeneous nationality without assimilation. The speed at which we are able to assimilate newcomers is the limit which has to be placed upon immigration operations.

Assimilation takes two forms: industrial and social. The industrial form is perhaps the most obvious. Unless labor can be found for the immigrant, profitable both to himself and his employer, and without dislocating the relation of other workers to their employment, the immigrant is a help neither to himself nor to the country. It cannot be too strongly stressed that what Canada needs, fundamentally, is not immigration, but production. The immigrant is welcomed as a means to that end. If he is not a producer he is an increased liability rather than an asset.

Social Assimilation

Social assimilation of the immigrant is a more abstract but even a more important matter than industrial assimilation. It means absorbing him into the social body of Canada. It is a finer, more delicate and more far-reaching process than industrial assimilation. It is accomplished only by imbuing a newcomer with Canadian ideals. And here let me say, parenthetically, that it is quite impossible to imbue a newcomer with Canadian ideals unless there are well pronounced Canadian ideals. This thought might easily lead one into a discussion upon the necessity of a reorganized idealism, which can only be built up through a Canadian literature, as the basic necessity in assimilation, but that is a thought probably foreign to the principal purpose of this article.

Canada's problems of assimilation, while great, need not be at all disheartening. We possess certain unique advantages. Our people are themselves bilingual, and the process of assimilation can therefore be carried on both in English and in French. Moreover we possess a great advantage as compared with the United States, for example, in the fact that our immigrants are not necessarily foreigners. Every immigrant who enters the United States is a foreigner, but this is not true of Canada. A large proportion of our immigrants experience no change in their national allegiance when they become Canadian citizens. They are of British stock and



Top View shows farmer's home in Clover Bar District, Edmonton. Owner came to Canada from Old Country only a few years ago, and began on a homestead.

The Lower View shows a farm at Nokomis, Sask. In this case the owner came to Canada 15 years ago with only $500 capital. His farm is now valued at over $50,000.

their assimilation is a comparatively simple matter. Another large source of our immigration is the United States, and while technically the American is a foreigner in Canada, actually he is not. He is not regarded as a foreigner by the Canadian people. He is regarded as a member of the same race although possibly of a different branch of the race.

These facts help make Canada's problem of assimilation easy and they also lie at the basis of much of Canada's immigration policy. Our active efforts to obtain settlers are mostly confined entirely to the two sources of immigration just referred to. There is naturally and inevitably more or less immigration from other countries as well, much of which is of a highly desirable nature, such as that which springs from France, Belgium, and the Scandinavian countries. Of our total immigration of 148,477 for the fiscal year ended March 31st, 1921, 47,687 were English, 6,384 Irish, 19,248 Scotch, 943 Welsh, 1,645 Belgian, 861 French, 1,042 from Newfoundland. 1,705 Scandinavian, 595 Dutch, 235 Swiss and 48,169 from the United States. It is therefore seen that our immigration, except for a comparatively small proportion, springs from the particularly favorable sources which have been mentioned.

It need hardly be added that the fact that Canada's immigration comes so largely from such favorable sources has not come about by accident. It is the result of the cultivation of desirable fields no less than of restrictions enforced against undesirable individuals no matter from what country they may come. The Canadian immigration regulations are based on the theory that Canada is entitled to the best possible type of citizen. These rules are applied as humanely as possible, but always with the recognition of the fact that the interests of Canada as a whole are greater than the interests of any individual.

What Course Should Be Taken?

Just what course Canada's immigration activities in the future will take will undoubtedly be governed to some extent by the conditions which arise. Since the war conditions have been such that extreme care had to be taken in the working out of any policies. As the people of the world settle into more fixed and dependable attitudes toward each other and the world as a whole, policies extending over greater groups and over longer periods will be possible.

One relatively new phase in the situation can hardly be overlooked. Until recent years Canada was in a position to offer free government land to all who would undertake to become settlers upon it. There are still large areas of free government lands, but for the most part they are now more or less inaccessible to railways and their settlement would necessitate the extension of our already somewhat elaborate railway system. If the settler, therefore, can no longer be offered the advantage of free land, and if the fact is recognized that to start on any other basis demands capital, a new and difficult problem is injected into immigration matters. It is a problem which is worthy of most serious consideration by the Canadian people, and the ability which they have shown in solving other problems leaves no question but that they will find a method of dealing with this new condition in such a way as to promote the general prosperity of the country and to permit of the assimilation of immigrants of the more desirable class in increasing numbers from year to year.

Recutting Silver Spoon Dies

Obsolete dies used in the manufacture of silver spoons are sometimes reclaimed for new patterns by cutting off the face of the die. The removal of 1-4 inch of steel, usually eliminates the old pattern and presents a new face for engraving the new pattern. Economies such as this may seem to be of trivial importance but to the large manufacturer of silverware they are well worth consideration in the aggregate. Not only can an old die be reclaimed and prepared for re-engraving at small cost but the problem of scrapping obsolete patterns is disposed of.

Heat Treatment of Dies

(1) The commonly accepted view that hammering expends itself on the outside of a forging whereas pressing penetrates the whole substance of the forging is erroneous.

(2) In forging between plain pallets, whether by blows or pressure, the metal tends to flow outwards parallel with the faces of the pallets.

The layer of metal next to the pallet, however, is restrained by the surface friction and the surface cooling action of the pallets, and this layer in turn restrains a smaller area of the layer next to it, and so on. Thus a prism or pyramid is built up on each pallet of metal which does not flow to any great extent, the base of the prism being that portion of the pallet which is in contact with the metal.

(3) The boundaries of these prisms are more definitely marked in the case of blows than in the case of pressure, and at a certain point when forging is carried on either at extreme velocity or at a low temperature, the metal "slips" or "shears" on the surface of the prism, creating local heat, which is often visible on the outside of the forging.

(4) In bars of square section or in which the height is not more than the width of the pallet in contact with the metal the upper and lower prisms meet near the centre of the bar. As, therefore, the main vertical force is transmitted through the prisms and these grow smaller in area as the distance from the pallet increases, it follows that the pressure per unit area increases towards the centre. As a consequence the horizontal flow of metal is greater near the centre of the bar and there is a greater thinning action in the central horizontal layers of the metal.

It follows from this that the ends or exterior surfaces of the forging will assume a convex form.

(5) The surface friction of the pallets is about the same under the press and hammer, but decreases slightly as the number of blows or squeezes increases.

(6) The surface cooling action is greater in the case of the press than in the case of the hammer, because of the longer time the pallets are in close contact with the forging.

(7) In bars or forgings in which the height is greater than the width of the pallet in contact with the metal, the top and bottom prisms do not meet and the metal between their apices is in tension. The exterior surface will therefore be convex at points horizontally opposite the apices of the prisms and concave between these points.

(8) It follows from No. 7 that if a forging of circular section be forged between flat pallets, only a narrow portion of the pallet being in contact at each blow or squeeze, the centre will always be in tension and the end will be concave for the most part, but convex in a ring all round the outside This results in a "piping" action in the centre, the action being more intense the narrower the width of pallet in contact with the metal.

Another way of stating this point is that the further we get away from square forging the more do we put the centre in tension, and therefore introduce a "piping" action.

This action takes place both in pressing and hammering, but is more intense in the case of pressing because of the greater cooling effect.

(9) Forcing in prisms makes the metal bulge out sideways and lengthways, and therefore successive blows on different parts of the bar, but in the same direction, produce a wave formation in the metal.

(10) In bars forged to and fro from end to end, first in one direction and then in a direction at right angles to the first, these waves tend to neutralize one another.

(These are a few of the principal points brought out by Harold F. Massey, B. Sc. M. I., Mech. E., in a paper which was presented at Manchester, England).

An interesting sidelight on the iron situation in Canada is the fact that a very small percentage,—less than five per cent.—of the large consumption of iron and steel is derived from our own domestic resources. Important deposits are found in Ontario, Nova Scotia, New Brunswick, Quebec, British Columbia. Present economic conditions interfere with their development.



Canada's Record For The Past Decade

Agricultural, Industrial and Commercial Development During Last Ten Years Has Been Wonderful—Canada is Well Equipped to Continue on Her Forward March of Progress

By Norman S. Rankine
Editor, Agricultural and Industrial Progress in Canada

CANADA'S RECORD of agricultural, industrial and commercial development during the past ten years, has been one of remarkable progress. From the comparatively insignificant status that she occupied amongst the nations of the world in 1910, she has achieved, largely as a result of her participation in the great war and consequent industrial activity and expansion, a position of international importance which the spirit of her people will uphold and extend.

For Canadians have a distinct national spirit; of that there is no doubt; a spirit of active and serious aggressiveness engendered possibly through a knowledge of their accomplishments in the past, of their country's stirring history and struggle to Confederation, and of life in a healthy, energy-arousing climate which produces the very sturdiest manhood and womanhood. If there exists, in the mind of any, doubt as to her ability to continue the forward march of progress and to execute complete economic reconstruction, it should be swept away in the thought of her splendid war record—both at home and abroad—for of all countries that participated in the European Maelstrom, Canada emerged in the most favorable financial condition. What she has done under stress and trial of conflict she can most assuredly carry out in the tranquil times of peace.

Year by year Canadian affairs are commanding increased interest in foreign countries. Readers of foreign newspapers and periodicals know this to be so. Today, in the press of many countries of the world is to be found increasing news of Canada and her activities—financial, industrial, political or otherwise, and particularly is that so in Great Britain and the United States, with which countries Canada has, naturally, the closest trade and financial relations.

A comprehensive survey of Canada's progress during the period under discussion is, of course, out of the question in the brief space of this article. The student of Canadian affairs, if he desires to go into them deeply and fully, must turn to governmental or other hand-books, where he will find, in their statistical data, a record of growth and augmentation which should be at once a source of satisfaction and pleasure. He will find that he has been participating in the upbuilding of a richly endowed country whose march towards that maturity which all Canadians desire, has been both steady and rapid.

Canada's Progress In Ten Years

1910		1920
6,917,000	Population	9,000,000
37,087,388	Crop Producing Acreage	53,050,000
132,077,547	Wheat Production (bus.)	263,189,300
12,082,077	Cattle, Horses, Swine (No.)	15,517,000
2,379	Bank Branches	4,921
24,731	Railway Mileage	38,896
$1,118,694,000*	Agricultural Production	$1,946,648,000
1,247,583,609	Invested in Manufactures	3,034,301,000
106,823,623	Mining Production	217,775,080
29,965,433	Value of Fish Catch	49,321,217
98,789,929	Bank Capital	124,250,338
909,964,839	Bank Deposits	2,228,332,268
298,763,993	Exports	1,287,000,000
369,815,427	Imports	1,064,000,000
101,503,711	Public Revenue	451,336,000

* (1915)

Canada's first industry is agriculture. The total estimated agricultural wealth of the Dominion, according to the Monthly Bureau of Agricultural Statistics, amounted in 1920 to $7,612,151,000 exclusive of certain other miscellaneous products which increase this value a further $23,000,000.

Canadian crop producing acreage in 1910 but slightly exceeded 37,000,000; in 1920 they had jumped to 53,000,000. In the same period, wheat production increased from 132,000,000 bushels to 263,000,000 with respective values of $113,000,000 and $427,360,000. According to the estimates of the International Institute of Agriculture, Canada now occupies second place in the list of world's wheat producers, being only exceeded by the United States. It is expected that the quantity of grain shipped through the port of Montreal this season will approximate 132,000,000 bushels, which is double the

Canadian Products Sent Into World's Markets.

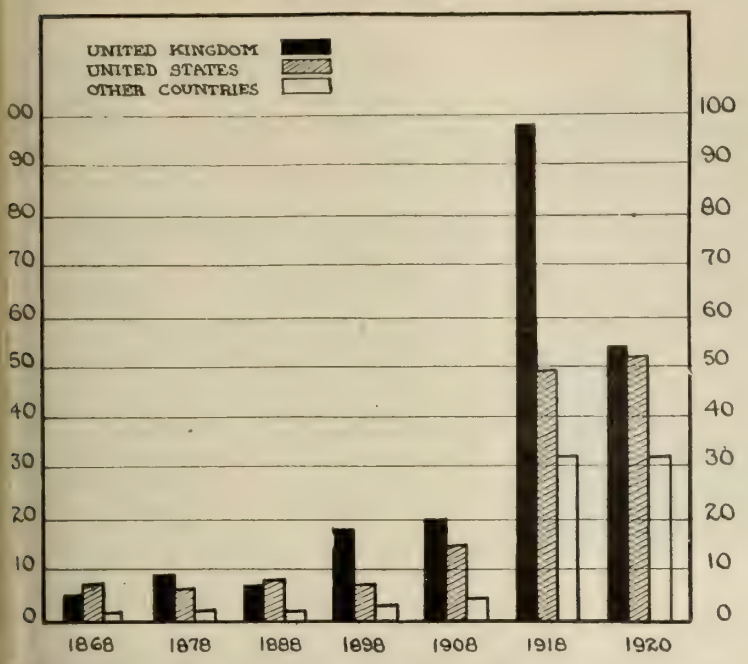


Chart showing value of products sent into world's markets since 1868.

quantity for any previous year. From this we see that Canada is stepping ahead quite nicely.

The value of total agricultural production has increased by over $700,000,000 in the past six years. Since 1910, the three Western Provinces of Alberta, Saskatchewan, and Manitoba, have held the world's wheat championship between them. Eight grand championships have been captured in this period for six of which the "Wheat Wizard," Seager Wheeler, whose name is widely known to all agriculturists, is directly responsible. Prizes for oats, barley and livestock have also become an annual occurrence.

Following the earlier northward march of the wheat belt, the corn belt has apparently crossed the international boundary and gives promise of becoming a staple product of the Canadian West, much to the surprise of the corn growers of the United States.

Horses, cattle and swine have increased from over 12,000,000 to 15,517,000.

The Western prairies, once treeless and bald, are rapidly ceasing to be so, bringing to the farms of the settlers, not only shelter and shade for man and beast, but to the homes, that charm and picturesqueness so typical of the East, and and which only green foliage can impart.

Announcement is now made from one nursery in Saskatchewan that six million trees,—poplars, Russian poplars and caraganas—will be distributed amongst farmers in that province alone next spring.

Good roads also, rapidly constructed and extended, have brought the producer into greater proximity with the markets an added to social intercourse and educational opportunity. While in 1910 there were but few automobiles throughout Western Canada—particularly in the hands of the farmer—a survey at the end of the next decade indicates one car to every twenty-five of the Dominion's total population. Latest figures increase this to one in every eighteen.

Banks Have Expanded

Canadian banks have expanded widely. A decade ago their paid-up capital stood at $98,789,929; in 1920 it reached $124,251,000. Bank deposits—an indication of thrift and prosperity—increased from $909,964,839 to $2,228,332,268 and bank branches from 2379 to 4921 (June 1st.) Canadian banks have manifested an aggressive spirit of extension and established branches in the United States, West Indies, Central and South America, Europe and the Orient. They have inaugurated departments of foreign trade and bureaux of information where all available information is on file at the disposition of their clients, both at home and abroad. Many of them issue handsome weekly and monthly literature of a decidedly interesting and informative character.

In 1910 the public revenue was $101,503,711; in 1920 $451,336 000. Exports and imports were $298,763,993 and $369,815,247 respectively as against $1,287,000,000 and $1,064,000,000, last year's figures.

Mining production has grown from $160,823,623 to $217,775,080. Canada with but one-half of one per cent of the world's population produces 90% of its cobalt, 88% of its asbestos, 85% of its nickel, 12% of its silver, and 4% of its gold and copper.

There was invested in manufacturies ten years ago the sum of $1,247,583,609; at the present time, $3,034,301,000. It is interesting to note that whereas prior to the war there were but some 400 branches of United States industries established in Canada, by 1920 these had increased to approximately 600 and are to-day over 700, with an interest, across the border, growing in intensity as manufacturers and business men realize the advantages to be derived by following in the footsteps of their predecessors. In addition, many British industries have become established here.



A typical farming scene on a Canadian farm.

The value of fish products grew from $29,965,433 to $49,-321,217 while capital invested in fisheries is placed at $29,-633,359.

As is well known, the population at this time approximates nine million—an increase of about two million since the past census. The war had its effect on immigration which dropped from over 400,000 in the fiscal year of 1913 to 48, 537 in 1915, rose slightly in the years 1917 and 1918, slipped back to 57,702 in 1919 and increased to 1,177,336 in 1920. Immigration is a vital subject to Canada at the present time and owing to the Government maintenance of the restrictions act, has fallen off tremendously. Much comment is being now devoted to the subject in the Canadian press and it is apparent that it will be the duty of the incoming government to inaugurate a more constructive policy. Australia, New Zealand and South Africa are actively engaged in soliciting British immigration.

Great strides have been effected in irrigation. Whereas ten years ago, with exception of some small private schemes, of inconsiderable extent, no watered lands were available to the farmer, although surveys of large bodies had been effected in the early nineties. In 1920 there was in Southern Alberta an irrigable area of close to one million acres and surveys covering a further 600,000 acres have been undertaken of which 114,500 are in course of construction.

Progress In Many Lines

The progress of the pulp and paper industry during the past decade has been phenomenal. When the last survey was conducted by the Dominion Bureau of Statistics in 1919, it was found that a total of $264,581,300 was invested in the industry, $69,896,588 being invested in pulp and paper mills, $16,533 276 in paper mills and $178,131,436 in pulp and paper mills. There were 99 mills, 33 paper, 39 pulp and paper mills. In the year 1881 Canada had but 5 paper mills with capital of $92,000 and an annual output of $63,000.

Another industry in which there has been great advancement is that of automobiles. At the end of the year 1919 there was an investment of $57,000,000 in the industry in 1289 plants, scattered through the country, Ontario greatly leading with one half the total plants.

The development of the fur trade dates from the early days of French regime when a monopoly of it lay in the hands of the Hudson Bay Co. It is only of recent years that attention has been given the fur farming industry and periodical fur auctions established at Montreal and Winnipeg. Buyers were attracted from all parts of the globe and their establishment of these auctions as permanent institutions is apparently accomplished, rivalling those of New York, St. Louis, London and other centers.

The year 1919 saw the first survey of the domestic industry. At the end of 1920, there was found to be 582 fur farms in operation in comparison with 419 in the previous year. In this space of time, the value of animals had increased by 50 per cent to $4,632,605. There were 573 fox farms as compared with 414 the previous December. Land and buildings on the fur farms were valued at $1,178,788. The silver fox has made Prince Edward Island famous. All these things have been accomplished in the short space of time under discussion.

What the next decade will bring to Canada is for time to tell. It cannot however, be doubted that Canada's progress will continue with increasing velocity. The great natural resources of the country—of which the main one is agriculture—are yet relatively unexploited. In the Canadian West alone, but one-fifth of its declared available cultivable area is occupied, while 300,000,000 acres await the hand of the husbandman, 34,000,000 of which are within 15 miles of existing railroads. There are many vacant farms in Eastern Canada which should be again settled and Canada is one of the few remaining countries which offers fertile lands on terms within the means of settlers of limited means, located in a land of democratic self-government and a climate acceptable and desirable to the white race. With the development of this vast area of farm lands, a corresponding extension in industry, commerce and all that goes to the building of a great nation, must accrue.

Unsolicited Praise

From M. R. MELDRUM
Morr's Crane & Hoist Co., Niagara Falls, Ont.

"WE ARE PLEASED to note that your Annual Review number is taking complete form," wrote the above gentleman a short time ago, and as the remainder of his letter contained so many points of interest, we take the liberty of publishing it verbatim.

"We think this number is very useful to the engineering world of Canada," continued Mr. Meldrum, "and we believe you should be encouraged to extend your editorial services as well as the publishing of special articles on timely subjects. In our opinion the future of industrial Canada is such as to warrant manufacturers in making ample preparation for big production in days which are not far distant. By this we do not suggest a lavish spending with little preliminary study such as characterized the war, now happily over.

"Every expenditure on capital account should be made only after the closest consideration and discussion between purchasing and engineering departments. The experience of Henry Ford and other manufacturers has shown that there is room for wonderful economies in production, organization and machinery. Our own business brings us directly in contact with this side of industrial life and it has been a matter of surprise even to us how much time and money can be saved in certain cases by the use of special or standard lifting and transporting machinery.

"The same remarks apply to a greater or less extent to almost every piece of plant equipment. Every day invention is placing at the service of the producer some more direct, more economical and more efficient means of manufacturing certain of the components entering into a finished product. These developments should be seized upon, and obsolete, time-wasting equipment relegated to the scrap heap.

"If such a policy is put into effect by individual manufacturers it will be a great benefit to our country. It would be greater benefit to Canada for our municipalities and our provincial and Dominion Governments to adopt similar policies of efficiency and economy. The amount of money annually wasted would be sufficient to finance a tremendous selling campaign covering the whole of the world which would provide an outlet for the products of all existing Canadian factories and induce expansion on all hands. We have every confidence in the future of this country if we can avoid restrictive legislation on the one hand, and unreasonable demands of individual classes on the other hand."

Addition of Aluminum

During the war a very small percentage of aluminum was sometimes used with cast iron in the making of munitions. This was done to prevent microscopic shrinkage cracks in the surface of castings that otherwise would have formed when the casting cooled.

China's Cotton Spinning Industry

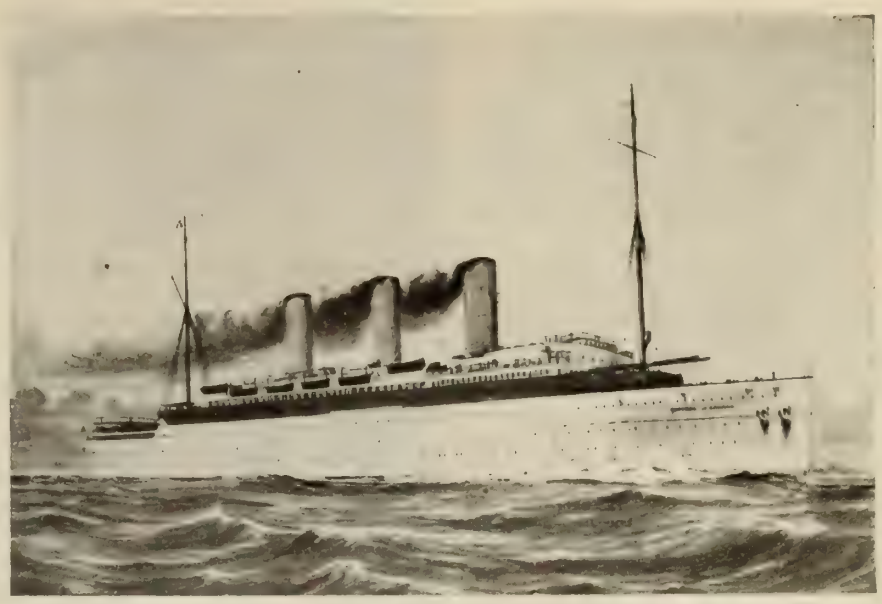
Twenty years ago China's cotton spinning industry was represented by two mills with 65,000 spindles; in 1902 the numbers had increased respectively to seventeen and 656,000; in 1920 they were sixty-three and 1,422,832. Some twenty additional mills are under construction or projected. There are four British-owned cotton mills in Shanghai with 248,756 spindles, while the Japanese are credited with sixteen mills and 469,000 spindles. "Speaking generally," says Engineering, "on account of Chinese cotton being of short staple, the Chinese mills have so far confined themselves to the production of yarn, but looms have been installed in some of the larger mills on which a fair amount of cloth is being produced. These cloths compete successfully with similar cloths from Japan, but there does not seem to be any likelihood of the Chinese being able to produce anything approaching the Lancashire textiles for many years to come. The Chinese Government has an arrangement in the matter of remission of taxation which is of great benefit to the native product.

Holding Export Trade

Thoroughness is Very Essential—Keep Goods Up To Quality — Supply Exactly What You Promised—Even To Seeming Trifles Like Labels, Etc.

By F. C. T. O'HARA

Deputy Minister Department of Trade and Commerce.



FEW persons realize how diversified are the functions of the Department of Trade and Commerce. No adequate intimation is conveyed by the title as to the importance of its component parts, or how widespread its activities. The branches as they at present exist may be enumerated as follows: the Board of Grain Commissioners at Fort William, which controls the inspection and weighing of grain; the Gas and Electricity Inspection Branch; the Weights and Measures Inspection Branch; the Dominion Bureau of Statistics, which in addition to compiling trade statistics is responsible for the taking of the decennial census; the Exhibits and Publicity Bureau, in which is included a cinematograph plant; and lastly, the Commercial Intelligence Service.

The foreign trade of Canada must expand rapidly, and it is the policy of the Government to lend all practicable help to its development. To this end the Commercial Intelligence Service was established. The department takes pride in its belief that, all things considered, no finer commercial intelligence service exists to-day throughout the world. This service does not cover so many fields, nor has it so many representatives as others, but man for man few countries, if any, can show a higher and more efficient personnel. It is an essential part of the general scheme of the service that these representatives, Canadian Government Trade Commissioners as they are designated, should be located in foreign countries.

Direct representation is, therefore, now maintained in the following countries: the Argentine Republic, Australia, Belgium, Brazil, British West Indies, China, Cuba, France, Holland, India, Italy, Japan, New Zealand, South Africa, the United Kingdom at London, Manchester, Liverpool, Bristol and Glasgow, and the United States at New York. In addition Mr. L. D. Wilgress, who was at first in Russia, is now on special duty in the course of which he has made a thorough review of the new countries of South Eastern Europe. There are four Commercial Agents at Sydney, N. S.W., Australia; Christiania, Norway; Port of Spain, Trinidad and Nassau, Bahamas.

Subsidiary to these is the assistance which under an arrangement made by the Minister of Trade and Commerce with Sir Edward Grey in July, 1912, may be rendered by the more important British Consulates whose officers have been instructed by the Foreign Office to answer inquiries from and give information to Canadians who wish to consult them in reference to trade matters. These Consulates are located in the following countries: Chile, Colombia, Ecuador, Egypt India, Mexico Panama, Peru, Portugal, Spain, Sweden, Switzerland, Uruguay and Venezuela.

For the important office of Trade Commissioner, special qualifications are required. It is desirable, for example, that a Trade Commissioner shall have a sound and liberal education, including a thorough knowledge of English, and be endowed with initiative, imagination, energy and enthusiasm. To these qualifications he must add tact, address and pleasing manners. These are considered necessary to equip the commercial intelligence service for its high purpose, and this can only be done by admitting for training those who measure up to the basic qualifications.

The duties of a trade commissioner are exceedingly comprehensive and demand from him a high measure of versatility. He must be familiar with the natural and industrial products of Canada, as well as the character of such commodities as are available for export. He may have to answer questions of a technical nature in relation to a wide range of Canadian products, such as boots and shoes, pianos, railway equipment, electrical material, men's furnishings, canned goods, etc., as well as be able to prepare reports which would furnish information to exporters with respect to all these commodities. In that connection the facts with regard to competition, packing, shipping, customs duties, financing and so on must be within his knowledge.

He must be more than a medium of information. In the event of misunderstandings or disputes between exporters and consignees, he may be called upon to act as an intermediary, and such a duty calls for tact and skill. He must make himself familiar with shipping and railway facilities, as well as the special conditions which attach to foreign markets. Furthermore the very nature of his work requires him to make the acquaintance of every importer of importance in the smaller countries, and with as many as may be practicable in the large.

To recruit such a service it is vital that candidates for training should be intelligent, patriotic and energetic. Beyond question, Canada has many men of the required calibre. The immediate problem is to attract them, and win their interest in this important work. Back of trade development lies the promotion abroad of Canadian interests in general, and in such a splendid and patriotic work the right kind of young men will find an interesting and promising career in the commercial intelligence service.

The period of probation in the office of the director of the commercial intelligence service may last from one to two years. If the candidate answers to this test satisfactorily he is promoted to the post of assistant trade commissioner and attached to the office of a Canadian trade commissioner abroad for further training and experience. If he continues to show capacity and suitabil-

ity he is given a higher appointment as vacancies occur or new offices are established. It will be realized that a trade commissioner can do much to advance the development of export trade, and in that work he will find full opportunity for a career, fair remuneration, a wide experience of men and countries and the consciousness of genuine patriotic service.

The Ability of Such Men

Scepticism is often expressed by business men as to the ability of our trade commissioners to comprehend their particular difficulties of export trade. The question is often asked: "Why do you not appoint business men to these positions?" On the face of it, this appears to be a very reasonable inquiry. There are, however, reasons why a business man is sometimes not the best man for the position. A successful business man does not care to enter the Government service, where the emoluments offered to him are, as a rule, less by far than he can obtain in the commercial world. Therefore, the chances are, that a highly-trained business man who makes application for such a position has been unsuccessful in his own enterprises.

Experience, extending now over a considerable number of years, has convinced the department that a young man trained in the department, conversant, from his examination of correspondence, with the difficulties, the needs and the trend of export trade, is much better qualified, both from the standpoint of the department and of Canadian firms, to fulfill his office abroad. The probability is that a manufacturer of boots and shoes may have a very thorough knowledge of everything relating to the marketing of his own product, but he will have very little or no knowledge of other lines, for example, agricultural implements, hardware, or the thousand and one other commodities which go to make up Canada's export trade. The marketing of these diverse products is constantly studied by the trade commissioners when in training. They have the intelligence to master the complex problems which may be submitted to them, and in time acquire a very thorough and wide-spread knowledge of the conditions pertaining to every feature of export trade.

The dissemination of such information to Canadian manufacturers is conducted through the medium of the "Weekly Bulletin." This corresponds to the official trade publications of other countries, and, once again, all things considered, is comparable to any. It is circulated from Ottawa throughout the Dominion every Monday morning. The circulation is now, roughly, eight thousand copies. It is sent free of charge in Canada to any bona fide applicant. The "Weekly Bulletin" contains regular reports from the trade commissioners abroad, supplemented by special articles in the Department, dealing with tariff changes and customs regulations, proposed steamship sailings from Canadian ports, Canadian trade statistics as issued by the Dominion Bureau of Statistics, statistics of grain movement in Canada; Exhibitions abroad, and other matters of commercial interest.

In addition to the "Weekly Bulletin" is issued a large number of miscellaneous publications outlining the possibility of trade in various countries. All these may be had on application to the commercial intelligence service, without charge. These reports are prepared with the utmost care, and not infrequently high commendations of their



Down at the wharfs, St. John, N. B.

value are received. Such reports are usually the result of special investigations by trade commissioners, and in the past three years, particularly, very valuable information has been circulated, as, for instance, in respect of the trade of the new countries of South Eastern Europe, Egypt, Greece, South China and Spain.

Destructive Criticism

As is to be expected, from time to time criticisms are made of the commercial intelligence service, particularly in respect of the efficiency of the trade commissioners. Most of this criticism is destructive rather than constructive; but the writer is firmly convinced that such criticism is not founded on an adequate knowledge or a just appreciation of their usefulness. Even after many years of experience, the department is often astounded to realize how little is known of the efforts of trade commissioners and their ability to render valuable assistance to exporters. Frequently much trouble might have been obviated if in the first instance the assistance of the commercial intelligence service had been enlisted, and the services of a trade commissioner engaged to consider an inquiry or a negotiation for overseas trade.

The following headings briefly indicate the matters dealt with by trade commissioners:—

The present and future demand for Canadian goods.

Foreign competition.

Specifications of best selling goods.

Reports on foreign buyers.

Recommendations of responsible parties to act as import agents, assistance to such agents by way of introducing them to influential individuals or associations.

Advice as to the best media in which to place advertisements, and the form which such advertisements should take.

The proper display of catalogues, price-lists and samples.

Receiving visitors from Canada and introducing them to possible buyers.

Collecting information as to freight rates, customs tariffs, port dues, etc.

Furnishing details respecting storage arrangements overseas.

Foreign Government regulations which must be complied with.

Terms of credit which can be given to foreign buyers.

Advice as to financial houses and banks which will discount bills or give credits.

Information as to regulations governing the recovery of debts and other legal matters.

Confidential commercial information.

Settling difficulties which arise between Canadian exporters and buyers abroad, as, for example, the disposal of goods abroad contracted for but not accepted.

Infringement of trade marks or patent rights, and advice as to registration, etc., etc.

Consular invoices, documentation and packing.

It will be appreciated, therefore, that the scope of the service which we can render is exceedingly wide, but it should also be borne in mind that unless we are advised of individual difficulties encountered by exporters and kept informed as to the exact type of information which is found by them to be of practical utility, the service must necessarily be of limited value.

The Foreign Tariff division of the commercial intelligence branch was established a year or so ago. There are 189 different and intricate tariffs to be studied, and the constant amendments, preferences, surtaxes, restriction, reclassifications, agreements, treaties, decisions, and the like, can only be accurately interpreted by experts. For many years the department received the publications of the International Customs Tariff Bureau in Brussels, but one who has little occasion to examine foreign tariffs cannot realize the time and effort involved to determine under what group a specific article may fall, and then trace the item through countless treasury decisions to ascertain what the duty is. There are also comparisons to be made as to the treatment accorded to Canada by the various foreign countries as compared with the treatment accorded to her competitors. This division also undertakes to advise on all matters of consular documents, certificates of origin, merchandise marks law, customs regulations, documentation, and invoice requirements for foreign markets.

Until the department succeeded in obtaining the necessary appropriation for establishing the Foreign Tariff division, this portion of its work was badly handicapped. Now, with a well-equipped office, every inquiry in connection with the foreign tariff of any country can be promptly dealt with.

In the consideration of export trade there is one word which the writer desires to impress with all possible em-

phasis—that word is "thoroughness." This idea should not be regarded as too commonplace or as the criticism of an arm-chair critic, but after many years' service in the department he is convinced that in the observance of this quality lies the key to success in business abroad. Want of thoroughness has been the cause of countless complaints received in the department of trade and commerce for many years. The writer does not wish to stress the point in general condemnation of Canadian methods, but thinks it is a complaint which is heard too often. Goods must be up to the quality to the last degree, and not only that, but if a reputation is to be maintained abroad, especially in Asiatic countries, (though the same applies very largely in Africa, and South America) such details as the identical colour and marks on the label must be consistently retained.

For example, a Chinaman takes a fancy to goods put up in a certain label. The goods are sold "on the label." If he likes them, a competitor cannot beguile him from his fancy. Better goods



Market slips at St. John, N. B.

might be put up, but if the label be changed in the slightest respect he will refuse them. This may seem absurd from a Canadian point of view, but it must not be forgotten that the foreigner has his peculiar point of view, his prejudices and his idiosyncrasies. The man who has goods to sell is the man who has to meet these peculiarities. The buyer is entrenched in his position; he is not forced to buy any special line of goods, hence exporters must meet him all the way if they want him as a customer. You cannot send him what you think is just as good as that which he knows he wants.

A shipment of clocks at one time was ordered for South Africa. The exporter had a slightly better line of clocks which



Another view of the market slip at St. John, N. B.

he shipped instead, and after the shipment had been carried on the backs of negroes, and by oxen transported into the back country, the shipment was refused and loss sustained. A few months later it was ascertained that the reason for the refusal was that the clocks had not a loud tick. The Kaffir had ordered the clock shown him, which happened to have a loud tick. He has his vanities like the rest of us. The Kaffir places his clock on the table and leaves his front door open so that his neighbor in passing can hear the clock tick. He wants his neighbours to know that he is able to possess a clock.

Exporters must, therefore, ship the identical thing ordered, and should nail this motto to the mast: "Thoroughness in quality, thoroughness in packing, thoroughness in everything connected with the shipping documents."

The department desires to encourage communications from exporters, and to aid them in their difficulties. It asks for their co-operation, their support, and their criticisms. It is hoped that the latter will be accompanied by constructive suggestions. It is further pointed out to exporters that, while the department of Trade and Commerce expects to render service to the whole country, the Commercial Intelligence Branch is particularly adapted to their needs, and aims at helping them in introducing Canadian products to every market in the world.

Canada has a government merchant marine consisting of a fleet of 63 steel ships ranging in tonnage from 2,800 to 10,500 dead weight. Of this number 54 were in commission this last season and the balance under construction. All contracts have been let in Canada at a cost of $73,000,000. These vessels are now found on all the principal trade routes of the world.

ELECTRIC RAILWAY BOOM IN GREAT BRITAIN

Remarkable activity is being shown by British railways in connection with the conversion of lines, especially in the neighbourhood of London, from steam to electric traction. The Great Eastern Railway Company, which carries an enormous volume of traffic from the city to the east and north east of London, has prepared a scheme of electrifications and other improvements which will involve a capital of about £10,000,000. The London Brighton and South Coast Rly. is bent upon electrifying practically the whole of its system between London and Brighton and the "Underground" group in London has prepared a scheme for spending £6,000,000 on the development of its tube railways and allied transport services. The South Eastern and Chatham Rly. has also made several plans for the conversion of its suburban system. One of the methods of propulsion laid before this country by a British engineering firm has some highly novel characteristics. It is proposed to propel the trains by means of internal combustion locomotives generating electricity, which in turn drives the motors on the locomotive or other parts of the train. The system is equipped with the usual overhead line or third rail which in this case, however, acts merely as a power interchange line. When a train is running down hill it returns current to the line; and when it is standing at a station the engine continues to run and to pump current into the interchange line. In this way additional power is afforded to trains which are ascending gradients or starting at stations. It is claimed that this system saves a large amount of capital expenditure and is very economical, especially where traffic is not dense enough to justify the construction of large power stations and transmission mains.

Two hundred and fifty million acres of tillable land in Canada await the tractor and the man.

There is a steady, though not now large volume of immigration pouring into Canada. The total for the year ending March 1921 was 148,477 an increase of 26 per cent. over 1919-20. Of this number 74,262 came from the United Kingdom and 48,059 from the U. S. A.



Looking Over the *Shipping* Situation



By T. H. FENNER, Editor Marine Engineering of Canada

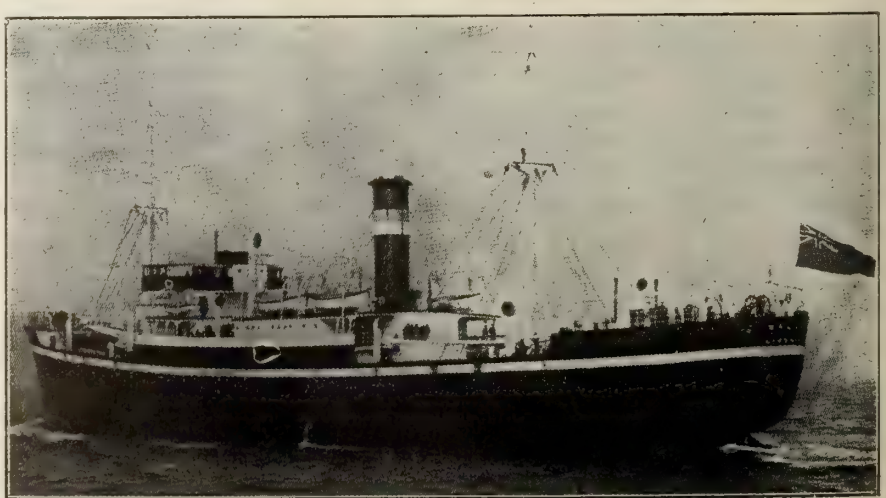
ONE year ago the writer opened a similar article by saying that shipping in general was in the doldrums, and sad to relate it has remained in the same desolate trade region during the intervening period. Shipowners and shipbuilders, like the old sailing ship men who were becalmed, are still whistling for a wind that will fill their sails, and carry them into the path of the full trade winds, but there are few signs of such a desirable breeze approaching. There have been zephyrs and ripples on the surface of the calm sea, but they have proved to be the lightest puffs, which died down before they had imparted any way to the vessel. Hope, which springs eternal in the human breast, is fortunately still lending its spreading wings to the minds of those becalmed, and giving them the necessary encouragement to face the situation with fortitude. The writer shares the hope that if he is called on to write on shipping one year hence, his introductory words will not be so lugubrious.

From the beginning of 1921 the returns of ships under construction have shown a steady falling off in point of tonnage, and even the tonnage shown in the tables was misleading, as a large amount of it was under suspension. That is, after a certain stage of completion had been reached, further work was stopped. A large number of contracts were cancelled, large sums being paid in default, owners feeling that it was better to take a known loss than to continue building ships at high capital cost when the freight market was rapidly falling.

Added to this the strike of the ship joiners in the British yards held up an enormous amount of tonnage, and made a bad situation worse. In this general period of depression, the liner companies kept steadily on at their building programmes, made necessary by the losses sustained by their fleets during the war. The class of vessel that was chiefly affected was the tramp or general cargo boat of medium tonnage. This of course was perfectly natural, as these vessels usually run on a small margin, and high capital costs would be fatal to their chances of paying a dividend to their owners. The fleets that were being built for the United States and Canadian Governments were of course continued with, the fact of being able to pay for themselves or otherwise, not being a consideration when the whole country had to pay for them. These fleets are now about completed, and shipbuilding in both Canada and the States has arrived back at the position it held before the war blew it up to such inflated dimensions.

State of Shipping Trade

There is no better barometer of the state of the shipping trade than price of ships in the open market. A couple of years ago anything that could float commanded a purchase price of from $175 to $200 per ton, and even on such a large capital expenditure, could still pay high operating costs and make a good profit. To-day, vessels that actually changed hands for prices such as mentioned above, are being sold, where a buyer can be found who has a special use for them, for the sum of $30 to $35 a ton. Probably no other line of merchandise or manufactured goods can show a drop approaching this, in values. Further, there are almost no buyers even at this low price unless it is, as before mentioned, for a ship to put on some special route or for a special purpose. This drop in value means to the people of Canada that the fleet they



The motor ship "Malia" fitted with opposed piston two cycle Diesel engines of the Fullagar type.

have invested some $70,000,000 in, is at present values only worth about $10,000,000 or would be if it was still all afloat. The vessels lost will of course be replaced in value by the insurance carried, that is the amount necessary to repurchase a ship of the same size at the prevailing prices would be paid to the owner, in cases where a total loss was incurred.

Whatever the amount received for the vessels lost, it will have little effect on the general value of the whole fleet, which is not influenced by whether the ships are privately or publicly owned, what flag they are under, or any factor at all except their value in the open market. For the next few years competition in the ocean transportation business is going to be of the keenest, and it will be a question of "sauve qui peut." There are many thoughtful men who think it would be a good plan to cut the losses, and dispose of the Canadian Government fleet at the most advantageous terms to be obtained, rather than continue operations at great loss to the country. There are others, and notably in the inland provinces, who feel that anything owned by a Government, or rather publicly owned, is possessed of certain inherent virtues, which make it worth while whatever losses it involves its owners in.

All the maritime nations have increased their shipping since the armistice, and it is interesting to note that the Germans are once more coming into the scene as active competitors on the sea lanes of the world. They have been conducting a joint service between Germany and the U. S. with the Harriman lines, using American ships. Quite recently an old arrangement existing before the war between British and German lines trading in the far East has been renewed, and the Germans will be able to man their part of this joint service with their own ships.

The Latest Figures

The latest returns of Lloyd's Register of Shipping tell the story of the decline in shipbuilding better than any other single factor. In December 1920 the total tonnage under construction in the world was, (excluding all vessels under 100 tons and war vessels), 7,179,779 tons, which was divided up between 1,640 steamers, 189 motor vessels, and 151 sailing vessels. The United States at that time had under construction 1,310,312 tons, of which 1,278,020 were steel steamers, the rest being motor vessels and sailing vessels both wood and steel. In Canada there were under construction 127,862 tons of steel steamers, and a number of wooden and steel sailing and motor vessels that brought the total up to 136,759 tons. The total tonnage under construction in the United Kingdom was 3,708,916 tons gross, while the total tonnage building outside of the U. K. was 3,470,862 tons.

The latest figures available, which are those for the quarter ending September 30th, 1921, show a falling off in figures, but the actual falling off is greater than the figures show. This is on account of the large amount of tonnage on which construction has been suspended. The total tonnage under construction in the United Kingdom at the date above mentioned, was 3,282,972 tons, while the total for the whole world was 5,542,978 tons. These figures, of course, in both cases exclude Germany, the latter not being available, but would have little influence on the general total. This shows a falling off of 1,636,821 tons, but when the figures for tonnage under suspension are considered the loss is much greater. There is in Great Britain a total of 1,188,000 tons, on which work has either been suspended or completion postponed, while abroad there is a total of 375,000 tons suspended. This materially reduces the figures which may be considered to represent work actually under construction, bringing it down to 3,979,978 tons. The tonnage under construction in the United States is at the date under consideration only 433,962 tons, which is composed of 403,362 tons of steel steamers, the rest being divided between steel and wooden motor and sailing vessels.

Canada had under construction only 67,255 tons steel steamers, and before the December quarter is reached, most of these will have been completed. It is interesting to note that outside of the United Kingdom and United States, the principal countries engaged in building ships are Italy, France, Holland, and Japan. Japan has the least tonnage of the four named, about 190,000 tons, while each of the others have just a little under 400,000 tons under construction. There are a large number of vessels of the special class built for carrying oil in bulk under construction, 81 of which are being built in Great Britain, and 23 in the United States. There are over 400,000 tons building which are to be fitted with internal combustion engines. The tonnage building in the United Kingdom is 59.2 per cent. of the total, which is getting back to where it used to be. However, the proportion of work completed to work commenced is very low, and it is this feature, combined with the absence of any new orders, that makes the outlook so bad.

Labor Troubles

Great Britain has suffered more from labor troubles in the shipbuilding trade than any other country during the past year, and the stubborn attitude adopted by the men has resulted in the loss of millions of pounds' worth of work. To make it all the more annoying, some of



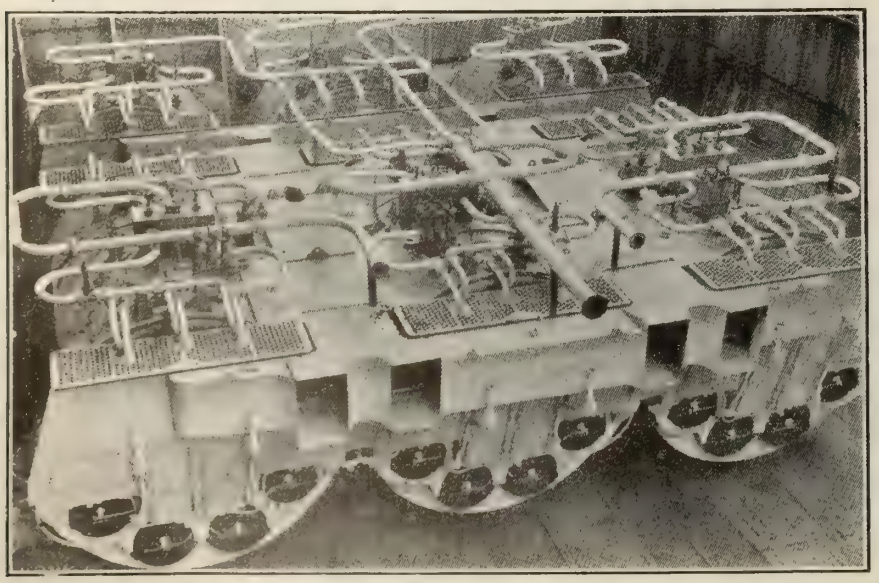
A typical British cargo liner.

this work has actually gone to our recent enemies, while in other cases the cost of ships has gone up very considerably from the first estimates. One of the worst strikes has been the ship joiners. These men went out on strike as a result of a proposed reduction in wages to allow the builders to compete. The cut was accepted by the other trades concerned, but the joiners refused to consider it. There happened to be a lot of work in the house-building trade and the joiners were readily absorbed in that. Not so the rest of the trades, who were thrown out of work by the action of the former. Many ships that were to be repaired and reconditioned were sent to Rotterdam, Antwerp, and even Hamburg because their owners needed them and could not take a chance on the delay in getting them into service again that would result from the dilatory tactics of the labor unions.

Many vexatious restrictions were stubbornly adhered to by the men in different trades, and thousands of men were walking about drawing unemployment doles as a result. One instance in point was the case of the boilermakers in the Liverpool district, and their objection to the use of the oxy-acetylene torch for cutting plates. They did not object to the torch, but demanded that when it was used the same number of men should be employed to do the cutting as when it was done by hand, and those men not handling the torch should stand by while the work was being done and draw pay for it. They hung out for a long while on this untenable position, but have finally capitulated. The joiners' strike has at last been settled, but things have come to such a pass that it will be a long time before there will be employment for them and their fellow workmen. The prime necessity in Great Britain is cheap coal, and until coal comes down to a price where steel makers can compete with other countries, there will be more or less stagnation in the shipbuilding and allied industries. There is one good sign, and that is the increase in production of coal, and the fact that Welsh coal is once more being shipped to the foreign markets where it once reigned supreme.

During the coal strike in England and Wales, American coal found its way into European markets, and even South African and Australian coal was shipped to the same quarter, but naturally, this could not be expected to continue. The American coal dealers, assisted by the U. S. Shipping Board, tried very hard to establish a firm footing, but with coal being produced at anything like the same price in England and Wales, it is an impossibility for them to compete. The French Government after hanging fire for as long as possible in order to benefit by any further reduction in price, has at last given orders for their supply of Welsh coal for the railways. Other European buyers who had fairly large stocks on hand are making enquiries. The miners seem to have made up their minds to work and in this is the most hopeful sign in the whole industrial outlook. As the writer has pointed out before, cheap British coal is a stimulus to the whole industrial world of Europe.

When European buyers can get this vital necessity at a price that makes it possible for them to run their factories at a reasonable cost, they have goods to interchange with each other, and Britain has cargo for her ships, and cheap raw materials for her factories. She has also cheap coal for her blast furnaces and her shipbuilding and engineering industries, so that she in turn can export manufactured articles in exchange for food stuffs, raw cotton, jute, fertilizers, ivory, rubber and the thousand and one things needed by a population of forty millions odd in a highly civilised country. One of the important trades is the ore trade from the coast of Spain, in exchange for coal from the coast of Engand, and this market has shown some improvement. The situation was admirably summed up recently by no less a person than Lloyd George in this way, "It is not summer, it is not even spring, but the extreme rigor of winter is passing." That description might be fittingly applied to the industrial situation in Canada, as apart from the shipping situation itself.



The boilers and steam pipe layout of the new Cunard liner "Laconia."

Canadian Shipping and Shipbuilding

Canada has always had a certain amount of shipping flying her own flag, and, as is well known, had at one time a very considerable wooden shipbuilding industry. This, of course, like the wooden ship industry in the U. S. was wiped out when Great Britain started building iron steamers, and captured the lion's share of the shipbuilding trade of the world. Although Canada has on her eastern coast very fine deposits of coal and iron, there does not seem to have been any effort made to establish a shipbuilding industry in the logical place for it till recent times. Of course, the earlier Canadians were more occupied in railway building, and agriculture, and the maritime provinces were more or less neglected for a long time. The higher cost of labor in Canada also militated against it. Whatever the causes, shipbuilding in Canada languished, with the exception of two or three yards on the Great Lakes, and one on the B. C. coast, till the war came along with its demand for ships, ships, and more ships. Then it was that shipyards sprang into existence overnight, almost. The first stimulus was given by the Imperial Munition Board, which carried out a program of building that amounted to about $70,000,000, and this was followed by the Canadian Government program of 63 ships, costing about the same or a little more. In addition to these two programs, a few ships were built to foreign order. A number of shipbuilding yards were started by contractors and others totally unused to shipbuilding, and when the rush subsided these yards naturally were the first to subside also.

The shipyards mentioned in the official report of the Department of Marine and Fisheries for the year 1915-16 covered just six firms. Of course there were really more than that, as there are always a number of little yards building schooners, etc., down on the N. S. and out on the B. C. coast but these six yards were the only ones that could really be designated as shipbuilding yards. In the following year's report there are ten yards more deemed of sufficient importance to be mentioned specifically. There were several fairly large yards which for some reason did not seem worth mentioning in the Government reports, but at the height of the boom, there were about twenty yards engaged in the building of steel and wooden ocean-going steam tonnage. This takes no account of the schooner builders of the Maritime Provinces, of whom there were literally hundreds. The Government were much impressed by the apparent permanence of this shipbuilding industry, and accordingly made arrangements to subsidize the Dominion Steel Corporation at Sydney in the erection of a plate mill which could roll plates and shapes for ships, eliminating

the need of importing these very necessary components of steel ships. They even made a contract with the company to take a large quantity of plate per annum over a period of five years from the completion of the mill, the contract being placed at the then high rates. Everyone in Canada seemed to approve of the Government's action at that time as being the best thing possible for the country, but in the light of events that have since happened, they are expressing doubts. Some of them are even saying that they knew all along that it was a mistake.

The writer has always held the opinion that there is room for a certain amount of shipbuilding in Canada, and that a steel company situated right on top of all its own material, as the Dominion Steel Corporation is, should be able to produce as cheaply as anyone in the world. There is no reason why in normal times the mill could not get some of the foreign orders that are going, and probably in time the action of the then Government will be justified, as far as the plate mill is concerned. As regards the shipbuilding industry, the Minister of Marine, through the departmental report, made mention of the fact that the Government's shipbuilding contracts would carry on until 1920, by which time the industry would be on a firm footing. As it happened, further contracts were let which carried on the work until 1921, but without the desired effect of putting the industry on a firm footing. As far as many of the yards were concerned there was no chance of them ever being on a firm footing, and it was just as well that they should disappear in the ordinary way of commerce.

There are, however, several husky survivors in existence to-day, whose foundations are firm, and who will tide over the intervening time in safety, and be ready to carry on when business resumes its normal activity. The writer has never had any fear for yards that are situated on tidewater, and have graving dock facilities as well as shipbuilding facilities. The same applies to the old established lake yards, which are well provided with repairing facilities. These yards can generally be depended on to carry on a profitable career even if they never built a ship. Yards on the other hand, that were erected purely and simply to build, and equipped with machinery purchased at war prices, and often built on land that cost war prices to acquire, had but little chance of living under ordinary competition. When it is further considered that the guiding hands in many cases were utterly unfamiliar with shipbuilding, it was but natural that they should fade from sight. The shipbuilding boom is over for Canada, leaving in its trail practically all the yards that were here before it arrived, and having ended the careers of most of the new ones.

When it comes to the ships themselves a different case is shown. Canada is, in this case, still in possession of all the ships that she built to create a merchant marine, with the exception of those that have been lost by perils of the sea. These include the "Canadian Recruit," which was unfortunate from her early days, and "Canadian Exporter," which are total losses, while the "Canadian Importer" will be repaired.

In the report of the Department of Marine for the year ending March 1916, it is stated that it had formerly been the habit to value ships on the Canadian Register at $30 per ton, but owing to abnormal conditions, this price was much lower than the actual price prevailing which was from $75 to $100 per ton. It also stated in this report that there had been much agitation for the creation of a purely Canadian Mercantile Marine, and that in this connection, it should be borne in mind that the day of the small carrier had gone. The most efficient vessel was one between 7,000 and 10,000 tons deadweight. This is interesting to note in view of the class of ship that was actually built for Canadian merchant marine, at a cost of practically $200 per ton.

Of the total number built there are no less than thirty-one which are under 5,000 tons, while there are nineteen of these under 4,000 tons, and three of them under 3,000 tons. There are but two ships of 10,000 tons or over and twenty-one of 8,000 tons or over. The value of all these ships in the open market is now about what it was before the war, that is about $30 per ton. Of the vessels building in the United Kingdom at the present time there are out of a total of 633, no less than 366 over 4,000 tons deadweight, and the remainder include a number of small craft for strictly local trades and coasting vessels. For ocean-going traffic, a vessel of under 7,000 tons deadweight capacity is not a good proposition, the reason being, of course, that operating costs are out of proportion with the larger vessels.

Engineering Development

The development in the marine engineering world has been, as it has for some time past, along the line of motor-driven vessels, coupled with a further application of the geared turbine. One vessel was built in the United Kingdom with electric drive, but this vessel was for an American shipping concern. The electric drive has not found favor with the British shipowner, although it is being adopted in the U. S. both in naval and merchant fleet construction. A discovery that is expected to considerably widen the knowledge of propelling problems is a method of getting the actual thrust developed by the propeller at the thrust block of the ship, something that has not hitherto been available. The method is by using a number of cylinders, grouped round the Michell thrust block, which receive the thrust in of the propeller on diaphragms, which transmit the pressure through oil pipes to gauges, on which the actual thrust in lbs. per sq. inch is registered. Much more accurate knowledge of propeller performance can be obtained in this way, and improvements in design will follow. Opposed piston two cycle Diesel engines have been developed further, and in one particular case which marks a radical departure, it has been tried out in a coasting steamer, and has now been fitted in an ocean-going steamer, an illustration of which is given here. There have been several large liners converted to the use of oil fuel during the year, including the "Aquitania" the "Mauretania" the "Olympic" and the "Empress of Britain". Another development in engineering which has been applied so far to only small coasting steamers, fishing boats, etc. is the Kitchen rudder, an apparatus which enables a steamer or motor boat to perform all the maneuvers of going ahead or astern, at any speed desirable, at the same time steering in any direction while the engines maintain a constant speed. This is especially useful in the case of small craft, such as tugs and fishing boats, as all the manoeuvering can be done by



Dry dock of the Halifax Shipyards.

the navigating officer, without the interposition of the engineer. The makers have gone slowly, and are gradually applying the apparatus to vessels of larger size, and it is quite within the bounds of possibility that it may eventually be applied to the largest. The more extensive use of oil for fuel and for internal combustion engines has led of course to a larger demand for oil tankers, and there are a large number of these vessels being built. The latest returns of Lloyds give a total of 140 of these tankers as being under construction throughout the world, of which 81 are being built in Great Britain and Ireland.

The U.S. Shipping Board Fleet

The past year has been a disastrous one for the great fleet of our neighbors to the south, and has witnessed considerable upheaval in the shipping board control. Following the general charges of graft and incompetence that were made against the original shipping board, a new board was appointed, with a new chairman, Mr. A. D. Lasker who was at the head of a large advertising agency but not by any means a shipping man. The rest of the board were just as inexperienced as the chairman in shipping matters, but before they had been very long in office they called to their aid three well known shipping men in the U.S. to assist them in the management of the national white elephant. The fleet during the year has been losing money at the rate of $300,000,000 per annum, but now that the wooden ships have all been got rid of, for the price of about one of them, the losses will be cut to some degree. These wooden vessels were costing no less than $135,000 per month to keep in idleness, so that getting rid of them at any price was a good move. A leading American shipping paper came out boldly with the suggestion that the whole fleet, wooden and steel as well, be taken to sea and sunk as the easiest way out of the mess, but naturally so drastic a course was not looked on with favor. One of the latest methods of trying to get the ships into use has been to offer them to private owners at a charter rate of $1 per ship per month, the board to carry all insurance charges. So far there has not been time to see how many private owners want them at that rate. The trouble with the U.S. fleet of course is that they cost more to operate than any vessels afloat, and furthermore there is ample evidence from reliable sources, that the operation as well as the management has been woefully inefficient. The United States is not a maritime nation any more than Canada is, and any artificial attempts to make it so are liable to be a failure. As Sir Joseph Noble, a well known shipowner, said recently, the growth of the British merchant fleet has been a slow one, extending over 200 years, and a result of the initiative and courage of traders, shipbuilders, shipowners and engineers. He further says, "These facts should give us confidence when we are inclined to fear the competition of friendly rivals who are actuated by sentiment more than actual need." This phrase surely applies to the United States, and in a lesser degree perhaps may be applied to Canada, who could hardly be conceived to have an overpowering need for a merchant navy.

The Shipping Board has on one or two occasions during the past year attempted to get cargoes for ships by shaking the big stick of the Jones Act, which ill-considered piece of legislation has never been put into force. One of these cases was the Egyptian cotton incident, when the Shipping Board demanded that all cotton cargoes from Egypt to the U. S. should be given to their steamers. They actually quoted much lower freight rates than the lines in the British conference, but the shippers had such little confidence in their ability to handle the cargoes successfully, that they refused to give them any cargo. The Shipping Board agent and the American consul then resorted to threats of discrimination against cotton coming into the U.S. by British ships, and there was almost an international incident over it, until their over-enthusiastic officials were called off by their Government in Washington.

The General Outlook

The outlook for the shipping fleets of the world is at present not very bright, as the world-wide depression naturally affects ships about as quickly and as severely as it does any other interests. The exchange rate, which militates so largely against international trade, prevents the ships having full cargoes to carry. The increase in the world shipping totals is not such a serious factor as some would have us believe, for while there has undoubtedly been a large increase, a great deal of the tonnage comprising it is of ancient vintage, and not suitable for modern use. With a revival of trade a good deal of this shipping would be removed from the register, and replaced by more modern tonnage. The liner fleets are busy bringing their fleets up to pre-war efficiency, one of the most notable being the Cunard, which has something like a dozen of the most up-to-date type of liner under construction, the first of which, the "Scythia," has been placed in commission. These sels are of the intermediate type, that is they combine large carrying capacity with a good amount of passenger accommodation and a reasonable speed. The liner de luxe is not being built. Tramp shipping, which plays such an important part in the well-being of Great Britain, is largely tied up, but as mentioned before the revival of demand for Welsh coal by foreign buyers, will give a welcome stimulus to this class of vessel. Exportation of coal will also help to bring the pound sterling back to normal again, and revenues from outward and homeward freights will be swelled. In this connection, it was estimated by a very high authority that the value of the invisible exports, which is how freight revenues are described, before the war, was £100,000,000. This is what the British mercantile marine earned without the values of the cargoes that they carried out with them, and the raw materials they brought back with them.

It is a rash man who would make any prognostication of the trend of future events, in the light of the performances of the past couple of years. As far as Great Britain is concerned, she is bringing her fleet up to efficiency as fast as she can, beset with labor troubles and general depression as she is, and will no doubt be found when the revival comes with at least her fair share of the world's carrying trade. Other countries, notably France, Italy, Holland and Japan, have increased their merchant fleets considerably but Japan, at least, has suffered some heavy losses with the decline of the freight market. The United States have a fleet on their hands which has cost billions of dollars, and the prospect of it ever being an asset to them is doubtful. Canada has also got a fleet on her hands, and how much the past year's operations have cost us we do not yet know. It has the benefit we believe of competent management, but in view of its high capital cost, and that it can only obtain the prevailing freight rates, it is doubtful if it can be expected to carry on without heavy losses. It has to compete in the world market. It has, like other properties owned by the people, the constant danger of being experimented with by any new set of politicians who happen to get elected, and in view of this the taxpayer cannot view his ownership of a fleet with anything like equanimity. He still has the privilege of hoping. As Mr. Ballantyne sorrowfully confessed, "the Canadian manufacturer does not seem to be availing himself of the opportunities to create new export markets which the fleet affords." There is little chance of any route being neglected by private owners where there is any hope of a return, and it is very doubtful if the C.G.M.M. will have much success in its efforts towards creating new trade fields.

It has been seriously mooted by a member of the Shipbuilders and Engineers in Scotland that in the coming few years it will be impossible for any vessel driven by power alone to make a living, and he has suggested that the solution is the motor-engined clipper schooner. He proves his case by means of curves taken over a period of a couple of thousand years. Other authorities insist that the worst is over, and several large British shipowners say it is entirely a matter of labor settling down to work in order to bring prosperity back. There are various theories The simple fact seems to be that we are slowly recovering from a time of abnormal conditions, and the period of adjustment is longer than it was expected to be. Probably a good deal of the trouble is due to artificial restraints of trade in the form of high tariffs that have been introduced in countries where formerly there was free trade, such as has happened in the newly created states of Europe. The Fordney Bill in the U

Continued on page 127

Expansion of Mineral Industry In Ontario

Ontario Occupies Premier Place in Production of Minerals—Gold—Silver—Nickel and Copper Are Chief Metals—Brief Review of Present Situation and Outlook

By THOMAS W. GIBSON
Deputy Minister of Mines for Ontario

THE MINERAL industry of Ontario has been steadily expanding for a number of years. It may not be generally realized that the Province of Ontario occupies the premier place in the Confederation as regards the production of minerals. For instance, in 1920 out of a Dominion production valued at $217,775,080, Ontario's output was $78,749,178, or over 36 per cent. of the whole; and twice that of any other Province; and this, too, notwithstanding the absence of coal, which bulks largely in the production of Alberta, British Columbia and Nova Scotia.

The metals of chief production in Ontario are gold, silver, nickel and copper. The effect of the war was to stimulate the production of nickel and copper, which are pre-eminently required for military purposes. On gold mining, the war had a depressing effect, due to increased cost of production and inefficiency of labor. These causes also adversely affected silver, but on the other hand, owing to the stoppage of shipping, silver was required to balance exchanges in the East, and in consequence the price of the metal was greatly increased. A brief review of the present situation and outlook may be timely, taking the metals separately.

Nickel and Copper

Both metals have their source in the ores of Sudbury. During the war these mines were worked to their maximum capacity. Levels and stopes were crowded with men; new furnaces were built, and refining facilities greatly increased. The sudden stoppage of the war in November 1918, found an accumulation of nickel in the hands of the mining companies, the Allied Governments, and their contractors. Like conditions obtained in copper. The process of reconstruction has been disappointingly slow, and these large stocks have not yet been absorbed. One large battleship will require 400 tons of nickel in its clothing of armour plate, which is more than enough to supply many thousands of automobiles. If the Disarmament Conference results in the cessation of battleship building, the world will rejoice, but it will be hard on the nickel industry. However, the use of nickel in strengthening and hardening steel and for other industrial purposes, is so well established, that with the return of manufacturing generally to anything like normal conditions, nickel will come back into its own. Monel metal will be pushed, and also the use of nickel for coinage, alloys, electro-plating, table and kitchen utensils, etc.

There are three nickel-copper companies at Sudbury. The International Nickel Co., the Mond Nickel Co. and the British America Nickel Corporation. All three are at present closed down, or nearly so. The production of nickel in 1921 will be less than it has been for many years, and the prospects for an early resumption are at present not too bright.

Silver Production

The Cobalt mines are the chief source of the silver production in Ontario. Cobalt has indeed been a wonderful camp. Since the discovery of silver in 1903, there has been produced about 325,000,000 fine ozs. of silver, valued at $200,000,000. The peak of production was reached in 1911 at 31,000,000 ozs. Since that time the output has been declining, but the higher prices for silver have pretty well maintained the value of the annual production. High-grade ore, abundant in the early years of the camp has become scarce, and the production now comes from low-grade rock. The life of the camp is being prolonged by the lowered costs of mining, improvement in metallurgical methods—notably the "flotation" process—and by the finding of new deposits in old properties. An instance of the last-mentioned feature is afforded by the Keeley mine in South Lorrain. This mine was deemed exhausted years ago, but is again producing at the rate of 100,000 ozs. per month. The total quantity of silver produced at Cobalt in 1920 was 11,000,000 ozs. worth $11,000,000. In 1921 the yield will be about the same, but the value will be less owing to the fall in the price of silver.

Gold Has Benefited

Unlike the other metals, gold has benefited greatly by the conditions which have prevailed since the war. Prices of supplies have gone down, and while there has not been much actual reduction in the daily rate of wages, labor is back to pre-war efficiency. Gold is its own market at a fixed price, and when sold is paid for in U. S. funds or their equivalent. The result of these favorable features has been to give a great impetus to gold mining in Northern Ontario, where, at the present time, the prospects for the industry are equal to those in any other part of the world. The output in 1920 was $11,665,000. In 1921 it will be about $15,000,000, and from present appearances, in 1922 it may reach $18,000,000 or $20,000,000. Ontario has outstripped in gold mining every state of the Union except California, and the figures for this year will probably show that even California has been left behind. A significant feature is the number of widely-separated localities in which important discoveries of gold have been made, thus increasing the chances for an extensive and permanent industry.

The main producing camps are Porcupine and Kirkland Lake. At Porcupine the leading mines are Hollinger Consolidated, McIntyre-Porcupine and Dome. The first named is one of the great gold mines of the world. Its output in 1920 was a little over six million dollars. This year it will be between eight and nine million dollars. Last year McIntyre yielded $2,200,000 and Dome a little over $2,000,000. Both these mines will show increased production for 1921, and all three contemplate increasing their crushing capacity provided additional electrical power can be obtained. At Kirkland Lake gold bullion in 1920 had a value of over $1,000,000 from three producing

(Continued on page 127)



Hollinger Mine as viewed from Gillies Lake.

Following the Trend of Machine Tool Design

Forty Years of Development Recorded—It is Surprising How Many Types Were in Use Even in 1881—Many Changes Have Taken Place — Modern Machines Are Marvels of Accuracy

By J. H. Moore

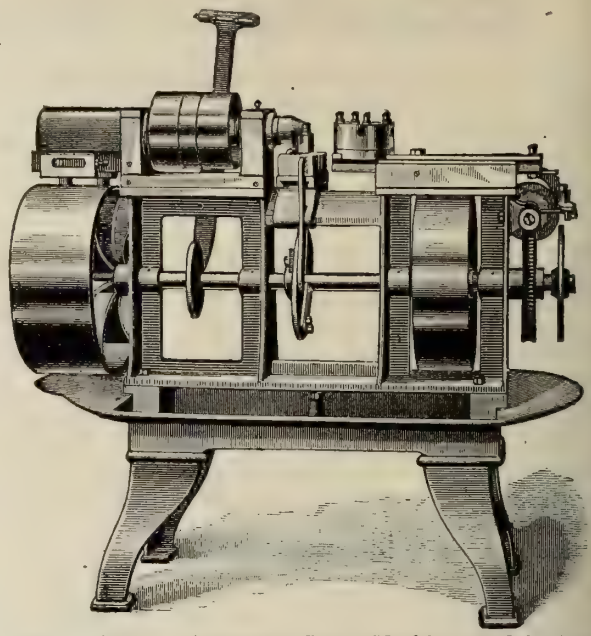


Fig. 14—Spencer Automatic Screw Machine used in 1897.

TO FOLLOW the trend of machine tool design is both interesting and instructive. It is like walking through a museum, where in retrospective manner, you can view the fashions and customs of those earler times. Comparing agricultural implements with those of today, we find that marvelous developments have taken place. What can be said of agricultural machinery is equally true regarding all kinds of machine tools, both metal and woodworking.

To go back to that period when any power other than hand, foot or mule, was unknown would serve no special purpose, so that on entering this subject of machine tool design and its trend, we will decide to begin at the year 1881, or exactly forty years ago. To cover both metal and woodworking tools would occupy quite an amount of space, so we will consider the metal-working tools only.

Reading from a catalogue dated 1881, we find the following, "The description of tools enclosed in this book are made from new and carefully studied designs, and are intended to meet the present demands of the trade, viz., "strong, accurate and durable machines," etc., etc. Evidently the English language was handled in about the same manner in 1881 as at the present time, for further on in the catalogue they speak of the importance of productive methods.

We could easily take the exact wording, insert it into any modern catalogue and it would read as if it were meant to be there. Therefore the method of description has not changed much, but how about the machines?

There is a slogan which runs, "The Picture Tells the Story," and as this statement is a very true one, we will largely depend on the message which the earlier models of machines present to the reader. We will merely comment briefly on each one, as to go into a lengthy description would occupy too much space. Take for example Fig. 1. Here we see a No. 7 plain milling machine. It will be noted that it is of the Lincoln type, and on viewing it closely we see that the head is cast solid with the bed. The description at that time says that it is heavily braced, not only above, but below the top of bed, and that the spindle is so mounted that it secures an exactness hardly possible in the old style machine. We would like to show the earlier model, but will adhere to the decision to start from 1881, the machine shown being used at that time. It had four changes of feed, also a postive automatic knockout.

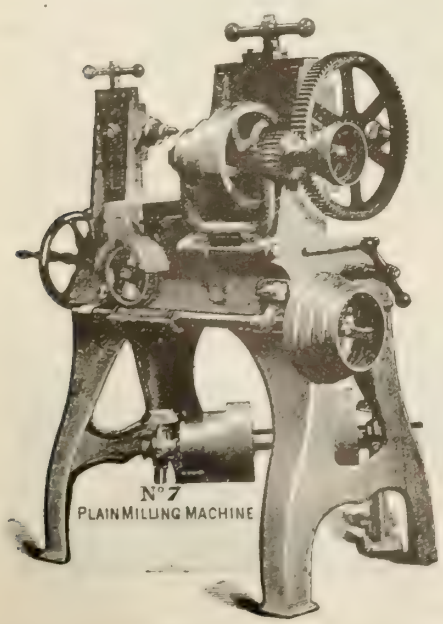


Fig. 1—Plain Milling Machine used in 1883.

Drill Press Design

At Fig. 2 we see a 22 in. upright drill press, and in this type of machine, designers seem to have hit pretty well on the present adopted idea. Of course the spindle construction was very poor in comparison with the modern type, and the method of supporting the back pulleys was rather peculiar. Proportions and general lines have also changed for the better, useless fancy design in casting work having been eliminated. We have records to show that in 1883 drill presses were equipped with back gearing, power feed, quick return, etc. Gear guards were considered unnecessary, and this fact is true on practically

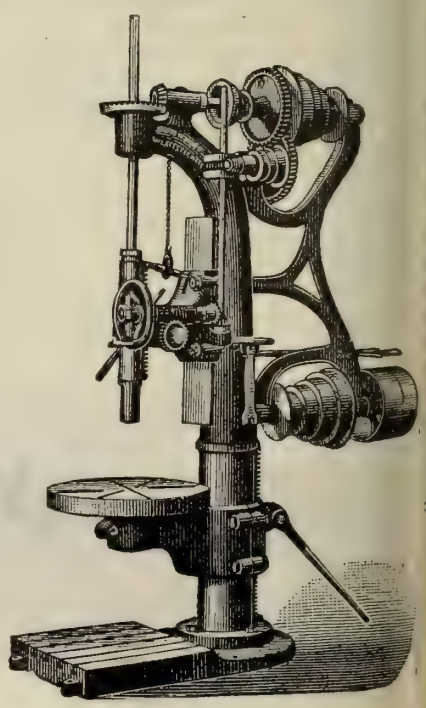


Fig. 2—Upright Drill used in 1883.

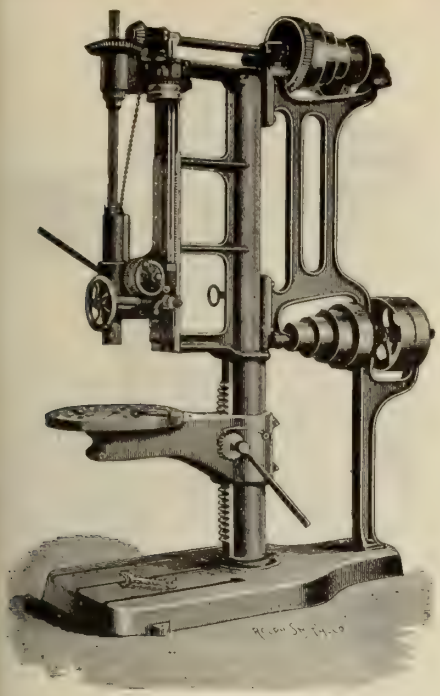


Fig. 3—Drill press used in 1886.

all the earlier models. When guards were attempted, they were usually made of sheet iron, being very clumsy and awkward to remove.

Ideas in drill press design seem to have differed around this period, for the machine shown at Fig. 3 was used in 1886. In speaking of this drill press, the makers say that it bores to centers of 4 feet, and that its weight is 3,040 lbs. This, to say the least, is a peculiar way to put it.

Radial drills were also in use at this time, although their design was quite different from the 1921 model. The table on the earlier type stretched the complete length of the radial arm, and usually, about thirty-two Tee slots were cut in this table, ten on each side, and twelve on the top. Of course this varied according to size. The lines were not appealing to the eye, but as the machines were of rugged design, they completed their work very satisfactorily, which was the main consideration.

Planers in 1886 were nothing to boast about, yet the fundamental principle was there. Compare Fig. 4 with the modern planer, then form your own conclusions. Designers had an eye for beauty (?) in those days and went in for fancy curves. No doubt the pattern maker and molder had different views on the matter, but such was the trend of the times. The writer remembers a very old planer that had some wonderful decorative designs cast on both the uprights and the bed. Beautiful (?) eagles perched on the machine at different points, but perhaps the makers were trying, in a sly way, to tell people it was a bird of a machine.

Looking at Fig. 4 we find that great developments have taken place since that time. Compare the present reversing mechanism with that shown. Power feed for raising the rail has also been added and at the time the machine shown was built, the feed gear was worked from a small friction plate. Note also how the bed V's came in at the end of the bed. The tool shown in cut weighed 15,000 lbs. and had a capacity of 36 in. by 36 in. with a 16 ft. stroke.

Drop Hammer Design

From 1894 to 1921 is only 27 years, yet compare the modern steam drop hammer with the one shown in Fig. 5. Describing this machine, the maker says that the weight of piston rod and hammer, which aggregate about 3,000 lbs. in addition to a force punch, which may weigh as much more, are lifted by the direct action of steam. The machine shown was especially designed for heavy sheet metal stamping, and was said to embody many novel features. Truly it is novel, when compared with the modern type of hammer.

Press Design

In 1894, punch presses were beginning to assume, in some measure at least, the shape of our modern presses. There was a slight tendency to lean toward the ornamental, but most of that had been eliminated by this time, and we find photographs of presses in 1894 which compare very favorably in exterior appearance with those of the present day. Inclinable bed presses were also in use, but of course such vital parts as the ram, tripping device, etc., have been improved upon considerably. Straight sided, double crank, and toggle drawing presses were in vogue, although the design at that time was very little like the ones in use today. Automatic roller feeds were also equipped on presses so that it is plain to be seen designers in that period were not wasting time. Of course it is only natural that all these lines show improvement, but in the main, designers in those earlier days supplied the original idea. Squaring shears, rotary slitting shears, etc., were all in use, the design having gradually improved as time went on.

An 1897 catalogue shows a bolt tapper like that at Fig. 6. Note how the power was transmitted to the five spindles. A small bevel pinion turned the large bevel gear, this in turn, revolving the centre tapping spindle. A train of connecting gears operated the other four. Even at this early period, designers realized the advantage of the spring collet, and each spindle was equipped with this type of collet. By doing so it allowed the taps, when filled with nuts, to be removed quickly without stopping the machine. The contour, spindle design, method of driving, and so on have improved quite a bit since that time, but here again the designers had a thorough grasp of the chief idea, namely speed.

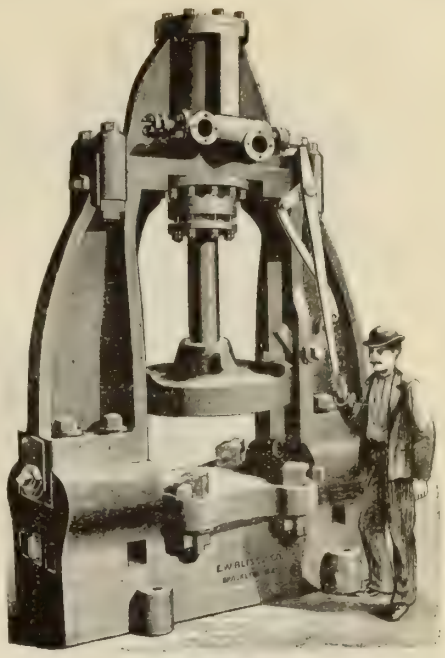


Fig. 5—Steam drop hammer for metal stamping.

The Vertical Miller

There is quite a difference between the up-to-date vertical milling machine, and the one shown at Fig. 7. Speaking about this machine in an 1897 catalogue, the maker says it was found that this type of tool was better adapted and handier for certain classes of work, and that the face mills used gave a smoother

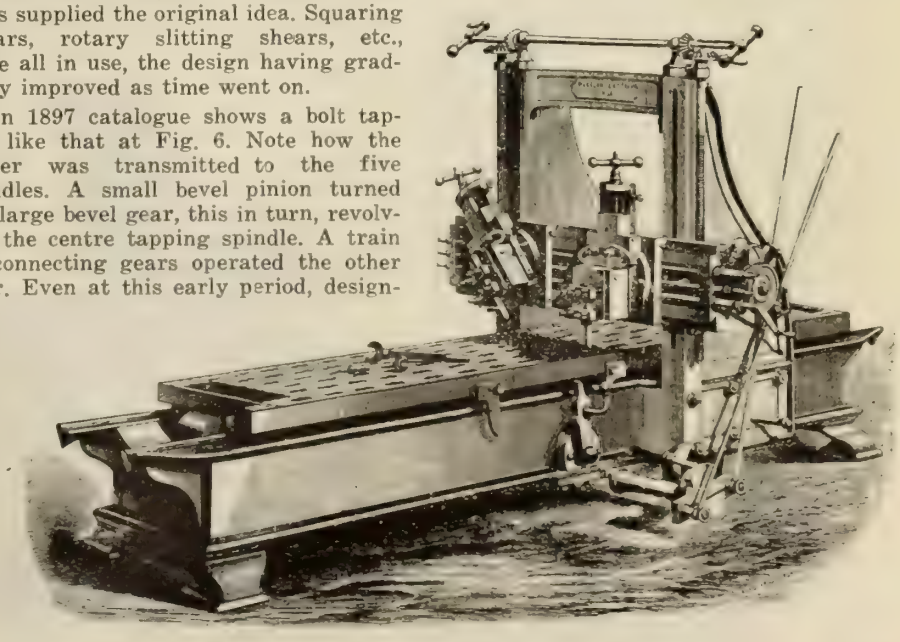


Fig. 4—Iron Planer as used in 1886.

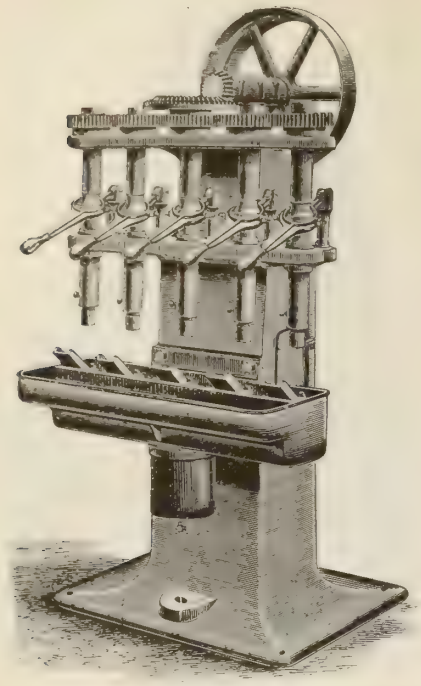


Fig. 6—Five spindle upright tapping machine.

finish than could be obtained on a horizontal machine with a surface mill. Note the gear drive to the spindle, also method of obtaining feeds, five being provided for. Designers have had an ideal opportunity to improve on this style of machine, and comparing our present 1921 models with the one shown, we can safely say that they have made good use of their time.

Column, and even traveling head shapes were in use in 1883. The column shaper in those days was a very simple affair, and while rather crude in many respects, the main underlying idea was incorporated. The style of column, the method of supporting table, etc, were very much like the shapers now in use. The refinements which have since taken place could well be termed improvements only to the original idea. Lines have been made more pleasing; machines more rugged, and ram adjustments and feed changes made to meet in with the requirements of the day. The style of traveling head shaper existent in 1883 was very much different however from the style in use at the present time. Fig. 8 shows an 1897 model, and as the picture is very clear, we leave readers to study the many changes at their leisure.

Lathe Design

So far in this article we have refrained from mentioning lathes, but this was done purposely, as up to 1890 no special improvement can be spoken of. Of course lathes in 1890, in fact long before this date, served their purpose and nicely, but rapid speed changes, speeds in geometric series, etc., were an unknown quantity. Up to about 1900, quick change feed boxes on lathes were conspicuous by their absence, but once they were installed, the change for the better was very rapid. For comparison purposes we show at Figs. 9 and 10 two lathes, the former being taken from an 1883 catalogue, and the latter from a 1901 book. Anyone can immediately see that several improvements were made during that time. The lines are better, both the saddle and apron has been improved, and the feed box added.

It will be also be noticed that gear guards have now made their appearance, or at least partially so. While the design shown in Fig. 10 is obsolete in many respects, still it is a vast improvement over former models. From this point on lathe design developed and improved very rapidly. Much better lines have been incorporated, lathe ways have been widened, higher, yet stronger castings have been made, and a wider range of feeds and speeds included. For heavy duty purposes the all gear drive has proved itself a departure worth while, and the changes in design and headstock have been especially noteworthy. The bed of a modern lathe is now of great depth, and it is usually well braced by box section girths.

Apron and saddle construction have also received careful attention, and quick change gear mechanism has been reduced to a carefully arranged science. It is nothing short of marvelous the combinations we can secure at a moment's notice on the modern lathe in use at the present time. Even the tailstock has not been forgotten, a more massive type being now used. They also have a much longer bearing than formerly, and are superior in many other ways.

Ball bearings have been largely responsible for the development which has taken place in machine tool design, this being particularly true regarding lathe headstocks. Wherever heavy duty or strain occurs, we usually find both ball and thrust bearings to take up that added duty. The cone type of lathe is likewise improved. In practically every case we now find all moving parts carefully protected, not by freakish sheet metal guards, but by serviceable covers which can be removed very quickly if necessary. In some cases these guards swing on hinges, allowing gears to be changed almost instantly.

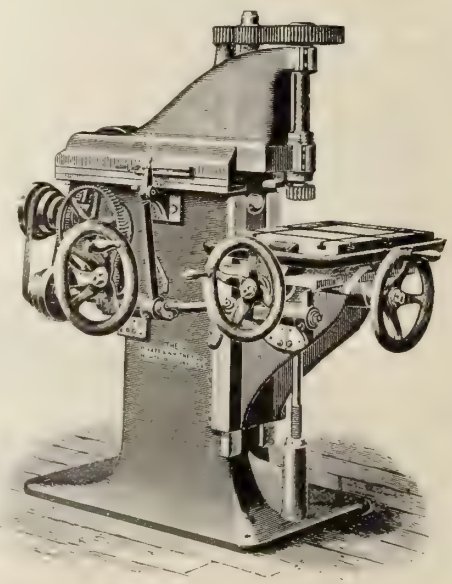


Fig. 7—A vertical miller used in 1897.

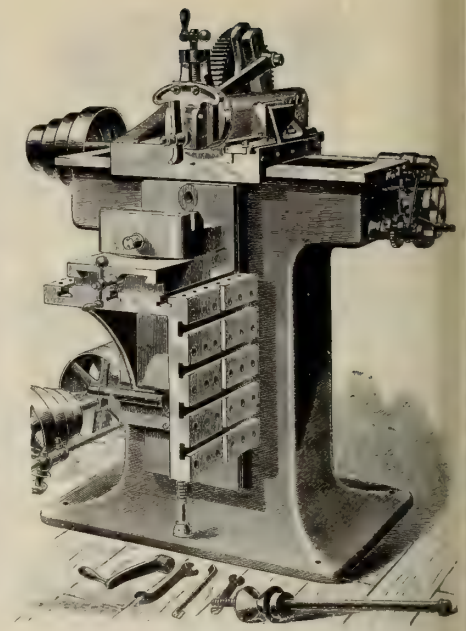


Fig. 8—Crank shaper used in 1897.

Then there is the question of motor drive. In many plants we find the individual motor drive a decided favorite. Each machine is an individual unit, and in some cases the machines are made self contained and portable. This is done by mounting machine on suitable wheels and in the case of portable lathes three wheels are usualy adopted, two at the headstock end, and one at the tailstock end. This type of machine is especially adaptable to the varying classes of work met with in railroad shops, arsenals and battleships. You can bring it up to the work, cut in on any convenient power circuit and start the machine, as the controlling apparatus is an integral part and it is only necessary to carry current to the switch. These portable lathes, in fact the many classes of portable tools now in use, are so arranged that after you get the machine to the desired location, it is the work of a moment to secure it firmly to the floor Usually either a. c. or d. c. current can be used.

As we have spoken of portable tools in our columns at different times we will not dwell further on this point but pass on to improvements which have been made to small details of the lathe such as tool posts, tool holders, etc.

In all cases better proportioned and shaped blocks have been adopted. Some favor the American type of tool post which is familiar to all mechanics, while others again believe and swear by the English type, this style consisting of two serrated plates, four studs and two clamps. Such a tool post is usually used in holding large turning and forming tools, and as the nuts on studs are tightened, the clamps hold the tool securely against the serrated plates Generally four springs, which are slipped over the studs, hold the clamps against the tightening nuts, this facili

tating the inserting and removal of tools. Tool holders have likewise improved, and now instead of heavily sectioned forged tools, we use, on lighter work especially, small tool bits ranging from ¼ in. square up, depending on the work to be done. This has been a rapid step toward efficiency, for the workman can now go to the supply room, pass in his check, and get whatever style of tool bit he desires.

Grinding Machinery

Speaking of tool bits ground to suit the workman's requirements brings up the question of grinders. We now have machines which can be set to grind almost any conceivable shaped tool. Everything has been carefully figured out in angles, and the designers have arranged such machines so carefully that semi-skilled help can produce as good ground tools as the highest type of mechanic. The machine does the work, the operator merely follows certain predetermined rules.

Of course grinding machine development has not been confined to tool grinders. Take for example the universal grinding machine shown at Fig. 11. This type was patented in 1877 and was considered a wonderful addition to machine tools of that time. If we were to place it alongside one of our modern universal grinders it would suffer much in comparison. Here again we must add however, that designers had very much the right idea in the construction of these machines, and what development has taken place is only the natural sequence of events. Many refinements have been made, but space does not permit dwelling on the features in detail. Emery wheel grinders, and polishing frames in the early eighties, were not very much like our 1921 styles. For example, Fig. 12 shows an emery wheel polishing frame used in 1897. Describing this machine the makers say that the arbors run in hard wood bearings, which are forced into iron shells. Compare this with the modern ball bearing polishing and grinding machinery, then give our designers due credit for their ingenuity.

The same story holds true of all grinding machines including disc, cylindrical, cam and other types. The original machines were very rough, but at least gave future designers the idea to work on. Now we have grinding machines that are marvels of speed and accuracy, and operations undreamed of before are performed on these tools. The automotive field owes a great deal to the designers of grinding machinery, for crank shafts, cams, tappet rods, etc., etc., could never have been produced so accurately had it not been for grinders. Disc grinding has also been a great boon, allowing designers to not only improve on the machine, but also to change the design of the part to be ground, so that the minimum amount of metal be removed.

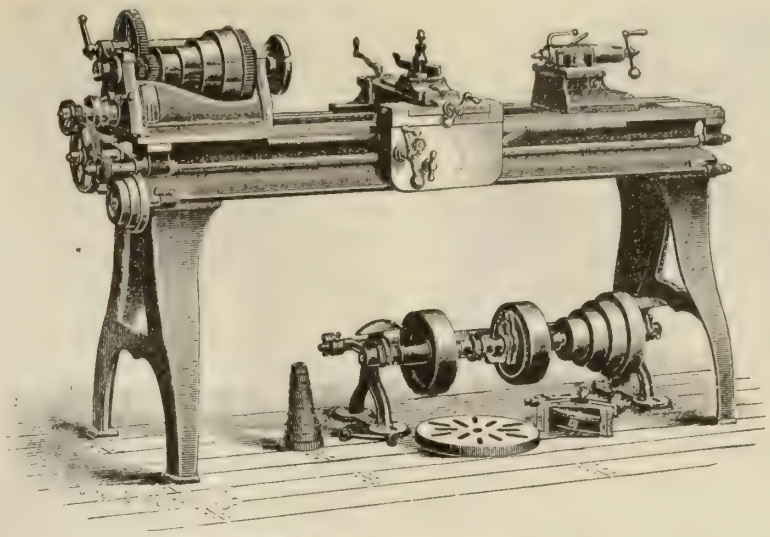


Fig. 9—14 in. Lathe used in 1883.

Lest we make this article of undue length, we must touch yet more briefly on the various tools. In review fashion here are the machines we find listed in a catalogue dated 1881. Lathes from the hand type, up to 60 in. capacity; planers from 16 in. by 42 in. by 5 ft. stroke up to 84 in. by 84 in. by 12 ft. stroke; upright drills to 32 in. and radial drills up to 60 in.; column shapers 15 in. and 24 in.; travelling head shapers 14 in.; slotting machines 10 in. to 18 in.; index milling machine used for gear cutting, etc., and small universal milling machine. Then we have the plain milling machine illustrated at Fig. 1; universal grinding machines; tool grinding machines; grindstone trough; gear cutting engine; grindstone gearing device; spur gear cutter; bolt cutter; cut off and screw cutting lathes; centering lathes; chucks of various natures; and the Westcott & Cushman chucks were listed even this is a much improved one over these far back. Of course the chuck of today former models. A few shears were also listed, but these are of the hand variety. We also find that the catalogue closes by showing differential pulley blocks which are very good considering the early date.

Another catalogue, issued only five years later, shows considerable improvement in the various lines, and from that time on, each new issue shows still further refinements. From 1894, we see remarkable improvement, until at the present time a machine tool catalogue is veritable mine of information. A noticeable feature in the modern catalogue is the frankness with which manufacturers treat their prospects. In the earlier days, manufacturers evidently did not believe in laying bare the secrets (?) of their design. Thus we were only allowed to gaze on exterior views.

At the present time, manufacturers vie with each other in presenting to the buying public the features claimed. Sectional line drawings are given; photographic reproductions of the inside of gear box, etc., are placed in a prominent position and carefully prepared artist drawings are made, when good photographs of some important part of the machine are not obtainable. In other words, a prospective buyer can sit down at his desk, probably over 1,000 miles from the plant where a machine is built, and he can almost see every part of what he proposes buying. He gets acquainted with it before he purchases, and in this way can make a comparison between the various makes. This policy has led to still further advancement in machine tool design, for it is no hidden secret that designers of one machine are not above embodying points into their own machines if they can apply it, and the

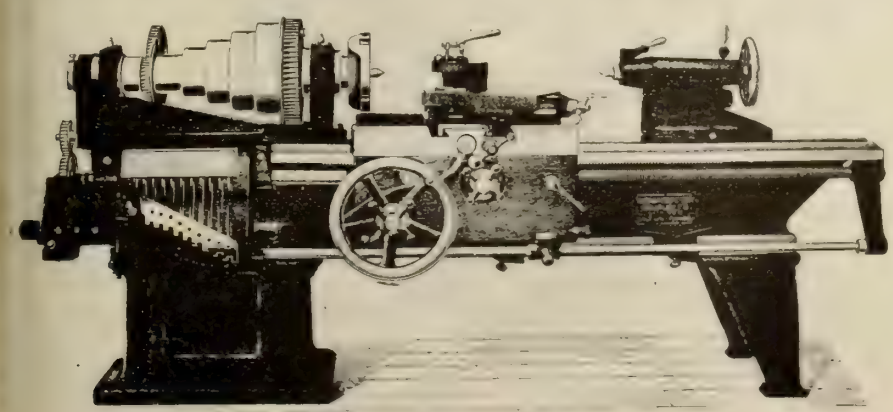


Fig. 10—Twenty inch engine lathe used in 1901.

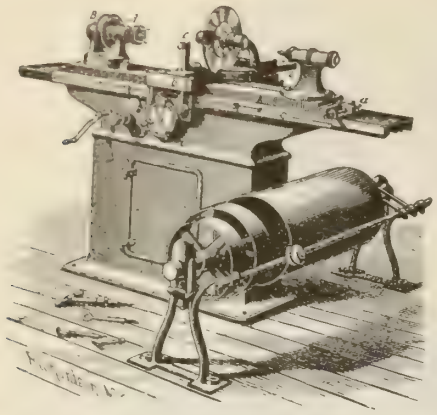


Fig. 11—Universal Grinding Machine which was patented in 1877.

feature is not patented. Instead of doing harm, it really acts as a spur to still greater efforts, for the up-to-date machine tool manufacturer is always striving to go the other fellow one better. Of course, if the feature is patented, that is another matter.

In an 1886 catalogue, we find a 42 in. car wheel boring machine, this being the forerunner of our present productive vertical boring mills. At this time we also see power driven punch and shears, and an automatic spiral cutting attachment which we reproduce at Fig. 13. Plate bending machinery, also power bending rolls appear at this date, and an upright turret pulley and wheel boring machine which is really an improved model of an old type vertical boring mill makes its appearance.

Around 1895 we see multiple spindle drills in use, these being somewhat after the type of our present wood working multiple drills. That is, universal joints, (of a kind), connected the spindles to a top gear box. Eight to ten spindles seem to have been the limit, and many were used for drilling the hubs of bicycles.

Tapping Machines

Patented tapping machines were then appearing, these varying in character, some being vertical and having three spindles or more, while others again were horizontal, and had two spindles, one at each end, the work sitting at the middle of the bed. Cam cutting machines also appeared on the market, these being made to special order only. They consisted of a lathe bed, with a sort of universal dividing head at each end operated by a handle. Alongside of the present cam cutting machine there is no comparison. Broad, deep hammers; bolt headers; jib cranes; rifling machines; gun barrel drilling machines, etc. were made to special order and Spencer's patented automatic screw machine makes its bow to the public. One of these we show in illustrative form in the heading of the article. Chucking machines and Tucker's opening die came out around this time and all sorts of power milling machines were on the market. In fact, a slabbing machine used at that time is not unlike the present Newton and Ingersoll style in use, considering, of course, the many improvements which have been embodied in the modern machines. The main idea was there, and in exterior appearance was very well designed. We even find the idea of combined drills at this period, two drill spindles being fastened to one common bed. Cutting off lathes, and many other types of lathes were in use, the design being rather crude if viewed alongside our modern machines. Most of the tools mentioned were not carried as regular lines, but were only made to special order.

Modern Tools

We could go on almost indefinately describing the gradual addition of other lines, but in preference to this course we will discuss a few of the up-to-date machines now on the market. Considering the field of lathes, we have varieties almost innumerable. There is the manufacturing lathe, the thread cutting type; standard engine lathe, quick change engine type; heavy duty automobile lathe; rapid production machine; heavy duty combination turret lathe; chucking lathes; tool room style; high duty; turret lathes of all descriptions, and in fact, machines with practically every conceivable improvement. In the shaper and planer field we find the same thing. In general appearance both machines have improved wonderfully, and in the case of the shaper, the style of table used, and its various attachments, allows a large variety of operations to be performed. The method of drive has been improved in both cases, and we can now secure an even and rigid stroke. Again we find the individual motor drive in much favor, and the neat emhtod of mounting is a feather in the caps of our modern machine tool designers.

The radial drill of today is a very different one from that in use in 1883. The bed of this type of machine is now a part of the base and an auxiliary table usually swings around the column when required. Then on top of the regular swinging table, we can mount circular tables, or in fact, almost any combination we desire. The field of usefulness for this type of tool has greatly increased during the past ten or twenty years.

In grinding machinery great advances have been made and we now have specialized machines for crankshaft, camshaft, ball race, internal, external and similar grinding work. These machines are marvels of precision and embody all the features needed for tool room and general manufacturing purposes. Shafting, rolls, taper spindles, cutters, gauges, in fact, so many kinds of work can be finished on our modern grinders that it is futile to attempt to classify them.

Then there is the bolt, nut, rivet and forging machines now on the market. These have been brought to such a point of efficiency that even a mechanic marvels at their productive capacity. To see them take a bar of iron or steel and gobble it up, spitting out completed nuts in less time than it takes to tell it, makes us admit we owe much to machine tool designers.

Air-operated tools of all kinds have also helped us to arrive at this highly specialized productive age. The development in air-operated tools has been wonderful during the past few years. Electrically operated portable tools must not be forgotten, for they too have helped to reduce production costs. Then we have the horizontal boring machine, the boring, milling and drilling machine and vertical boring mill and the many diversified lines which practically perform the above mentioned operations. The development in presses has also been marvelous and today we find huge presses that punch out and form pieces in one operation that almost make the eyes pop out of your head. To pass through a large metal working establishment where a considerable amount of press work is done, is an education in itself. The author was privileged to do so not long ago, and to see men, who

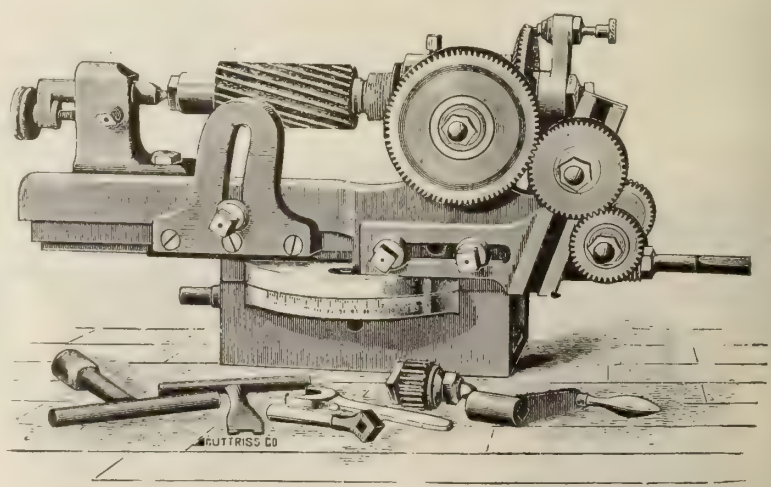


Fig. 13—Automatic spiral cutting attachment for Universal Milling Machine.

appear almost as midgets, operating machines of huge proportions is a sight never to be forgotten. It merely goes to show how designers have mastered the control of design and operation.

We also have the special purpose tool and the type of machine that is especially equipped with many cutting tools so that the work can be produced at high speed. All these have their place in the machine tool field.

Then come the many types of automatics, both large and small. What could we have done without these machines? Think of the millions of small parts which are produced yearly by the use of automatics. They have made possible the economic production of screws, nuts, bolts, etc., etc., not to speak of the thousands of other shaped pieces turned out on these machines. To stand and watch an automatic making even such a small part as a screw causes wonder. It is almost human. The rod feeds in, everything is automatic. One after another, the tools perform their work. If the head of screw is to be slotted, down comes an arm with a gripping attachment which can be likened to a human hand, grasps the screw as it is cut off, takes it up and holds it while the head is being slotted. Not content with their progress in automatic machinery, designers proceeded in the heavier class of work to supply magazine feeds to the machine, so that the operator would be able to attend to a larger number. This feature has helped the productive capacity of automatics considerably.

Bolt cutters, cold saws and other kindred lines have also improved. We cannot to attempt to cover all lines, but it is sufficient to say that the improvement which has been made to drills, milling cutters, tool steels, emery wheels, etc., has led to many further improvements in the machines themselves. As soon as milling cutters became of better quality, machines increased their productive capacity, and it has practically been a race for supremacy ever since.

We must not forget the improvement made in gear cutting and gear grinding machinery of all kinds. The development which has taken place in this branch of the industry has been very important and has helped the designers of other machinery to a great extent, as better gears make smoother running machines. The advancement made in bearing metals has been most important. In the earlier days the quality of bearings was rather uncertain, but now, bearing metals are made to very careful analysis. The class of castings has also improved considerably and this has done much to reduce weight, yet add strength to the machines.

Many types of self opening dies, collapsible taps, taper turning attachments and other production aids have all helped the cause. Air operated chucks during the war made themselves famous, as did many other labor and time saving

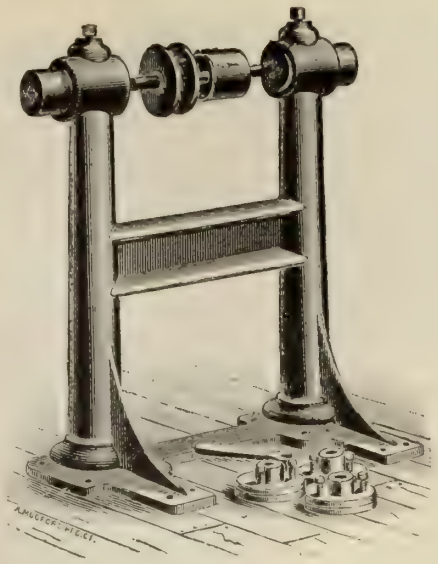


Fig. 12—Emery wheel polishing frame used in 1897.

devices. Die castings have also improved certain classes of tools and have been very useful in reducing costs on many completed articles. As stated previously, we cannot, without filling a volume, cover all lines in detail. In fact, there are bound to be many lines of development which are left out in this article, but the machines spoken of will be sufficient for our purpose. It is of course understood, that when we speak of any machine being on the market at any particular date, we do not infer it was invented at that time, for in many cases, cruder types of similar machines were made in earlier periods. The article is simply a forty year review, and in closing we can only add that the world owes a great deal to machine tool designers, and while such men do not as a rule appear before the public eye they are a great asset to any country. The past ten years especially has seen many noteworthy developments and while we are prone to look upon our 1921 machine tools as marvels of accuracy and efficiency, there is no telling what the tool designers of 1940 will be up to. A few years ago aeroplanes were a novelty. Now the first models are used only for exhibition purposes and the aeroplane has proved itself a big factor in times of war and peace. Likewise the machines in use today may be considered very old fashioned around the year 1940. Hats off to our machine tool designers. May they always be as ambitious and far seeing as they are at present.

MINERAL INDUSTRY

Continued from Page 120

mines. This year five mines are turning out gold. In short, gold mining is the bright spot in the mineral industry of Ontario at the present time, and the curve of production has a strong upward tendency here, while everywhere else it is downward.

The list of non-metallic minerals raised in Ontario is a long and varied one. It includes mica, graphite, feldspar, talc, fluorspar, arsenic, pyrite, etc. These substances form the basis of important industries. Owing to the lessened activity in trade, the demand has fallen off for most of them, and production this year will be below normal. Building materials such as stone, cement, brick and lime have usually a large output, controlled by the demands of the building and construction trades. These substances too will probably show a smaller output than in previous years. When trade revives and manufactories are once more humming, the mining industry of Ontario will quickly resume its former place. The minerals are here, and when wanted they will be forthcoming.

FOUNDRY DEVELOPMENT

Continued from page 131

vaded this territory. The crucible furnace in most improved form is still in evidence, while oil burning furnaces of various types are becoming popular. This class of foundry has made rapid strides during the last decade and today we have a large number 238 doing non-ferrous metal founding either as an entire business or as a department in the business. On the whole, Canada's foundry development has been satisfactory during the last ten years.

SHIPPING ARTICLE

Continued from Page 119

S. is a good illustration of creating artificial restraints of trade.

However, that is perhaps verging on dangerous topics. We must go on in the most efficient manner possible, getting the production of costs of goods down a point where they meet the purchasing power of the people and leaving them a bit of money over to buy some of the little luxuries of life. Lower railway rates will have their effect on trade, as lower coal prices are having their effect in Great Britain, and gradually we shall emerge from this valley of unrest until we get on the plate of sane business. There will be no need then for agonised enquiries into what is wrong with trade, and no demand for the nostrums so freely offered by various self appointed business practitioners. Let us all work for that day.

An analysis of farm implement production in the United States is interesting. The total turned out in 1920 reached a value of $537,000,000. Gas tractors to the number of 203,000 had a value of $193,000,000; plows amounted to $40,000,000 for 1,000,000 of them; 225 wagons came to nearly $25,000,000 and 412,000 haying machines were valued at nearly $25,000,000. The summaries were made by the Bureau of Public Roads from detailed reorts of 583 manufacturers.

Foundry Development During Last Decade

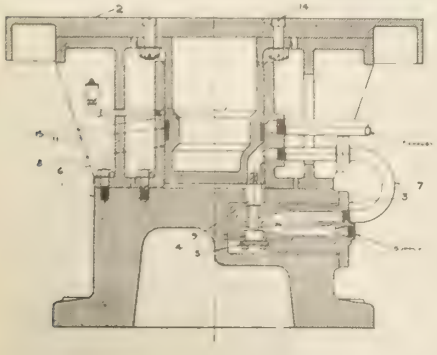
Castings Are Now of Better Quality—Working Conditions Have Improved—Molding Machinery Has Proved Its Worth—Electric Furnaces Are Now Quite Common

By F. H. BELL
Editor Canadian Foundryman



IN SPEAKING of what the last decade has brought forth in regard to the development of the foundry business in Canada, we are confronted with certain features of the situation which should be given consideration before proceeding with the real subject in hand. For instance, various changes which have been made for the betterment of the foundry have been made elsewhere as well as in Canada. Take the subjects of malleable iron and steel founding—both these branches have undergone radical changes during the last ten years, but this does not affect Canadian foundry practice any more than that of all countries. Malleable iron, which is among the pioneer branches of the foundry industry, was never what could be considered a real success, but as there was nothing any better, it was allowed to run along in a hap-hazard way until steel castings threatened to succeed it in most of the engineering fields.

Steel castings also had their drawbacks as it seemed to be impossible to produce them without having them pitted. This, however, did not materially injure their physical qualities, and steel was rapidly replacing malleable iron and would, no doubt, have accomplished its extinction had it not been for the organization of the American Malleable Casting Association and similar organizations elsewhere, the members of which threw aside all secrets and, putting their heads together, have placed malleable iron on a solid foundation by engaging experts to go the limit in the matter of research.



Pneumatic jolt-ramming molding machine.

Steel, which as we have shown, was its most formidable competitor, was also being perfected and has now become as easily controlled as any other metal. This fact is causing the grey iron foundryman to open his eyes and see what he can do to hold the ground which has so long been his.

I am just pointing out these few features of the situation so that the reader may understand that the foundry business the world over has been undergoing changes during the last few years in excess of most other lines of industry, and Canada, while only one of the many, has not lagged behind the others.

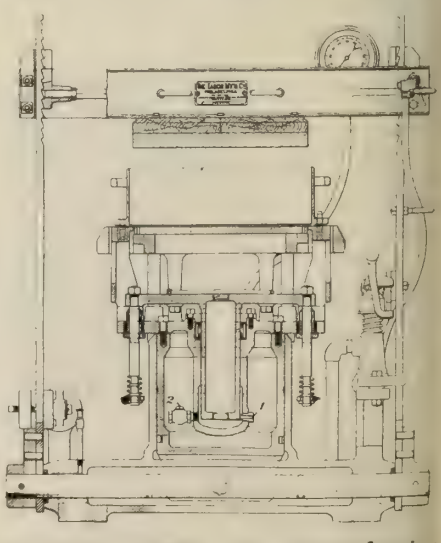
Looking Back a Decade

In looking back a decade in our history it seems but a short span, yet during those ten years the world has experienced four years of the most terrible war which savage man has ever perpetrated—four years in which foundry business was practically suspended, so that in speaking of what the last ten years have accomplished in the foundry we are to a very great extent showing what has been accomplished during six of these ten years. If, we analyse these six years we find that the year preceding the outbreak of the war was one of the worst on record, and that some of the years since the close of the war have not been what we would wish for, so that all things considered, the last ten years have not been ideal from the standpoint of comparison, but in spite of this, these ten years have been most prolific in achievements in the Canadian foundry field.

When I say that foundry business was practically suspended during the first period of the war I say it advisedly, as war calls for very little foundry work. In fact all lines of occupation had to surrender to the call to arms or else to the munition works, but in spite of this, the methods adopted in molding, and the new devices for melting the metal have advanced in a manner almost phenomenal. Molding machines while not being a new idea ten years ago, were almost entirely confined to the stripping plate variety and these were scarce in this country. The cupola furnace, which is the back-bone of the grey iron foundry, had to be modernized if grey iron was to hold its own. This has been done and old make-shift cupolas are practically off the ground today.

Results of War Not All Bad

The war, which we have blamed for standing in the way of the foundry, has however some things to its credit, and to this source we may trace some valuable improvements in the non-fer-



Pneumatic squeezing and pattern-drawing molding machine.

rous fields, particularly that of aluminum. What we have accomplished in the way of new industries should, perhaps, have precedence over improvements in details, so I will endeavor to show some comparisons between what we have now and what we had ten years ago.

Grey Iron Foundries

The grey iron foundry has made the poorest showing of any in regard to number of plants, but it has nevertheless held its own, and a little to the good, which is something worthy of consideration, in the face of the opposition which it is receiving from steel and malleable, as well as the depressed state of the times. The type of grey iron foundry which has been built in Canada during the last ten years will stand comparison with those of any country in the world and as examples of what is being done I will point to a few of the new foundries which have just been completed and which are in lines far remote from each other.



Twenty ton ladle, receiving metal from air furnace, Dominion Steel Products Company, Brantford, Ont.



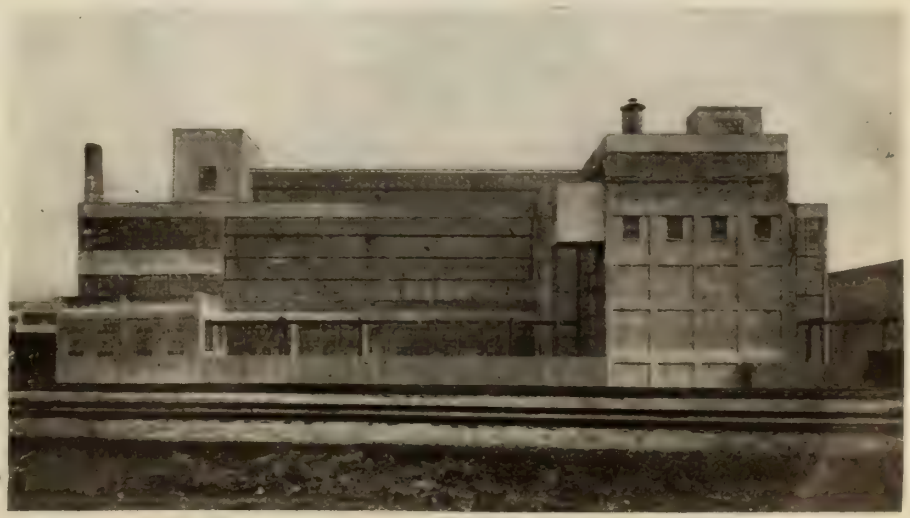
Interior view, Bowmanville Foundry Co.

The Bowmanville Foundry Co. of Bowmanville, who have just moved into their new plant, (shown in the illustration,) make a speciality of very light castings, even supplying stove foundrymen who have foundries of their own, with trimmings which are too light for them to successfully produce with their regular metal. This company employs fifty-five men, thirty-five of whom are molders doing this class of work, and regardless of the times, they are busy. In another view will be seen a reverse line of work displayed at the foundry of the Dominion Steel Products Co. of Brantford, Ont.

This company makes a specialty of heavy castings which are beyond the reach of the average general foundry. To accomplish this they have two continuous tuyere cupolas, one 72 inches in diameter and the other 44 inches. They have also a twenty-ton Pittsburgh type air furnace which is used for the production of castings of exceptionally fine quality and strength, such as chilled and sand rolls, close grained rams, large engine castings and mill castings, caustic pots, etc., which were formerly imported. They also have an electric furnace of 50 k.w. capacity and an oil burning crucible furnace with a capacity of 200 lbs. per heat. In this department they manufacture brass and bronze castings of all kinds. The illustration shows the mold for a phospor-bronze bushing weighing five hundred pounds. Manganese bronze gearing and valve castings with a tensile strength of 70,000 lbs. to the sq. in., or equal to that of a steel forging, are also produced.

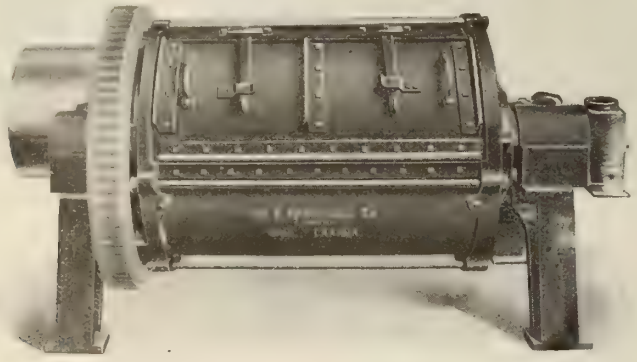
In another illustration will be seen an outside view of the new Grinnell foundry which was opened in Toronto a few months ago. This is a specialty foundry where nothing but pipe fittings are made. This foundry is three stories in height and the equipment is so complete that the machine operatives are little more than attendants. The molders do not require shovels, while even the sand cutting and mixing is done by machinery. These three foundries are selected, simply as examples of the way foundry work is being specialized during the last ten years. Each has its special feature, and is equipped in the most modern manner for the work it is doing. This class of foundry is springing into existence on every hand throughout the country. While the specialty shop is rapidly gaining in popularity the general purpose jobbing foundry is by no means dropping out. These shops will always be a necessity, but they must be up-to-date in order to hold their own, and to-day there are very few jobbing foundries in Canada which do not have a sand sifter, a sand mixer, also pneumatic and electric tools of different kinds, even to dustless casting cleaners.

Apart from the grey-iron foundries



Three story foundry, the Grinnell Company of Canada.

there are the malleable, steel and non-ferrous foundries previously referred to. These are, and have been for the last decade making forward strides in excess of the regular run of grey iron foundries from the standpoint of numbers of new plants being erected, but not, of course, in type of foundry or equipment. The type



Dustless, back-geared tumbling mill.

of grey iron foundry which has been built has, as we have shown, been of the most modern, but grey-iron has its field, and will hold its own in its own field while making room for the others where they are most adapted.

Malleable Iron Foundries

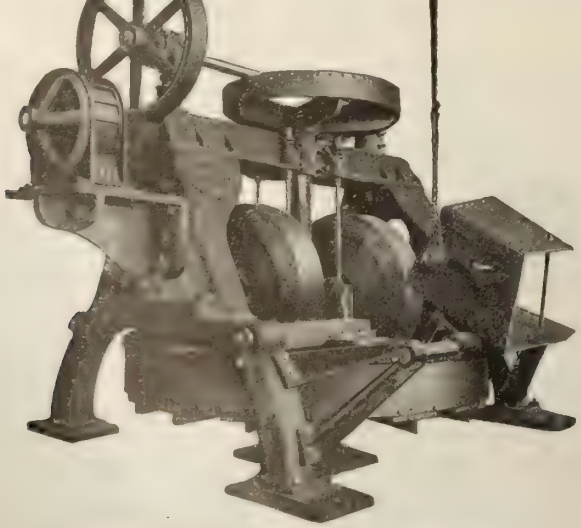
The malleable iron foundry, as previously stated, has been in existence in Canada for a period dating back almost as far as our history goes, but it was not overly progressive until recently. For many years we had a good malleable iron works at Oshawa, another at Smiths Falls and an occasional small one at a few other places, but ten years ago six or seven would cover the lot. To-day we have twenty-three modern malleable iron foundries, some of them on a very large scale. Fifteen of these are in Ontario, five in Quebec, two in British Columbia, and one in Nova Scotia. To go into details would be a big task, but among the improvements over old type of equipment, to say nothing of chemical knowledge there are such features as that of uniting several air furnaces to one large chimney and introducing forced drafts, the power for which is derived from what would otherwise be the waste heat from the furnaces after having done its work in melting the metal. This heat is used as fuel in the steam boilers which in turn supply power to electric motors.

Steel Foundries

Ten years ago we had two steel foundries producing one grade of steel castings. To-day we have forty foundries producing steel castings of any analysis required and by any process, either open hearth, converter, crucible or electric furnace. To give a list of these with their capacities and the grades of steel produced would be rather more than can be expected in an article such as this, but I will say that we have steel foundries in Canada which take orders for 50 ton pieces and pour them without difficulty; we have steel foundries that turn out manganese steel which can be bent but resists the file; we have steel foundries which produce blooms which are ready for the forge shop when taken from the mold; in fact we have steel foundries which will produce steel castings of any known variety.



Brass foundry department, Dominion Steel Products Company, Brantford, Ont. Note electric furnace and molds for heavy bronze castings.



Muller type of sand mixer and blender.

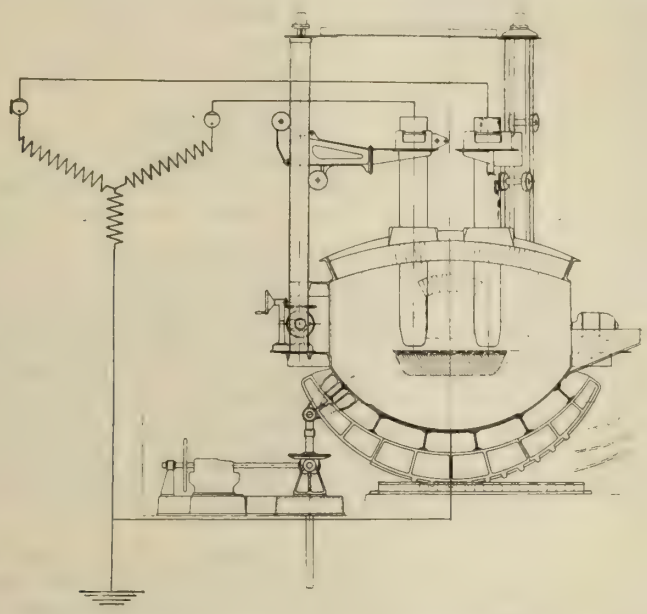
Electric Furnaces

The electric furnace has to my mind a very bright future. Canada is well blessed with water power with which to generate the electricity, and this has been taken advantage of during the last few years. Ten years ago such a thing as an electric furnace was unknown in Canada, while to-day we have no less than twenty-eight foundries with about seventy furnaces. Some of these are small but others are very large, and it might be news to many Canadians, as well as to the rest of the world, to learn that during the last ten years Canada had achieved the enviable position of having the largest electric steel foundry in the world. The electric furnace, being of such importance, and having a wonderful prospect in Canada, a list of these already installed will be of interest.

The Department of Mines of the Dominion Government compiled the following list which was correct at the time of compilation, but may, possibly, not include some of the latest installations. In fact there are to my knowledge a few which have been omitted. Following are those in the different provinces:

Furnaces in Ontario

Baldwin's Canadian Steel Corporation, Toronto, 10 six ton Herault; Baldwin's Canadian Steel Corporation, Collingwood, 1 three ton Herault; Electric Steel and Metals, Welland, 1 seven ton basic Herault and 1 six ton basic Herault Dominion Foundries & Steel, Hamilton, 2 six ton "Volta" Herault type, three-phase tilting furnace; Canada Electric Castings Co., Orillia. 1 two-ton and 1 one and a half ton, two-phase tilting; Electric Foundries, Ltd., Orillia, 1 six ton "Volta" 2-phase pig iron furnace, 1 six-ton "Volta" 3-phase ferro-alloy furnace; Electric Iron Ltd., of Lakefield, Orillia, 1 six-ton "Volta" 3-phase tilting furnace; Turnbull Electric Metals, Ltd., St. Catharines, 1 six-ton "Volta" stationary 3-phase, pig iron furnace; Tivani Electric Steel Co., Belleville, 1 two-ton 1 half ton and 1 one-third ton; and Bowmanville Foundry Co., Bowmanville, 1 one and a quarter ton Cornwall-Dixon.



Tilting electric furnace of the Greaves-Etchells type.

In Quebec we have the following:—Armstrong-Whitworth, of Canada, Montreal, 1 three-ton and 3 six ton Heroult; Canadian Electric Steel, Montreal, 3 seven-ton modified type Heroult three-phase; Canadian Brakeshoe Co., Sherbrooke, 3 two-ton, 1 one ton; Canadian Steel Foundries, Montreal, 1 three-ton "Volta" Heroult type, 3-phase, quick-melting, tilting furnace; Thomas Davidson Mfg., Co., Montreal, 4 six-ton, 1 two-ton and 1 one and a half ton; Hull Iron & Steel Foundries, Hull, 1 six-ton Heroult, 3-phase tilting; Joliette Casting & Forgings, Ltd., Joliette, 1 two-ton "Greaves-Ethell"; and Shawinigan Foundries, Ltd., Shawinigan Falls, 1 five-ton "Volta" Heroult type, three-phase, stationary furnace.

British Columbia

Port Moody Steel Works, Port Moody. 1 six-ton "Volta" 2-phase; Lowes Steel Co., Vancouver, 1 six-ton "Volta" three-phase stationary type; Opsal Steel Co, Vancouver, 1 two an da half tons, three-phase tilting; Shipton Electric Pig Iron and Steel Smelting Co., Vancouver, 1 one-ton; and Vancouver Engineering Works, Vancouver. 1 one-ton "Greaves-Etchell."

In Manitoba

Manitoba Steel Foundries, Winnipeg, 1 two-ton single-phase, 1 two-ton three phase. In addition to these the Electric Tin, Products, Brantford, Ont., have a Cobb electric furnace of two tons capacity for use in smelting tin, and the Empire Manufacturing Co., London, Ont., have just installed an electric furnace for smelting brass and bronze in the manufacture of fittings. The Dominion Steel Products Co., Brantford, also have an electric furnace, as has been shown, while the J. W. Cumming Mfg., Co., of New Glasgow, N. S. have a two-ton electric furnace which has been in operation for about six months. There are undoubtedly others which have not been brought to my attention, but those already enumerated make a fair showing for so short a time and in face of such conditions as have been prevailing.

Worthy of Note

There are other considerations worthy of note. The foundry, as a business had been neglected to a greater extent than, possibly, any other business, and although it was one of the original crafts—being practiced, by the ancients as far back as history goes, very little improvement was made in the methods adopted by the ancients until very recent date, and the last ten years will, no doubt, show more real improvements than all the other years combined. A few of the notable improvements in equipment are illustrated.

I have spoken of Canada having the largest electric furnace in the world. It might be equally as big a surprise to some people to know that Canadians built the largest electric generators which were ever made and that they are in operation here in Canada at the present time. In the illustration will be seen a dynamo base being made at the foundry of the Canadian Allis-Chalmers Co., Toronto. This base is 27 feet in diameter and weighs 48 ton. It is but one unit in one of the enormous dynamos installed by the Ontario Hydro-Electric Commission. at the Chippawa Canal development along the Niagara River.

There are many other points which might be dealt with but which are pretty well known; for instance the non-ferrous foundry. I have already shown that the electric furnace has in-

Continued on page 127



Molding 48-ton dynamo base at Allis-Chalmers Foundry, Toronto.

Decade of Canadian Railway Development

Tonnage Produced Without Transportation Facilities to Carry It to Market Has No Commercial Value—Railways Can Really Create New Material Wealth—Increases Noted in Mileage and Business.

By D. B. HANNA
President Canadian National Railways

WHAT CONSTITUTES progress in railway development in a country like Canada? If mileage is to be taken as the measure of progress, then an advance of 54 per cent. has been made in the last decade. In 1911 the mileage of all Canadian railways was 25,400. In 1920 the total was 39,196 miles.

Tonnage handled and passengers carried are measures of progress in a traffic sense, but the length of haul and journey must be considered as well as the mileage operated to get a recognized gauge of the density of traffic. Earnings and expenses must be considered. Earnings are affected by increases in freight rates and passenger fares; operating expenses by increases in wages and the costs of material. These in turn are all affected in an economic sense by the varying purchasing power of the dollar. Comparison of all these items, and some others, is however, necessarily a part of any analysis of the situation. Some comparative figures for 1911 and 1920 follow. This is only a nine-year spread. The changing conditions of 1921 would make that an undesirable year for comparison, and of course it would be impossible to get returns for some time yet covering this year.

SUMMARY OF CANADIAN STATISTICS.

1911	Item	1920
25,400	Mileage	39,196
79,884,282	Tons handled	127,388,453
37,097,718	Passengers carried	51,306,074
$188,733,494	Gross earnings	$491,938,857
$131,033,785	Operating expenses	$475,002,823
$ 57,698,709	Net earnings	$ 13,936,003
$ 74,613,738	Pay roll	$290,510,517
69.4	Operating ratio	97.17%

From the above table those who wish to deduct gloom may point out that the railways were better off in 1911 than they are to-day, measured by the operating ratio. But this conclusion would ignore many features of the case which are important from the point of view of the national welfare. Nor should the very much lower percentage of the earnings available for a return on capital be regarded as a situation peculiar to Canada. In United States the return on capital which as recently as 1916 was 6.16 per cent., fell to 32 one-hundredths of one per cent. in 1920.

Increase in Mileage

The increase in Canadian railway mileage since 1911, or seven years before the formation of the Canadian National Railways has been distributed among the provinces of Canada as follows:

Prince Edward Island	9.54
Nova Scotia	77.78
New Brunswick	399.55
Quebec	978.38
Ontario	2,678.15
Manitoba	723.30
Saskatchewan	3,027.72
Alberta	2,791,09
British Columbia	2,396.11
	13,081.62

The mileage has been absorbed by the large systems as shown below:

Canadian Pacific		3,867.17
Can. Nat. Rys.	Canadian Northern, Grand Trunk Pacific, Nat. Transcontinental	8,713.13
Other Lines		501.32

It is seen from the two tables above that of the new mileage put into operation since 1911 68.3% is in the Western Provinces, and 66.6% of the total increase has gone into what is now Canadian National Railways. Therefore on the lines now included in that system has fallen the greater part of the task of developing traffic for the new mileage. In the period under review there were four and a half years of actual world warfare, from which recovery to normal conditions has not yet taken place. That any great development has taken place in this nine year period is remarkable when it is considered that it includes only 2 ½ years of pre-war development.

The Canadian National Railways as a system dates from the time the management of the Canadian Government Railways was placed under the control of the Board of Directors which the Government appointed for the Canadian Northern Railway Company. This was done in September, 1918, after the completion of the arbitration proceedings for the acquisition of the C. N. R.'s capital stock. The management of the Grand Trunk Pacific was not taken over by the Canadian National Railways until 1st October, 1920.

It is, of course, impossible to say what greater progress could have been made since 1911 if the three railway systems had been under one management since that date. Ignoring this feature, however, we can compare the traffic handled in 1911 by the three railways with that in 1920, which will give some idea of the traffic development of the lines now included in the National System.

1911 Tons Handled	Products of	1920 Tons Handled	Increase % over 1911
2,043,464	Agriculture	7,702,435	276.93
253,342	Animals	622,153	145.58
2,728,734	Mines	7,955,072	191.52
3,227,120	Forests	7,707 435	138.83
2,199,500	Manufactur's	4 697,933	113.59
299,894	Merchandise	537,852	79.35
979,332	Miscellan's	1,109,961	13.34
11,731,386	Total	30,332,841	158.56

To convey an appreciation of what this increase in traffic means in the production of national wealth, let me point out that a competent authority in United States placed the value of the average ton of freight carried in 1920 at $143.00. The proportion of low valued commodities transported by rail in United States is greater than in Canada. In United States there is more mineral tonnage and a smaller percentage of agricultural products, so that on the average a ton of freight in Canada is more valuable than in U.S. Using the United States valuation, however, as an approximation, and deducting the tonnage which does not originate on the lines now included in the National System, the value of the additional

tonnage produced on the National System in the year 1920 over the 1911 tonnage would amount to $1,680,000,000. This sum does not take into account the differences in value of commodities in 1911 as compared with 1920. When this is included the additional value of the total tonnage originating on Canadian National Railways amounts to the enormous sum of $2,400,000,000. This is the increase in value in production in 1920 over 1911 which considers only the valuation of the articles transported originating on the lines of the National System, but this, of course, does not take into count the value which may be added to these products by various advances in their state of manufacture.

As tonnage produced without transportation facilities to carry it to market has no commercial value the railways can rightly claim credit for the creation of much new national wealth. The value of certain commodities has dropped since 1920 but the figures quoted may still be regarded as representing an approximation of the situation as no account has been taken of the increase of over 6 1-2 million tons of freight received from United States and Canadian railway connections which naturally represents a large increase in the nation's trade accounts.

As far as the entire Canadian railway situation is concerned, measured by the ton miles per mile of line (recognized as the gauge of density traffic) the country has since 1911 absorbed the 54% increase of railway mileage, because the density of freight traffic in 1920 per mile of line was actually greater than in 1911. This is one of the most important features of the comparative figures. It goes to show that notwithstanding the many unfavourable features present in the period, Canada has gone ahead in a remarkable manner and is now using on the average all of its railway mileage to the same extent it did in 1911. Canada had in 1911 but one Transcontinental line. It now has three, although two are under one management. The development of the country has been greatly extended, many new sections have been opened up for settlement. Due to the war some branch lines that were under construction in 1911, 1912 and 1913 have just recently been completed. Going back a little further, if the new towns created and new communities established are considered, it will be readily seen that the value of a railway to a country like Canada cannot be measured by its net earnings. Its effect on the National welfare must be kept in mind. Canada now enjoys better transportation facilities and is in a much more favourable position than ever before to enter upon a period of intensive development.

The fact that the Canadian National Railway System is in a position to handle a greater proportion of the nation's traffic is gradually being recognized by the Canadian people. This is shown by the larger percentage of the total traffic being handled by National Lines. There will no doubt be greater efforts made to attract new-comers to Canada of the proper type. With the gradual return to normal conditions and the resumption of immigration in pre-war volume, with the natural development of the newer districts served by many of the National System's lines which this will bring about, the relative position of the National System will be further improved and the pleasing operating results of the last four months will become the regular thing. In fact, net earnings can be expected to show a steady growth, provided that rates are on a proper basis and that the volume of business increases. It is a matter of time only, always provided of course that the railways' operations are kept in the hands of capable railway officers and business men free from the bane of political interference.



Pulp and Paper Census for 1920

Mills in operation during 1920—100, comprising 40 pulp mills, 27 pulp and paper mills and 33 paper mills and distributed as follows: British Columbia; 4 pulp mills, 2 pulp and paper mills, total, 6; Ontario, 7 pulp mills, 13 pulp and paper mills, 17 paper mills, total 37; Quebec, 18 pulp mills, 12 pulp and paper mills, 16 paper mills, total,, 46; New Brunswick, 5 pulp mills; Novia Scotia, 6 pulp mills.

Capital Invested.—$347,553,333; distributed by provinces as follows: British Columbia, $36,782,030; Ontario, $109,169,591; Quebec, $176,347,349; New Brunswick, $19,306,351; Nova Scotia, $5,948,012.

Number of employees including executives, and clerical and mill labor, 31,298. Paid in salaries and wages, $45,253,892. Distributed by provinces as follows: British Columbia, 3,015, employees; $5,617,123 in wages; Ontario, 10,071 employees; $16,151,737 in wages; Quebec, 16,223 employees; $21,305,462 in wages; New Brunswick, 1,458 employes; $1,846,775 in wages; Nova Scotia, 531 employes; $332,795 in wages.

Paper Mill Machinery Equipment.—In all mills making paper, 101 Fourdrinier machines, with a 24 hour capacity of 3,307 tons; 28 cylinder machines, with a 24 hour capacity of 824 tons. Total yearly capacity in paper of all kinds, 1,273,994 tons.

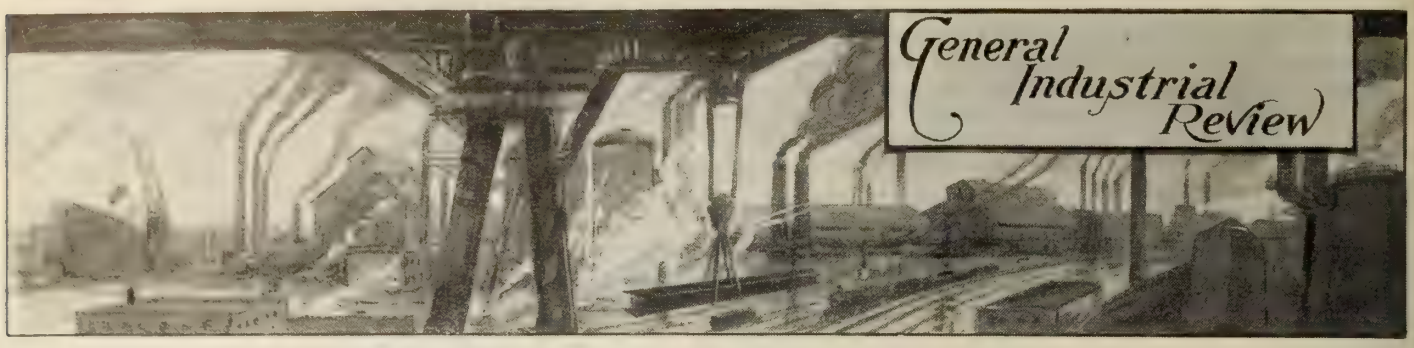
Wood consumed.—2,777,422 cords, valued at $45,404,889; average cost per cord $16.34. Spruce, 1,873,024 cords; balsam fir, 687,519 cords; hemlock, 176,029 cords; poplar, 5,732 cords; pine, 15,743 cords; other kinds, 19,375 cords, distributed by provinces:

Province	Cords	Cost delivered at Mill	Average cost Per cord
Quebec	1,333,815	$20,628,246	$15.46
Ontario	942,672	17,131,849	18.47
British Columbia	295,617	4,790,020	16.20
New Brunswick	180,723	2,553,613	14.13
Nova Scotia	24,595	301,161	12.24
Total	2,777,422	$45,404,889	$16.34

Woodpulp produced.—1,960,102 tons, of which 963,762 tons, valued at $41,772,617, were made for the producers' own use; 238,119 tons, valued at $21,998,630, made for sale in Canada, and 758,221 tons valued at $77,781,615, were made for export. Total value of all pulp produced $141,552,862, distributed as follows:

Description	Total production tons	Made for own use tons	Made for own use cost value
Groundwood	1,090,114	702,519	$23,505,693
Sulphite, unbld.	138,624	3,630	471,323
Sulphite, bl.	515,649	199,507	13,210,198
Sulphate	188,478	51,041	4,058,745
Soda	5,768	5,239	482,377
Other chem. fibre	21,460	1,826	44,281
Totals	1,960,102	963,762	$41,772,617

Description	Made for sale in Canada tons	Made for sale in Canada selling value	Made for sale for export tons	Made for sale for export selling value
Groundwood	107,079	$6,524,883	280,516	$19,958,761
Sulphite, unbld.	36,070	5,638,224	98,924	15,191,918
Sulphite, bl.	80,994	8,697,030	235,148	26,811,141
Sulphate	4,978	583,467	132,468	14,795,631
Soda	529	53,945	.....	.....
Other chem. fibre	8,469	600,081	11,165	964,164
Totals	238,119	$21,998,630	758,221	$77,781,615



CANADIAN CHEMICAL INDUSTRIES

Past Ten Years Have Shown Remarkable Progress —General Basis of Development Is And Always Will Be Our Mineral Resources

By L. E. WESTMAN, General Manager Canadian Chemistry and Metallurgy

PERHAPS the best way to get a grasp of the progress of Canadian chemical industries is to appeal directly to statistics. Going back to 1901, we find that for chemical and allied products, Canada imported goods to the value of $7,500,000, while exports amounted to $500,000. By 1910, imports had reached about $10,500,000, and exports $2,500,000. In 1920, imports were $30,000,000, and exports $22,500,000. Some growth indeed. The maximum occurred in 1919, when Canada exported the amazing total of $55,000,000, and imported around $35,000,000.

The general basis of this development is and will be our wonderful resources in industrial and precious minerals and our wealth of hydro-electric power. The chemical industry is as highly specialized as any field of manufacturing, and requires exceedingly skilled labor. Semi-popular conception of the chemical industries would confine them to pharmaceutical and medicinal preparations, but they are much broader than this, and include such operations as the production of refined nickel and the manufacture of artificial silk.

A recent list published by the Dominion Government Department of Statistics indicated the geographical location of 1,002 plants in Canada, classified as being chemical industries, properly speaking. This distribution shows at once how chemical industries follow and grow up in manufacturing districts or close to hydro-electric power.

Chemical Industries in Canada, 1921.

Nova Scotia	61
Prince Edward Island	8
New Brunswick	35
Quebec	279
Ontario	431
Manitoba	51
Saskatchewan	7
Alberta	39
British Columbia	91
Total	1002

These industries are even now passing through their most trying periods. The Canadian market, protected though it may be, is not large, and as our greatest chemical companies are concerned with selling on the market of the world, they have considerable difficulty in entering the large protected foreign fields. However, the economical basis of their operations will allow them to compete on open markets.

The principles of any chemical industry or the functions of chemists, which amount to the same thing, are two: (1) The elimination of waste; (2) the creation of new or better products. Industrial research, about which so much has been written, and which the Dominion Government and manufacturers generally have treated in such a fumbling manner, is nothing more than the application of the best brains in the country to these specific problems. That country which becomes really enthusiastic about her chemical industries and the application of sound chemical principles in research, simply cannot fail in industrial progress. Canada has the resources of all kinds, and we trust the vision. As a proof of the indomitable faith of manufacturers in the success of a chemical industry in Canada, mention might be made of the fact that within the last few months two companies began to manufacture aniline dye stuffs for Canadian textile mills, although Canada is one of the countries open to the free and unprotected sale of dye stuffs from Germany, England and the United States. This is indeed, for those who can appreciate it, the ultimate in faith and building for the future.

In a general way, it is very probable that the chemical industries of Canada will make progress out of proportion to our population growth. The essential raw materials are available and the energy to create new products from them exists in abundance. However, Canadian manufacturers do need a general awakening to the value of the work of the right kind of chemists, given the right kind of opportunity.

Much could be said about the large scale developments of individual companies, but the hope of the country consists in the proper expansion of many small but economically sound undertakings. So far remarkable progress has been made and while much of the war time expansion has passed away, a residue is left which these industries will maintain. Ten years has worked wonders in the past and science as applied through chemistry is even now just beginning to take a proper hold of our industries both basic and specialized.

PAINT OUTPUT HAS MORE THAN DOUBLED IN TEN YEARS

Paint And Varnish Industry Has Made Rapid Strides—In 1918 $15,784,610 Invested— Many Additions Have Been Made

By W. S. FALLIS, Vice-President and Managing Director Sherwin-Williams Co. of Canada

ALTHOUGH ten years ago the "Paint and Varnish" industry in Canada was an important part of the industrial life of the country, its growth since that time has been extraordinarily rapid, and the activities of this industry have now been developed to the greatest degree, through the enterprise and co-operation of the paint manufacturers of the Dominion. The greatest activity in the industry is found in the Provinces of Ontario and Quebec, but paint and varnish is manufactured in localities as widely separated as Halifax, Winnipeg, Vancouver and Victoria.

The last Government figures available are those for 1918, which give the output of these factories as $17,678,049.00. These figures were low even for the year which they covered, and as the paint and varnish business has increased very considerably since then, a conservative estimate of the volume of business for last year in paint and varnish, and allied products, would be $35,000,000.00. To produce this business fully forty-five different companies have been operated with an invested capital which amounted in 1918 to $15,784,610.00. In 1910 we find that there were only twenty-six firms engaged in the manufacture of such products in Canada, representing a capital investment of $6,277,915.00. The total output for the year 1910 was $8,041,154.00, so that it is apparent that the industry has more than doubled in ten years, both with respect to capital invested, and volume of business turnover.

The paint and varnish industry provides a market for a very considerable proportion of the country's raw materials. In the manufacture of their product, a large quantity of linseed oil is used, made from Western Canada flax. Pig lead from the British Columbia mines is another raw material which is used exclusively in the corroding of white lead, and in addition to this, the industry supplies a large home market for wooden boxes made from Canadian lumber, tin cans, commercial alcohol, creosote, naphtha, acetone, benzine, paraffin, benzol, and large quantities of pigments, dry colors and driers, so that in addition to the 5,000 employes directly engaged in the manufacture of paints and varnishes, the industry provides employment for many additional workers in the manufacture of products which it consumes.

The industry has educated the consumer to appreciate the value of paints and varnishes, not only as a beautifying agency, but also as a dominant factor in the preservation of property from decay. More and more the property owner is coming to realize that paint and varnish is just as necessary an insurance against deterioration of valuable property through the action of climate and weather, as is the possession of an insurance policy against loss through destruction of property by fire.

Due to the general realization of the value of paints, varnishes, and allied products as a factor in personal and national economy, the present depression in business has not fallen with undue weight upon the industry, although naturally it has been felt to some considerable degree.

With the stimulation in buying which is bound to come as a result of the revival in business, which is now in evidence, we who are engaged in the advancement of the interests of the paint and varnish business in Canada feel that great as have been the strides in the past ten years, the future holds an even brighter promise for increased prosperity to the industry, and constantly growing service to the community in beautifying and preserving the property of the Canadian people.

MANY REFINEMENTS IN DESIGN HAVE OCCURRED IN TEN YEARS

There is Approximately One Locomotive to Every Seven Miles of Track in Canada

By WM. CASEY, Vice-President and General Manager Canadian Locomotive Co.

THE RATIO of number of locomotives to miles of track in Canada is about one to seven, as compared to one to 2.8 in the United States, and while we can never hope for the same traffic density in Canada, as population and production increase there will be a continually decreasing ratio with a greater building program to care for depreciation.

During the five years preceding the war period—1910 to 1915—there were many more engines ordered than in the years 1915 to 1920, and while undoubtedly part of this was occasioned by the opening up of new lines, it is believed that when conditions throughout the country become normal, Canadian roads will require a much larger number of locomotives annually to provide for the efficient maintenance of their equipment.

In any comparison of the growth of the industry in the period referred to, the increase in power, weight and cost of a locomotive must be considered, as while the annual number constructed has increased from one hundred and eighty in 1910 to two hundred and twenty in 1920, the average weight of engine and tender in working order has, in the same period, increased from one hundred and fifty to two hundred tons, or in other words, the tonnage production of the industry has increased sixty per cent.

The growth for the first five years of this period was steady. As the road beds on the newly constructed lines improved, larger power was gradually adopted, and while for freight service ten years ago the locomotive of the Consolidation type was standard, in 1913 the Mikado type of approximately thirty per cent. greater weight was adopted, to be followed in 1915 by the Santa Fe type, introduced for heavy traffic on certain lines with heavy grades, and approximately a fifteen per cent. larger engine than the Mikado.

As the size of the engines increased, many refinements in design and construction became necessary, also the development and application of labor and coal saving devices—many necessitated by the increased power and weight, and all adding to the complication and cost of the machine. Whereas in 1910 the average locomotive cost for main line work was about $22,000.00, in 1920 this figure approximated $70,000.00.

The building plants in Canada and the railway companies' shops kept pace with the growth in the size of the equipment, and while during the war period the great bulk of the plants were engaged in munition work, locomotive construction was also carried on.

Export business has been started in a small way and connections formed, which under more favorable conditions it is hoped will considerably develop. In the past few years Canadian built locomotives have been shipped to Russia, South Africa, Rhodesia, Jamaica, Trinidad, France, Italy and South America, and from all reports received, the Canadian equipment has been most satisfactory and in numerous instances has led to repeat orders.

DEVELOPMENT OF ELECTRIC TOOL HARDENING FURNACES

By R. B. LINCOLN, Engineering Dept. Hiram Walker & Sons Metal Products, Ltd.

THE HEATING power of an electric current has been known a long time, but the electric tool hardening furnace was made possible when Mr. A. L. March in 1909 discovered the valuable properties of alloys of nickel and chromium as a resistance element. Before that time small electric muffle furnaces had been made with platinum heating elements. The high cost and the low resistance of platinum made it necessary to use a very fine wire of platinum foil or strip as a heating element. Such a furnace was both costly and delicate.

An alloy of about 20% chromium and 80% nickel has about seventeen times the resistance of platinum and such remarkable life, that it is used almost exclusively for the heating element of electric furnaces designed to operate below 2,000 degrees F. The first models were small muffle furnaces for use in the chemical laboratory, but a demand soon developed for a larger and more rugged furnace. Such a furnace was produced by using a heating element nearly one-quarter inch square, and a low voltage from the secondary of a small transformer.

An installation of this kind has come into quite general



A Modern Type of Locomotive Built at Kingston, Ont.

use for hardening carbon tool steel, but cannot be used at temperatures greatly exceeding 2,000 degrees F. or 1,100 degrees C. To harden high speed steel, a furnace has been developed in which the heat is radiated from stacks of carbon plates on each side of the furnace. The plates are about ¼-in. thick and 2 to 2½-in. wide and as long as the furnace is deep. They are placed one on top of the other to produce a column as high as the side of the furnace. The two stacks are connected at the top by a heavy carbon plate, and are connected to the source of energy by means of graphite electrodes projecting through the bottom of the furnace. The electrical energy used by the furnace is regulated by varying the pressure on the carbon plates by raising and lowering the electrodes.

The carbon plates slowly burn away when in use, but in so doing consume the oxygen that is in the furnace chamber and thus protect the steel from oxidation. By careful operation it is possible to heat high speed steel to any desired temperature, with practically no loss by scaling or burning.

Before the introduction of the electric furnace it was generally supposed that high speed steel should be heated to practically its melting point to get the best life from the tools. This was due to the fact that when high speed tools are heated in a fire to a temperature high enough to produce the best cutting properties, the edge is burned away by action of the flame to such an extent that the tools have the appearance of having been melted. In an electric furnace properly operated, it is possible to heat the most delicate tools to the proper hardening temperature without injury to their cutting edges, greatly increasing their life, and decreasing the cost of finishing the tool.

The greatest advantage of an electric furnace over one heated by fuel is the ease of accurate control and the freedom from noise and dirt. It is possible to obtain a quiescent non-scaling atmosphere in the furnace, and at the same time accurately control the temperature. Recently a very practical and at the same time accurate automatic temperature controlling device has been put on the market, still further increasing the usefulness of the electric tool hardening furnace. Many toolmakers prefer to do their own hardening, or at least have the tools treated in the tool room under their supervision, saving much time in insuring the tool being hardened in a manner most suitable for its particular duty. When the furnace is to be installed in a tool room, the cleanliness and quietness of an electric furnace is a great advantage.

ADVANCE IN ELECTRIC ARC WELDING

Electric Arc Welding Has Made Splendid Progress; Has Been In Commercial Use For Twenty Years; Railroad Shops Advanced Users of Process

By R. E. SMYTHIES, Engineer Lincoln Electric Co.

IT IS ONLY three years ago that electric arc welding really started to make progress in Canada. Prior to 1919 the process was in use in a few scattered steel foundries and railroad shops but had not begun to receive that general recognition from the mechanical engineering profession that is now being accorded to it. Arc welding has been in actual commercial use for twenty years or more. In Europe and America the war-time activity in the manufacture of munitions gave a great impetus to the practical application of the process to various branches of the metal working industries. Canada does not seem to have been concurrently affected to any marked extent, for some reason. This only makes more noticeable the development which has taken place since the armistice.

Out of a dozen or more firms, the names of which naturally occur to one as being the largest Canadian manufacturers of iron and steel products, to my certain knowledge only one possessed an electric welding outfit three years ago. I know only too well, because of the amount of good boot leather and lung power I expended trying to get them interested in the process, finding them almost without exception only mildly interested and very sceptical.

At the moment of writing, every one of these concerns has either installed arc welding equipment or started to make experiments in its application to some particular line of work. The start is often made by such concerns being called upon to tender on material in the construction of which electric welding is specified. It is gratifying to note how fresh applications are discovered, week after week in such plants, until it is soon found that additional welding equipment is needed. Railroad shops are probably the most advanced users of arc welding. The average moderate-sized shop engaged in the repair and upkeep of rolling stock has enough work to keep a battery of welders busy. It is used for repairing broken locomotive frames, all kinds of boiler repairs, building up worn journals and other parts, and has been successfully applied to the repair of cracked cylinders and other castings.

Another field in which great strides have been made is in the manufacture of steel tanks, containers, stills, digesters and similar equipment. In this connection it is interesting to note that in the recent explosion of pressure stills at Imperoyal, N. S., the welded joints were almost the only parts left intact.

Quite recently, some of the larger mines, mills and factories have begun to investigate the possibilities of arc welding in the repair and maintenance of the heavy machinery with which they are equipped. The Hollinger gold mines purchased a welder some months ago and from all accounts are now wondering how they ever managed to get along without it. Since Sept. 1st the citizens of Toronto have had an object lesson in arc welding, in watching one or other of the half dozen machines belonging to the Transportation Commission at work, bonding the new tracks by means of welded fish plates. During the last few years this special application of the process has come into extensive use in the United States, and there is also an ever-lengthening list of users in Great Britain.

It is also during the last three years that the job-welding shop equipped with the electric arc has sprung into existence. It is quite beyond the scope of this review to begin to describe the numerous and varied applications that the enterprising job-welder has worked out in the short time that he has been in the business. The total value of the equipment that he has saved from the scrap heap, at a relatively trifling cost, must alone be an important economic factor.

It is not desirable, however, to lay too much stress on the value of arc welding in the repair of worn and broken equipment. Too many people are inclined to regard it in that light entirely and overlook the biggest field for future development, which is undoubtedly in the manufacture of iron and steel products of all kinds.

The surface of this field has been barely scratched as yet and it is no exaggeration to say that during the next few



The electric welding of these penstocks is a wonderful achievement. They are 16 ft. diameter; made of, from ½ in. to 1¼ in. plate. Three men worked about one month on each penstock, 50 hours constituting a week's work. About a quarter of a ton of welding rod was used on one penstock alone.

years a revolution will be worked in many branches of the mechanical engineering industry by the more extensive application of electric arc welding to its processes. The low cost of electric power in Canada makes the whole subject of the greatest interest and importance to Canadian manufacturers.

TEN-YEAR DEVELOPMENT IN CEMENT INDUSTRY

By H. S. VAN SCOYOE, Canada Cement Co.

THE PAST ten years have been in many ways the most interesting in the development of the cement industry in Canada. They have included the peak point of 1913 when the total consumption in Canada reached 8,913,014 barrels. When this figure is contrasted with 102,750 barrels the consumption in 1887, or even with 1,401,419 barrels, the consumption in 1903, the importance of this industry when Canada again resumes its normal development is evident.

The per capita consumption of cement in Canada during both 1912 and 1913 was the largest of any country in the world. It is quite likely that this condition will again obtain when Canada gets back into her full stride.

The war period very seriously affected the consumption of cement; the sales reaching their lowest level in 1918 when they were less than 60% of the maximum sales of 1913. Conditions improved considerably during 1919, however, and to a still greater extent in 1920. While it is too early to give accurate figures for 1921 they will approximate those for 1920, a very satisfactory showing when general business conditions are considered.

It was not until 1890 that any Portland cement was manufactured in Canada and as late as 1903, 55% of the cement consumed was imported. Since 1912, however, the imports have been very small, exceeding 1% in only one year. A conservative estimate of the producing capacity of the mills operating in Canada this year or in condition to operate is 13,600,000 barrels which is more than 50% in excess of the consumption during the best year the industry has so far enjoyed.

It is this fact together with the fact that cement manufacturers in Canada have sold the product at cost plus a profit rather than at what the imported article would cost with freight, duty and exchange added, that has held the cement market in Canada for Canadian manufacturers.

Cement with a duty which is equivalent to 16% is not imported into Canada to-day although in many cases goods are being brought in and sold to the consumer at a price 50% more than the same goods can be bought for in the United States.

The cost of manufacture is somewhat less to-day than it was in 1920 but even now in the three main items which include more than 90% of the cost, labor, coal, materials and supplies, the costs are from 125 to 150 per cent. higher than in 1914.

Improved conditions have already been reflected in the decreased cost of cement. Nothing will give greater satisfaction to the cement manufacturers than a continued improvement and a continued decline in the selling price of their product.

BUSINESS MACHINES THE ESSENTIAL

By F. E. MUTTON, General Manager International Business Machines Co.

NO BUSINESS can successfully operate without business machines, and one only needs to survey the remarkable progress in such machines through the last decade to realize just what they mean to business. In fact, the success of any concern to-day, that will live through the keen competition, depends on just how thoroughly they are equipped with modern business machines.

The progress in manufacturing business machines that do the work instead of the human is one of the greatest factors in reducing the cost of prosperity. It is easy to prove that all that is necessary is to present to the business man what automatic machines will do for him and he will buy them. Six years ago the entire purchase of time recorders in Canada would not exceed twenty-five thousand dollars annually. To-day it reaches half a million annually, which is simply the result of a proper presentation of the great value of time.

When you save time you save money, and time is more important than money ever was. What is money anyway? Money is only a chemical combination of a clock tick and a drop of sweat. The greatest element in cost to-day is the cost of labor time, and any successful business man recognizes that he must of necessity have a printed record not only of the time he purchases from employees, but also of the time devoted to each individual operation. Without the printed record then there is the great hazard of inaccurate costs and inaccurate costs means failure.

Business machines which embody time recorders, job time recorders, time stamps, master clocks, wall clocks, tabulating machines, sorting machines, and scales made for all kinds of businesses, are really amongst the most valuable commodities on earth, for they mean speed, accuracy and economy.

There was a time when time recorders were looked upon as only useful in factories. That is all changed. They are as essential, and even more essential for the office staffs and when you go into the modern office to-day you will not have much trouble locating the time clock. Anything that teaches accuracy and method saves time. Anything that teaches order and regularity saves time, which means the reduction of the number of employes, which reduces costs, and as Herbert Kaufman says, "Never mind the Yukon and its gold. You can dig all the gold the world needs out of a time clock."

RUBBER INDUSTRY SHOWS DEVELOPMENT IN TEN YEARS

Capital Invested Exceeds Fifty Million Dollars—Over 16,000 Employees Engaged—Remarkable Progress Has Been Made

By W. A. EDEN, Vice-President Canadian Consolidated Rubber Co.

FEW industries in Canada show greater development during the past ten years than the rubber industry, which to-day stands as one of the five leaders in Canada's industrial activities. In the manufacture of rubber goods, Canada ranks fourth among the countries of the world.

In 1910 there were half-a-dozen rubber companies. At the end of 1919, over twenty companies were operating thirty-two factories. The capital invested in 1910 amounted to approximately eight million dollars. In 1920 it exceeded fifty million dollars. In 1910 less than five thousand workers were employed. Ten years later over sixteen thousand were on the pay-rolls of the rubber companies. In 1910 approximately 2,400,000 pounds of crude rubber were imported into Canada for manufacturing purposes. For 1920, crude rubber imports exceeded 20,000,000 pounds. In 1910 Canadian factories manufactured rubber products to the value of $5,000,000, and ten years later the factory value of their output was approximately $56,000,000.

In the above figures the reader has a tabloid statement of the growth and development of Canada's rubber industry, the products of which are being shipped to all parts of the globe. Exports of rubber articles, made in Canada, for the fiscal year ended March 31, 1921, amounted to $15,480,960.

The great development of this industry in Canada reflects the tremendous increase in the use of the automobile during the last decade. In 1910 automobile tires were manufactured on a very limited scale, but in 1920 it is estimated that over one million three hundred thousand automobile tire casings were manufactured in Canadian factories. Rubber footwear, too, made remarkable progress and to-day the Canadian product is the equal of the best rubber footwear made anywhere in the world. Mechanical rubber goods, such as belting, hose, packing, mattings, plumbers' supplies, etc., and druggists' rubber sundries are also important factors in Canada's rubber industry.

Rubber is of real service to mankind, and touches every phase of human life. "From the cradle to the grave" would aptly tell the story of its uses, which are countless, because rubber has many qualities. It stretches; it is air-tight and water-tight; it is a non-conductor of electricity; it has great plasticity as well as great hardness; it is a shock-absorber; it is adhesive.

In speaking of its varied uses, a prominent authority said:

"Rubber literally holds up the stockings and the trousers of the world. Infants cut their teeth on it and old age uses it in false teeth. Millions of motorists and other millions of cylists ride on rubber tires that are durable, noiseless and air-tight. Balloons of rubber float aloft and huge submarines plow their routes beneath the ocean surface propelled by electricity stored in great rubber cells. Sheathed in rubber, the lightning makes a peaceful way through our homes, offices and factories, furnishing light and telephone service. Divers sink out of sight beneath the waves in rubber suits. Rubber air-brake hose makes safe the travel of a nation. Air-drill hose rivets our ships and skyscrapers. Fire hose protects our property in city and home, while garden hose brings nourishment to our growing plants. Rubber clothing protects us against storm. Rubber footwear guards us against cold and wet. Tennis balls, golf balls and rubber-core baseballs give healthful sport to millions. In hospitals and medical work, the uses of rubber are without number. For the steam engine and connecting machinery, rubber packing has been an essential factor in the development of steam as a motive power."

As the uses of rubber are extended, the industry in Canada keep pace with the advance of science and its discoveries of will continue to flourish, because Canadian manufacturers new uses for rubber.

HAS PROVED A VERY SATISFACTORY YEAR

Milling Industry Has Completed Its First Year of Readjustment—Roller Process Was Introduced in Canada About 1880

By A. E. LABELLE, Vice-President St. Lawrence Flour Mills Co.

THE Canadian milling industry has just completed its first year of re-adjustment, (it having remained under the control of the Wheat Board until the 31st August 1920) and I think on the whole, it has proved a fairly satisfactory one, especially if compared to other concerns, who have all more or less suffered by war conditions.

The history of flour milling in Canada is most interesting and probably is the best example of the industrial development of our country; we can still see several of the old grinding stones, which were operated by hand in the North West territories, by the Indians, and of course everybody has seen many of the old windmills, which are still standing up and which were built at the beginning of the colony. I understand there are yet a very few in operation. The roller process was introduced in Canada about 1880 and has gradually replaced the old grinding stone.

In a country like ours, covering such a large area, mills had to be built at nearly every centre, in order to supply the wants of each community, the miller was always considered one of the principal citizens (in Quebec, the Seigneurs were the owners of the first mills). Gradually, these mills were changed, enlarged or rebuilt; large companies were formed; several large mills were built within the last fifteen years, until to-day there are 1,255 mills, spread from the Atlantic to the Pacific. Many of them, are very small but some are of the largest and most modern type. In fact, Canada has more large mills than any other country, except the United States, but we compare very favorably with any of them and just as efficient.

The capital invested in milling in Canada at present is $76,000,000 and its product was valued at $262,000,000 in 1920, being the most valuable production of all industries.

It must be born in mind, however, that the present milling capacity is over three times the requirements of our domestic consumption, so that in order to operate economically, foreign markets have to be found to take our surplus, our exports which ten years ago, amounted to 4,217,543 barrels, grew to 10,826,633 in 1917-18, but it has decreased since and the problem of the mill now is to export more flour, which will cheapen their cost and produce more mill feeds, of which the farmers are always short.

The one great advantage that the Canadian mills have is the quality of their flour, our wheat is the best in the world—this fact is recognized everywhere—so with proper legislation and equitable rates of freight, there is no reason why our milling industry should not develop still further and keep pace with the prosperity of our country.

TEXTILE TRADE SHOWS REMARKABLE GROWTH

Canadian Textile Mills Have Sold Goods in Spite of Keen Competition—Domestic Mills Have Grip on Home Trade

By H. H. BLACK, Montreal Editorial Representative Financial Post

Probably no industry, except pulp and paper, has experienced such consistent and permanent development in Canada during the past decade as that of textiles. This includes, in a varying degree, the departments of cotton, woollen and knit goods. Figures quoted below show a marked increase in the capital invested, value of products and number of employees. They indicate a remarkable growth, but figures are inclined to be dead unless suitably applied. To what causes, then, does the textile industry in Canada chiefly owe its healthy development?

In every branch it is forced to face as keen competition, probably, as is experienced by any trade. The boot and shoe industry, for instance, has been wearing down the competition of United States goods, particularly in men's wear and to some extent in women's. In the field of cottons, however, the goods of England had become household words in home and store, much more so in fact than in woollen and knit lines. It took years of steady salesmanship, after skilful and competent manufacturing processes, for Canadian mills

CENSUS OF KNIT GOODS

	1910	1920
Capital invested	$ 7,657,731	$ 21,311,633
Employes	4,512	5,887
Wages	$ 1 374,898	$ 4,511,325
Materials used	$ 3,154,013	$ 15,180,368
Value of production	$ 5,738,773	$ 27,516,270

to convince the wholesalers and retailers, as distributors, to accept the domestic instead of imported stocks. Among woollens, Scotch tweeds held a place all their own. As to certain French lines of silks, and some Swiss goods, no attempt has been made to dislodge them. Nevertheless in the past ten years the Canadian textile mills have, in dozens of directions, pushed Canadian-made fabrics in face of the keenest competition and they have won. More than ever before have the domestic mills a grip on the home trade. Improvements in machinery and in processes, over a period of years, have been the basis of the success won in displacing imported stocks. To-day there are few industries running so close to capacity, especially is this true with respect to cottons. The Wabasco Company, for example, is operating night shifts to make certain of the finer lines of cotton fabrics.

Advance to Finer Goods

Generally speaking the cotton industry in Canada at first contented itself with the more staple lines, without attempting the finer goods, but some years before the war mills were going into the latter, installing more delicate machines, and using the finer yarns that at first were imported. Later, they manufactured on machinery which was brought over from

CENSUS FIGURES OF COTTON MILLS

	1910	1920
Capital	$ 33,091,344	$ 58,732,941
Employes	13,041	16,124
Wages	$ 4,561,199	$ 10,981,091
Materials	$ 13,979,741	$ 43,816,517
Products	$ 24,584,931	$ 82,642,949

England. Some four or five years ago it was considered a great achievement when the Bonner-Worth mill at Peterborough installed machines for the making of fine dry-spun French yarns, and mills in Toronto, Hamilton and Paris followed. These yarns were used in some cases by the domestic mills in their own manufacturing work, and in others sold to other mills in this country; in either case they displaced yarns that heretofore had been imported from England. Practically all the Canadian cotton mills improved the lines they turned out, among them the Dominion Textile, Canadian Cottons, Wabasco, Montreal Cottons. In the last ten years the first three have easily averaged an increase in output of fifty per cent. In this period three mills, producing tire cotton, have been established in Canada, two of these within the past two years. A duck mill was started at Hamilton, and the cotton fabric mills of the Woods Mfg. Co. at Welland.

In cotton goods marked improvements have been shown in lawns, cambrics, nainsooks, dress and apron ginghams, fine shirtings, fine printed goods, etc. In the woollen mills a large number of lines of women's clothes, overcoatings and suitings are now made that were not even attempted ten years ago. There has been betterment also in men's suitings. In knit goods the past decade has probably witnessed a greater development than in any other textile department. This applies to cotton, woollen and silk hosiery particularly, with underwear and sweater coats well up. All kinds of novelties in knit goods have heen introduced. It can be said, without exaggeration, that the knit goods mills of Canada are gaining a greater supremacy in the domestic field with every succeeding year.

CENSUS FIGURES FOR KNIT GOODS

	1910	1920
Capital invested	$ 11,938,029	$ 34,149,593
Employes	8,364	12,995
Wages	$ 2,527,631	$ 8,460,739
Materials used	$ 6,904,217	$ 26,548,736
Value of production	$ 13,393,854	$ 45,052,002

The war, which injured many another industry, proved of inestimable aid to Canada's textile business. For sometime it shut off, in many instances completely, the importation of English goods, (the keenest competition), and also to considerable extent United States substitutes. The former fact was due to the changing over of hundreds of British mills to munitions work. Faced with domestic goods only, the Canadian wholesalers and retailers were compelled to try out Canadian products that had been scorned before.

A trial proved to be the mills' best advertisement and the buyers, like Oliver Twist, came back for more. Once sold, they stayed sold and to-day hundreds and thousands of new accounts all over Canada have been opened for the output of Canadian mills.

Export business is light now. It will be keener later on, but the domestic factories will face the future without fear. Their success along the enlarged scale on which they are operating to-day seems assured. But more and more they should, and no doubt will, look to the improvement of their equipment, with automatic looms displacing steadily the old-timers.

PROGRESS IN LIFTING APPARATUS

Manual Labor Is Now Superseded By Mechanical Lifting Devices—Development Has Been Remarkable For Short Time

By M. R. MELDRUM, President Herbert Morris Crane and Hoist Co.

THE DEVELOPMENT in the usefulness, practicality, speed and efficiency of hoisting machinery has been slower than the progress in some other kinds of machinery. This may be due to a variety of reasons, but among others it is undoubtedly true that people are reluctant to buy machinery for intermittent operations which can be performed by workmen without mechanical aids. The development of handling machinery has, however, speeded up during the last few years.

An up-to-date superintendent, worthy of the name, now hesitates to take men away from productive work to lend a hand on a lifting job. So development has been going on, due to a gradual change of ideas and thanks to a few persistent pioneers.

Hand operated chain hoists have been improved, simplified, made more efficient, fitted with brakes and with other effective devices. Among such improvements may be mentioned a feature to take advantage of gravity instead of fighting it, allowing the load to fall by its own weight, adequately controlled by a suitable governor.

Trolleys have been fitted with anti-friction bearings, flexible bogies for facilitating the traversing of curves and they have been made adjustable to suit different sections of track beam.

Hand operated overhead cranes have been adapted to use the most modern types of lifting gear and they have been fitted with roller bearings and with variable operating speeds. But the greatest development of all has been in electric hoists.

In the beginning, as is usual with almost all mechanical developments, electric hoists were extremely complicated. Stunts and gadgets were literally plastered all over them, all leading to trouble and requiring constant adjustment. The real genius of design consists in making a mechanism ideally simple. Each component should perform two or more functions. In a successful design it is not uncommon for one part to fulfill half a dozen purposes. The latest electric rope hoist is simple, compact, highly efficient both mechanically and electrically and it is truly portable.

This invention marks a real stage in the development of handling facilities for industrial plants and it is safe to say that within the next few years it will effect a revolution in handling methods.

METAL CUTTING PRACTICE HAS MADE RAPID STRIDES

New Steels Now in General Use Call for Higher Grade of Saw Blade—Quality and Design of Blades Have Improved

By EDWARD S. NORVELL, E. C. Atkins & Co. Hamilton Factory

THE PAST decade has probably witnessed the greatest development of cutting metal by means of saws that has ever been known. Before the war, the increased demand for metals and the replacement of wood in many articles by some metal, developed a demand for more efficient and scientific metal cutting saws, that was met by improved tools by manufacturers.

But the war demanded even more improved tools, that would produce accurate work at high speed, and that would stand up under this increased demand. Saw manufacturers were not found lacking in imagination or ability with the result that saws were made capable of meeting every requirement. How various problems were mastered would each entail a long story, if told in detail, so we will only try to outline the general process of development.

Ten years ago most steels were of the straight carbon type and the very hard alloy steels which we have to-day were not in general use. During those times, metal sawing was not quite so difficult so that the straight carbon steel saw was satisfactory. But gradually tool steels and alloy steels came into more general use, and it became difficult to find saws that would cut the new metals economically. This growing demand showed saw manufacturers a large field of business, some spending much time and money in experiments to find the proper materials and correct design to make a better saw. New saw steels were developed, and new designs perfected. High speed steel saws came into general use during the war because they would stand a higher rate of feed and cut pounds of metal per sharpening. The proper tempering of high speed steel was a difficult problem, as it is a hard material to manipulate, and failures were expensive. Since the war high speed steel saws have been perfected and are

now dependable. Semi-high speed saws are for use when the demands are not excessive.

Hand in hand with the improvement in material, the design of metal cutting saws was improved, and standard specifications have been adopted for cutting each kind of steel, and all other metals. By extensive experiments the proper speeds and feeds at which to run various types of saws to cut every metal have been determined, thereby eliminating expensive guesswork.

As wood becomes scarce, metal or other substitutes must be found to take its place, and with wood, a saw is in most cases the most economical and practical tool to cut metal. We have not discussed the development of metal sawing machines, but they have also kept pace with the times. The present machinery could not recognize its prototype of ten years ago. The modern hacksaw does not hack; the modern cold saw is really a milling machine; the band hacksaw machine is new altogether; and the former wood cutting swing saw is a most valuable metal cutting machine, when equipped with the proper blade. In closing this short review, we wish readers to remember that the performance of any metal cutting machine depends greatly on the blade that is used.

AUTOMOBILE INDUSTRY CLOUDS NOT WITHOUT BRIGHT LINING

Estimated Replacements for Coming Year Said to Furnish Opportunity for Fair Business Despite Dullness in the Trade

By J. M. ELSON

A GLANCE back over the conditions which have prevailed in the automobile industry for some time can lead to only one conclusion. There is a long way to go before they will be back to anything like normal health. Men engaged in the various branches of the trade, like their fellows in other departments of business activity, are hopeful that 1922 will witness an encouraging improvement, but hard facts do not permit of much enthusiasm. The strongest real factor, perhaps, entering into consideration is that of necessary replacements. At least, aggressive men who feel that there will be business to be had for those who go after it, estimate that on a replacement basis there will be enough trade to make a fairly substantial market.

It is obvious to even a casual student and observer that the industry has suffered heavily by the depression which has existed. With tight money came a low buying power and a tendency on the part of people to avoid expenditures involving any considerable sum of money. There must always be a bottom, of course, to every trough, and it is considered by men who are in a position to read signs, that the trend of events in the future will be upward. During 1920 and 1921 there was a decided quietness, a quietness which made presidents and managers of companies knit their brows, but if anything is said now it is with more optimism.

One of the points made is that the rapid decline in the cost of materials and the consequent reduction in the prices of cars will have the effect of stimulating buying. Whether this is speculative or becomes a fact next year will have to prove itself but it is a peg on which a salesman can hang an argument. In almost everything except cotton the drop in the cost of manufacturing automobiles has been sharp. Steel, for instance, has gone down 40 to 50 per cent. Labor is cheaper and, of course, very plentiful. Rubber, too, is down as well as various other materials used. Sometime ago the industry anticipated these things and reduced the prices of cars.

INCREASE IN PRODUCTION

The rapid increase in the production of automobiles from 1916 to 1921 is shown in the following statistical report:

Year	Total Production
1920	402,929
1919	322,887
1918	268,960
1917	198,878
1916	120,318
1921 production to October 31st	178,575

Canada's Automobile Business, export and import.

Comparative figures of export and import business done by Canada in automobiles show a large trade in 1919-20, with a decided falling in the six months of 1921, ending with September. The imports were as follows:

Freight	$2,142,477	$2,693,543	$1,080,537
Passenger	5,864,484	6,388,031	6,219,053
Automobile parts	5,410,424	8,384,161	4,951,232

Financial Features of the Industry are:

Capital invested by manufacturers of cars	$43,467,000
Capital invested by manufacturers of materials	5,450,000
Capital invested by manufacturers of parts	19,678,182
Capital invested by manufacturers of tires	43,691,869
Capital invested by dealers	44,176,000
This makes a total investment of	$156,463,051

Replacement Prospects Are Good

Of a more substantial nature, however, is the statistical record on which the trade bases its outlook. It is pointed out that the average life of an automobile is around ten years. Taking the number, therefore, which were sold in 1912 and which would have to be replaced in 1922, there is a good amount of business to be done even if new buyers and owners are not found.

In Canada, as in the United States, there is a strong public movement for improved highways. This, undoubtedly has come about as an outgrowth of the rapid increase in the use of motor form of transportation, but whatever the cause it is a fact and in several of the provinces large sums of money are being expended by governments to build and improve trunk line roads. With the existing popularity of the motor car and the motor truck, coupled with the continued development of highways, it is held by many in the automobile business that the pendulum is bound to swing back soon.

For instance, the total number of cars registered in Canada in 1913 was only 220. For 1920 the registration ran up to well over 400,000. Figures available up to the end of October 1921 give the registration for Ontario as 178,575 and it is estimated hat for the year 1921 now closing the total will be over 180,000. Figures given herewith show the rapid development in five years.

Rapid Growth in Registration

In the United States the growth has been remarkably fast. The number of cars registered in that country in 1916 was 3,687,000, whereas the total registration in 1920 was 9,118,000 or almost three times as many.

Incidental features in connection with motor traffic indicate so far as figures can be secured that of all the cars used in Canada 90 per cent. are for business purposes of one kind and another; that from an automobile standpoint the best county is Kent, which has one car to every nine people; and that 74 per cent. of all cars sold come within the $1,000 or less class. This estimate is based on known conditions in Ontario and Western Canada. The remaining 26 per cent. is divided among 140 makes of cars.

In connection with the probable production for the coming year it is calculated that for replacements alone there will be 65,000 cars sold. Should a fair percentage of new buyers be located this output would of course be greatly increased. The estimated production value of cars put out in Canada reaches the big total of $377,480,047. In Ontario alone, last year 41,747 cars were sold. Replacements for the same province are estimated to be 29,000 for 1922.

Statistics gathered by responsible bodies and firms show that the growth of the motor truck as a means of transportation has increased enormously and that its future promises to be much greater with the new highways. Business houses are now shipping all kinds of short haul business by motor transport up to 60 and 80 miles. If this branch of the trade grows as rapidly as expected and the replacement output is

anywhere near what is hoped, the coming year should see a gratifying improvement in an industry in which enormous sums of money are invested and equally large sums are paid out in wages when plants are running.

INDUSTRY HAS UNDERGONE MANY CHANGES

Price of Sugar in 1920 Reached Higher Point Than at Any Other Time in History of Industry—Future Holds Forth Better Things

By JOHN D. LOWRY, Atlantic Sugar Refineries, Ltd.

THE sugar industry in the past eight years has undergone great changes. In the year 1920 prices for raw and refined sugars reached a higher point than at any other time in the history of the industry. During the American Civil War refined sugar retailed in parts of the United States at a higher price than it did during the year 1920. This, however, was a condition local to the United States; and it was for the world war just past to create conditions which were world-wide in their effects. At the outbreak of war the world's greatest sugar market was Hamburg, and while all the sugars of the world were not bought and sold in Hamburg, it was in Hamburg that the price of raw sugars was established. With the changes that occurred in 1914, New York became, and is at the present time, the great sugar market of the world.

With the outbreak of war the beet sugars of Europe, heretofore a dominating factor in the world market, ceased to exist as such. As the war progressed the sugar-producing countries of Continental Europe, whether enemy or ally, were unable to produce enough to meet their own requirements. France and Belgium producers with a greatly curtailed production; and Great Britain a non-producer, and dependent upon the Continent for her supply, were forced to look elsewhere for sugar. This demand stimulated production in all cane sugar producing countries of the world. And through the war the production of cane sugars increased, while beet sugar production in Europe decreased.

The graph shows the production of cane and beet sugars from the crop years of 1912-13 to 1920-21, and from it may be seen to what extent the beet sugar industry of Europe has suffered. Cuba producing more cane sugar than any other country showed an increase between 1912-13 to 1920-21 of 1,507,503 long tons. The crop of 1912-13 being 2,428,537 and the crop of 1920-21 3,936,040 long tons. The graph also shows an increase in production of European beet since the crop of 1919-20.

To predct how long it will take for European production to reach pre-war figures is impossible; the sugar beet crops are directly affected by unsatisfactory general conditions, and with the revolutionary changes that have taken place over a large portion of the beet-growing areas of Europe, the owner of large lands has given way to the peasant as a small-land holder, and the latter is more intent upon growing a crop which he can store, and consume within his own family, than in growing such a crop as sugar beet.

In 1919 and the early months of 1920 a large portion of the Cuban crop was purchased abroad; thus greatly curtailing the stocks available for the United States. The United States with average yearly increase in total sugar consumption over the past ninety-seven years of 5.313%; with a total consumption of 85.43 lbs. for the same year was confronted with an apparent shortage. Early in March 1920 a buying movement that is without precedent commenced in the raw sugar market, New York. On the 9th of March Cuban 96° centrifugal sugars sold for $10.00 per 100 pounds, cost and freight New York. From then until May 19th the price advanced rapidly and on May 19th sales were recorded of these sugars at $22.50 per 100 pounds cost and freight New York (these quotations without duty).

The foreign buyers earlier referred to as having bought a large portion of the Cuban crop, re-sold during this advance to buyers of the United States, a large percentage of their holdings. At the same time sugar-producing countries throughout the world attracted by the high prices obtainable in the New York market sold even to the extent of causing a sugar shortage within their own boundaries.

Imports of full duty paying sugars into the United States in the year 1920 were 885,868 long tons; whereas in the previous year about 60,000 long tons were imported. From an

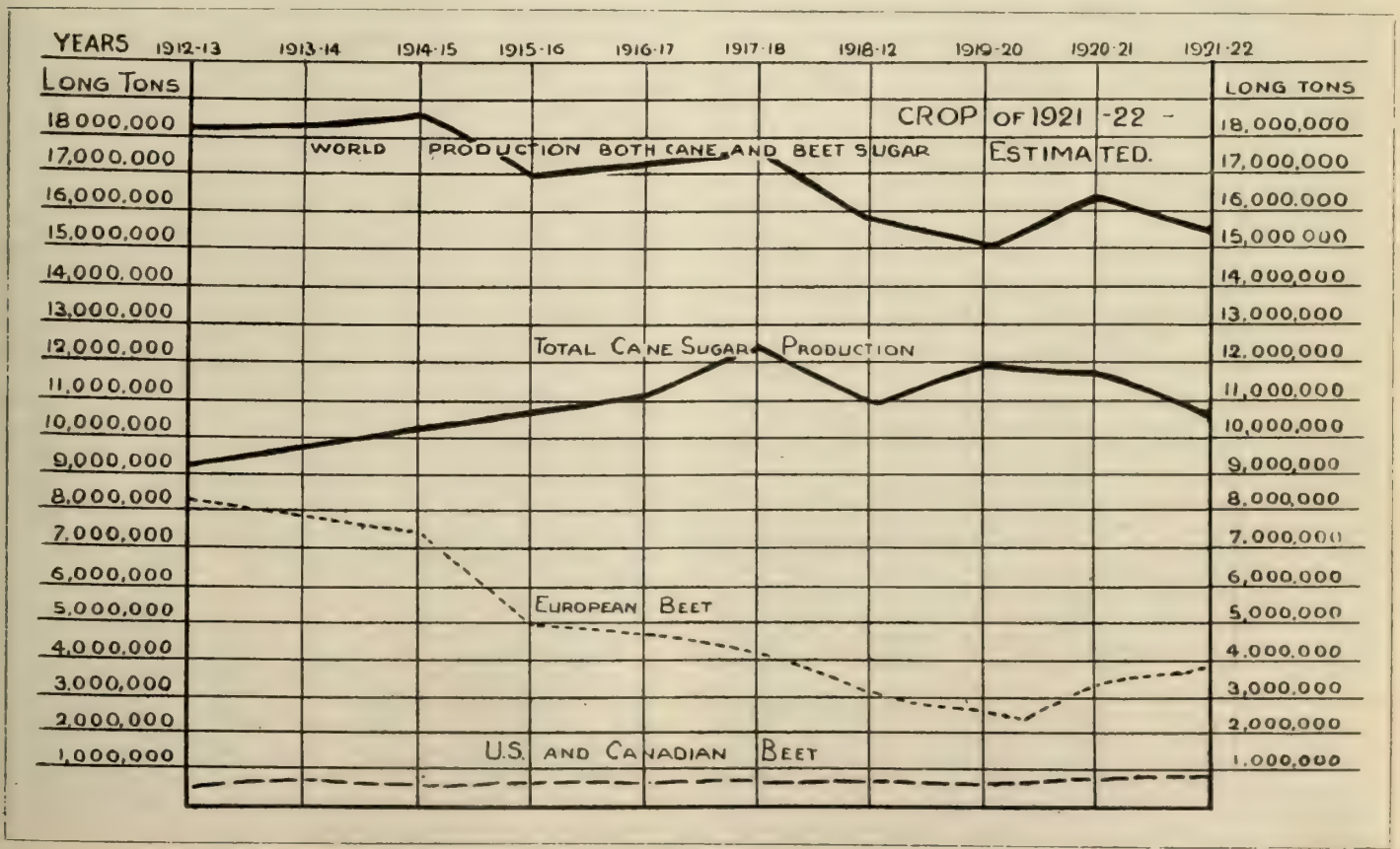


Chart showing production of cane and beet sugar since 1912.

apparent shortage, an over-supply was thus created. In the last week of May a decline in prices commenced, which was very rapid; on the 14th of December 1920 the low figure for the year was reached, Cubas selling for $3.625 per 100 pounds cost and freight New York. Government control in the United States was operative between October 1917 and December 1919.

In Canada the sugar industry was controlled by the Government from October, 1917, until July, 1920. In each case purchases and sales were entirely in the hands of the Governments, refiners working on fixed margins. In Great Britain control lasted until the end of February, 1921. In Great Britain the control body dissolved showing a net loss through its operations in sugar of some 24,000,000 pounds sterling.

In Canada, for the first six months of 1920, with the exception of one, and one half months from the middle of February to the end of March, the Government forced refiners to sell refined sugar at a price actually below the cost of raw sugar. Such action caused Canadian refiners alone to sustain a loss estimated at thirty million dollars. This apart from losses of others directly and indirectly associated with the sugar industry.

The year 1920 in passing left conditions to say the least chaotic; at no time during the present year of 1921 has the raw or refined sugar markets shown any sustained firmness. The refiners' price of granulated sugar at the time of writing is $7.135 net per 100 pounds Montreal basis, which when the restricted purchasing power of the dollar is considered, is back to a pre-war basis. It may be said for the sugar industry of this continent that it has passed through the storm; and from those who look into the future greater optimism is being expressed, now, than at any time for many months past.

MARKED CHANGES IN DESIGN

The General Purpose Machine Is Again With Us —Strides Made in Electrical Distribution Causing Changes to Methods of Driving

By R. M. HAMILTON, Works Manager Canada Machinery Corporation

A FEW YEARS prior to 1910, and since then, has seen very marked changes in designs of ironworking machine tools brought out by the introduction of high speed steel, practically all types of machine tools lacking rigidity and not having power and speed equal to the marked improvement in cutting steels. The years previous to the war also saw the development of complex machines designed to do the various machining operations required on one piece in one machine.

War experience on shell work showed that this type of machine was not the most efficient on repetition work, but that the method of doing a single operation on one simple machine with speed and feed suited to the work was much better, and many manufacturers thought that great progress had been made in methods of manufacture for all time.

We believe, however, that experience since the close of the war has proven that war methods were only applicable to war times excepting in specialized industries such as the manufacture of automobile parts or similar work which can be made in great quantities, and apparently the time of the general purpose machine is again with us.

The strides made in electrical distribution are causing changes to quite an extent in regard to the methods of driving and the supplanting of continuous current by alternating is resulting in many machines being now designed with all speed changes being taken care of by quick change drive gears, although we believe it will be many years before the individual motor drive will supersede the group method of driving, as first cost is not the only objection to individual motor drive on small machines.

In regard to woodworking machinery, the high wage rate prevailing in recent years has forced the design of machines of greater production and all first class factories now have to study methods and machines that will lower the labor cost. It has recently been demonstrated that on ordinary revolving cutter head machines, it is one cutter only that does the finishing, owing to probably one of three things, viz: lack of rigidity in machine design, lack of running balance or bad setting of the cutters. Given a machine well built and rigid, with heads and spindles in perfect running balance, and with the knives ground and jointed in place, the feed of the material per minute can easily be increased fourfold with work equal in finish. While this reads as being quite simple, it is a lot of work for the manufacturer of machinery and means a radical change in design in most cases.

In addition to this, there are quite a number of machines designed on the principle of one knife finishing, and the speed of the cutter head increased to the limit of endurance of the knife. This means in many cases spindle speeds of eight thousand revolutions per minute and over and is accomplished very nicely by ball bearings specially selected for accuracy.

Motor drive is another departure from old lines, but in the Niagara Power Zone, progress in direct connected motors on woodworking machinery spindles is handicapped by the twenty-five cycle current furnished, as the cost of the electrical equipment necessary to get the high speed is almost prohibitive.

CANADIANS ARE HEAVY USERS OF SHEETS—PROTECTION NEEDED

Successful Making of Galvanized Sheets Goes Back to 1915—In 1917 Black and Blue Annealed Sheets Were Made

By A. T. ENLOW, President and General Manager Dominion Sheet Metal Corporation

THE ENTRY of Canada into active participation as a manufacturer of steel sheets is of comparatively recent date. There was an unsuccessful attempt in 1910 to roll black sheets in a plant at Morrisburg, Ontario, but the company was unable to make headway and in 1912 the plant was closed. The location in Morrisburg was extremely illogical and evidently had in contemplation the assistance of the leader of the Ontario Government, Sir James Whitney, whose home was in Morrisburg. The expected political help did not eventuate, and, having nothing in its favor otherwise, the proposition naturally languished.

In 1915 a plant was established in Hamilton for the manufacture of galvanized steel sheets, which has been in continuous operation since, and from this source the galvanized sheet requirements of Canada throughout the war period and later were largely supplied. In their Hamilton plant the Dominion Sheet Metal Corporation have a capacity for supplying up to 25,000 tons of galvanized sheets per annum, and as the normal requirements of the Dominion are fully double that amount, it would appear that the future developments might well be assumed to be promising, although the recent high prices such as in effect in 1919 and 1920 cut the Canadian consumption to a minimum of less than 25,000 tons.

In 1917 the abandoned sheet mill at Morrisburg was bought by the Steel Company of Canada and brought to Hamilton, where it has since been operated in conjunction with their open hearth and blast furnaces. Two hot mills with auxiliary equipment have been operated until recently when a third mill was started, leaving a fourth available for further expansion. The output of three hot mills would be approximately 18,000 tons per annum, the product being box annealed black sheets, blue annealed sheets and uniform color and special stamping stock, as well as single pickled and oiled sheets.

In 1919 the Baldwin Canadian Steel Corporation located in Toronto, and took over the plant used throughout the war by British Forgings, Ltd. Due to the feverish activity in all lines of trade in 1919 and the first half of 1920 the company was not able to get into operation as soon as anticipated, and while both black and galvanized sheets have been made to date, their operations have mostly been in tinplate. The Baldwin Corporation has available eight hot mills for making sheets and tinplate, which, however, have not yet been reduced to a basis of systematic operation. They buy their sheet bar

requirements from outside sources, the bulk so far being from the United States.

In view of the foregoing it is evident that Canada has at least made a start as a producer of sheets, and as it is well known that Canadians are the largest users of sheets per capita in the world, it would appear logical that the powers at Ottawa, whatever their politics, do what they can to assist in raising the country to a self-contained basis. The tariff on sheets is extremely low, being 7½ per cent. from Great Britain and 12½ per cent. from the United States, and while the exchange rate has been an additional protection to a small extent during the last two or three years, yet this may soon be inoperative if the troubles of the English and Welsh producers are eliminated.

Very little in the way of sheets has come in from Great Britain from 1919 to date, because their costs have been high and operations unsatisfactory. With rapidly reducing costs, low ocean freights and a 10 per cent. below par pound sterling one may easily conjecture that the local producers may soon have the bulk of their competition from across the water, and the preferential tariff rate may be found so low in view of below par English currency that an effort will be made to adjust tariff rates upwards if the industry is to succeed in establishing itself here.

Canada's rate of duty from Great Britain is only one-third that of the United States import rate from outside sources and yet they profess to be alarmed in the United States as to what may occur when costs drop to normal in overseas mills. The next two or three years will tell whether Canada has a sheet industry of its own, or continues with the "moss-back" policy of letting the outsider furnish its requirements.

STEEL MAKERS OF CANADA HAVE INCREASED CAPACITY

Steel Must Be Manufactured in Advance of the Actual Requirements—Canadian Mills Well Able to Carry On

By C. W. SHERMAN, President of Dominion Foundries & Steel, Ltd.

STEEL is the base of industry. Any country's development or position in this world can be measured by its steel-producing capacities. Steel is like a railroad through a virgin country; it must be manufactured in advance of the actual requirements. All industries are dependent upon steel or machines made from iron and steel, and if any industry contemplates starting operations in Canada, one of the first questions which will be considered is that of the proper supply of steel or machinery.

Prospective industries need no longer hesitate about such supplies. The steel makers of Canada, during the past ten years, have so increased their capacities and widened their range of products that Canadian industries can carry on practically independent of the outside world insofar as their steel requirements are concerned.

Canada's demand for steel steadily increased each year from 1910 and the Canadian steel makers anticipated these needs mostly by enlargements to their existing plants. In the fall of 1914 and beginning of 1915 the steel makers of Canada were suddenly confronted with an avalanche of demands for steel for war needs: the Imperial Munitions Board wanting steel for shells, guns and other munitions; the shipbuilders needing ship plate, rudders, propellers and etc.; the railroads with their orders for rails and steel parts for their locomotives and cars; the machinery manufacturers making their insistent demands for their needs, until the total yearly demands reached a point where it was a million tons greater than the normal capacity of the steel plants then existing.

Canada's normal steel-producing capacity before the war was approximately 900,000 tons yearly. By 1918 she had more than doubled this capacity, government statistics crediting Canadian steel makers with a total production for that year of 1,873,708 tons of steel. Compare these figures with that of twenty years previous when in 1898 Canada's total yearly steel production was only 24,125 tons.

Armistice day found Canada possessing more than a score of steel plants which, for the most part, had been developed specially for war needs. In order to prevent wholesale scrapping of these huge developments the steel manufacturers set to work to revamp their plants to produce needed steel products still insufficiently produced in Canada.

Canada's steel development has out grown the existing tariff. Our present tariff can be revised in many ways that will benefit the producers without increasing the average cost to the consumer of steel, and at the same time be of great assistance in correcting our adverse trade balance. While Canada's markets do not demand or permit the developments of such huge steel works as now exist in the United States, her modern steel plants stand second to none in efficiency, and in the quality of their products.

PAST DECADE HAS SEEN MANY IMPORTANT DEVELOPMENTS

Over 15,000 Are Employed in Automotive Business in Canada—Attitude of Business Men Towards Motor Car Has Entirely Changed

By T. A. RUSSELL, President Willys-Overland Co.

THE PAST ten years in the automotive industry has been marked by a development which has placed this industry as one of the most important in the country. The secretary of Automotive Industries of Canada has compiled some detailed statistics which are full of information to illustrate this. I wish only to quote a few of the outstanding features.

Ten years ago the industry was one of our smallest. To-day there are over 15,000 people employed in Canada with an investment of approximately $50,000,000, and an annual payroll in excess of $15,000,000. In Ontario the license fees in 1911 were $50,000 a year. In 1920 they exceed $2,000,000 and the Provincial Treasurer is now counting on them as being dependable for an annual income to the Province of $3,000,000. The total number of licenses issued in all of Canada in 1910 was 8,937; in 1920 this had grown to 402,929. Seven companies are manufacturing motor vehicles in Canada, and the value of their output in 1920 was approximately $93,000,000. Some of these plants are most complete. One company claims over 90 per cent. of the parts entering into it are made in Canada. One company with which I am identified, has an equipment which rendered it capable of producing five fighting aeroplane engines of over 200 horse power each every eight hours, when the need of the moment was for munitions of war.

The attitude of business and business men towards the motor car is entirely changed. Ten years ago it was regarded as a luxury and its use confined to the few. To-day it is recognized as one of the great utilities of the country, adding to the efficiency of men in all walks of life, taking its place with the telegraph, telephone and other inventions in adding to the efficiency of the individual in business. Ten years ago scarcely a single farmer owned a motor car. To-day, a moderate-priced car is regarded in the light of an agricultural implement of daily benefit on the farm.

The last year and a half has seen the industry meet conditions of curtailment in business, which would have threatened its very existence had not the industry been well founded and actually meeting the daily need of the people. Instead of there being evidence of a declining use of the motor car, there it every evidence of continued extension of its sphere of usefulness. While the buying power may continue low for a period, long or short, the motor car has demonstrated it has a function to perform and that the industry is therefore secure.

Up to date, general data has shown that the average car drops out about five or six years after its manufacture, so that there is a continuing business ahead of us in replacement alone, equal to the business of the corresponding period, five or six years back. There will be more discrimination in buying in the future. The public will judge more keenly between cars which are attractive and economical and durable, as against those which have these advantages to a less marked extent. They will discriminate more in favor of cars which are able to give good service, replacement of parts, etc., as

against those whose facilities are less satisfying. There may be less of a tendency to buy extravagant cars and more insistence upon cars in the economy class, but that there is a continuing business of large volume in front of us, no one at present can reasonably doubt.

TRANSPORTATION METHODS HAVE ADVANCED RAPIDLY

Automobile Manufacture Has Developed Quickly; Ono Out of Every Twenty-Two Inhabitants in Canada Owns An Automobile

By T. M. McGREGOR, Vice-President and Treasurer Ford Motor Co. of Canada

DURING THE past decade a revolution has taken place in transportation. The motor car, truck and bus have entered into active competition with the trolley and interurban electric system and are seriously encroaching on steam line business for short haul freights. In these few years the automotive industry has bounded from comparative insignificance to a position of paramount importance.

In 1910 there were 8,937 automobiles registered in Canada. In 1920 there were 403,000.

In 1910 the total capital invested in the industry was $4,699,000, with a value in products estimated at $6,252,000. In 1920 these figures were, respectively, $56,943,000 and $101.196.000. These totals spell employment directly for 12,500 people with an annual payroll of over $15,500,000. Indirectly, the amount of employment provided will more than double this figure. These data can be divided approximately as follows: Automobile plants, 7,000 employes with payroll of $9,700,000; automotive supply plants, 1,800 employes with payroll of $2,000,000; automotive repair plants, 3,700 employes with payroll of $3,800,000.

The industry is wide spread. Cars are manufactured and assembled at Toronto. Oshawa, Walkerville, Windsor, Ford, Kitchener, Chatham, London, Hamilton, Brockville, Montreal and Winnipeg.

No estimate has been made of the army of salesmen, mechanics, repairmen, clerks and canvassers engaged in the service, sale and distribution of automotive vehicles, but some indication is given by the fact that there are over 1,600 automobile dealers in Canada, 500 automotive equipment and accessory jobbers and dealers, besides many tire manufacturers.

The industry pays taxes to municipality, province and Dominion involving purchaser, dealer and manufacturer. On license alone over $4,000,000 was paid in 1920, to which must be added business profits tax, income tax and provincial, local and other charges.

One in twenty-two people in Canada owns a motor car and it is enlightening to note how many cars are brought for business rather than for pleasure. Our company which keeps an accurate analysis of sales, reports the following after classifying 57,185 consecutive purchases of cars:

	Per Cent. of Purchasers
Agents	5.93
Agricultural	45.05
Government	1.68
Manufacturers	3.65
Jobbers	2.91
Retail Merchants	13.77
Public Service Corporations	.52
Transportation	4.18
Public Institutions	.14
Trades	5.53
Total Commercial Purchasers	83.36
Professional, Private and Sundry	16 64
	100.

Canada's part in the automotive industry by no means ends with production for domestic purposes. She is beginning to be one of the great automobile export nations. Department of Trade and Commerce figures for 1920 show the following export shipment values:

Autos—Freight	$ 2,602,853
Autos—Passenger	11,376,268
Autos—Parts	4,262,325
Total Auto Exports	$ 18,241,446

Export figures for 1910 are unavailable, as at that time no separation was made between gas engines, steam tractors and automobiles.

Canada's greatest opportunity for development lies in improved transportation. The automobile, truck and bus bid fair to solve the problem; and judging from the growth of the industry during the past ten years her people have not been slow to grasp the opportunity.

CANADIAN FORESTS SHOULD BE PROPERLY SAFEGUARDED

Canada's Pulp and Paper Industry Growing Rapidly—Industry Ranks First in Exports and Second in Capitalization

By W. H. CRABTREE, President Howard Smith Paper Mills

PAPER-MAKING began in Canada in the Province of Quebec about one hundred and twenty years ago, but for a period of forty or more years little or no development appears to have taken place. The industry apparently received some impetus between the years 1840 and 1867, when several small mills were erected in both Lower and Upper Canada.

It was about this date when pulpwood was first used in this country as a raw material in the manufacture of paper, and from this time the progress of the industry has been steady and constant. In the year 1891 some twenty small mills were in operation, with a total capital investment of less than three million dollars. At the close of the year 1920 there were about one hundred pulp and paper mills in operation throughout the country, representing a total capital investment of over three hundred million dollars, and giving employment to some fifty thousand persons in mills and woods.

The industry ranks first in exports, second in capitalization and is making a fair bid to become Canada's leading industry.

It is estimated Canada's forest area is capable of yielding over one billion cords of pulpwood, while the present rate of consumption is approximately two and one-half million cords annually.

Vast, however, as these timber resources appear to be, it is imperative that some definite steps be taken to safeguard our forests. To my mind, rigid regulations should be passed by the Provincial Governments and machinery set up to enforce the same. These regulations should provide for forest protection against: (a) fire; (b) destruction of the timber by worms or other species of insect; (c) improper cutting, and (d) depletion.

It is true there are certain restrictions and regulations in the statute books. These are not, however, enforced in anything like the degree that is necessary if we are to keep front rank in the pulp and paper industry, and I cannot urge upon our Provincial Governments too strongly the vital necessity for the enforcement of such restrictions. Wise legislation, well enforced, in co-operation with the limit holders, will ensure for Canada a supply of raw material for generations to come.

Our exports, which in the past thirty years have been built up from nothing to the amount of about one hundred million dollars per annum, can be greatly increased, and the increase maintained, but at the present rate of consumption and destruction we are surely running our heads against a stone wall. I feel greatly alarmed concerning the position of the industry twenty years hence. We have a golden ball in our hands. Do not let us throw it away.

Not only has Canada built up a tremendous trade in the

making of newsprint paper, but she has also made for herself a very enviable reputation for the making of high-grade writing and ledger papers, considerable tonnage of which is being exported to all parts of the world. This branch of the industry, however, is unfortunately handicapped, inasmuch as its growth is limited, very largely due to the fact that Canadian publications (other than newspapers) cannot compete with the United States publications that are now flooding this country. That some protection should be given to Canadian publishers is self-evident. Consider the tremendous influence that would be at work if our people were reading Canadian literature, presenting Canadian views from a Canadian standpoint. The development of our country would be along rapid, safe and sound lines, and not only result in the promoting of this branch of the paper industry in Canada, but Canadian industry generally.

MINERAL INDUSTRY DURING THE LAST TEN YEARS

Has Been Carried on Under Remarkably Abnormal Conditions—Nickel Industry Fluctuated—Asbestos Production Increased

By WYATT MALCOLM, Chief of Division of Geological Information

THE HISTORY of mining in Canada during the last ten years is the history of an industry carried on during most of the time under remarkably abnormal conditions.

Prior to the war there was a long period of steady growth of the mineral industry. This was, of course, affected by temporary depressions such as came in 1914. For a short time after the outbreak of the great war with its terrible disruption of established industrial and trade relationships there was a slackening in mining operations. When, however, it became manifest that the struggle was to be one of long duration and that an unprecedented demand for such metals as iron, nickel, copper, lead and zinc would assert itself, great energy was thrown into mining operations and the value of the production increased from $128,863,075 in 1914 to $211,301,897 in 1918.

With the close of the war came a cessation of the abnormal demand, and activities declined. The great world reaction, however, that followed shortly after the signing of the armistice and spent itself in a wild orgy of luxury and extravagance gave a powerful, though shortlived, stimulus to mining, and the value of the production reached its maximum in 1920 when it amounted to $217,775,080.

The general industrial depression that the winds of circumstance drove to every corner of the world in 1920 struck the mineral industry of Canada and led to the discontinuance of operations in certain quarters, and to marked curtailment in others.

The Nickel Industry

The nickel industry presents one of the most striking examples of fluctuation under the abnormal conditions. During the war the production of the Sudbury district, which supplies over three-quarters of the world's requirements, rapidly increased. To meet the insistent demand a new smelter was erected and two refineries were built in Canada. At the present time mining and smelting operations are greatly reduced and the Canadian refineries are closed.

The last ten years have seen the exhaustion of certain large copper deposits of southern British Columbia and the development and exploitation of others.

The mineral possibilities of Manitoba have attracted attention in recent years. Shipments of copper have been made and a large copper deposit awaits better transportation facilities for its development.

The famous Cobalt silver mines after reaching their maximum production of 31,039,104 ounces in 1911 have shown a gradual falling off, although temporary stimulus was given the industry by the high price of silver that prevailed for some time in 1919 and 1920.

A considerable increase in asbestos production was made during the war.

There has not been the same fluctuation in the production of coal as in the case of some other minerals. Alberta's mines have increased their output and contest with those of Nova Scotia for first place in production.

Certain minerals assumed unusual importance during the war; molybdenite mining sprang up, grew, and died out; the production of magnesite grew to considerable proportions; the production of pyrite made a marked increase and has since declined.

The mining of gold presents one of the most hopeful features of the industry. Recent declines in the cost of supplies, the abundance of skilled mine labor available, and the increased efficiency of labor have led to an increase in mining operations, and Porcupine gold district, one of the most important of the world, is passing through a period of greater activity than ever before.

The mineral industry in general is affected by the present industrial depression. There are, however, large reserves of ore in sight, and the return to normal and stable conditions is bound to bring with it a revival of mining.

OXY-ACETYLENE WELDING HAS MADE GREAT PROGRESS

By F. W. CARTER, President Carter Welding Co.

THE SUBJECT of welding metals by the Oxy-Acetylene process is one of paramount importance to all machinists, those interested in machinery, and those who employ machinery in their operations to any extent. Its history is so well known at the present time that it will suffice to touch briefly on some of the outstanding points. The fact that oxygen and acetylene when combined and ignited would under pressure produce an immediate heat of 6,300 deg. fahr., was first discovered by a French scientist, Fouchè, in the early part of this century. It was used in laboratory practice to a certain extent but was not employed commercially until 1906, and in 1907 was introduced into the United States where its possibilities were appreciated and it came into use extensively.

At first its use was practically confined to repairs of broken parts, but as was to be expected in this age of experiment, it was found that its ramifications were practically unlimited and it is to-day being employed by manufacturers as a most valuable adjunct in the manufacture of steel cars, steel barrels, metal sash and frames and aluminum ware — in fact, the number of industries which benefit by the use of oxy-acetylene welding are so numerous that it would be impossible to attempt to give them in detail.

The rapid strides which this process has made since its introduction into North America have been so enormous that it is hard to find, either in the United States or Canada, an up-to-date machine shop, metal-working concern, mine, garage or similar business which does not include an oxy-acetylene welding and cutting apparatus as one of the most important elements of its equipment. In fact, a firm of that character which does not possess one is not in a position to compete satisfactorily with one which makes use of the process. In order that some idea may be given as to the extent to which this process is used in this country it may be stated that our firm alone have completed over 60,000 successful welding jobs in aluminum, cast iron, brass, steel and other metals during the twelve years they have been in business.

One of the most important uses to which oxy-acetylene welding has of recent years been adapted is the welding of high and low pressure pipe lines, two striking examples of which are the heating line of the General Motors plant at Oshawa and the high pressure steam line at the new Union Station at Toronto. The contract for these lines was undertaken and carried to a successful completion by the above mentioned firm at a great saving in time and money over the old method of screw joints and packed joints. Both of these lines were subjected to a hydrostatic pressure of 400 pounds and no leaks developed.



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There is a ULOY steel for each purpose. For automobile, truck and tractor parts; for ball bearings, axes, hatchets, wedges, agricultural implements, lumbermen's tools, track tools, shovels, picks, beater bars, coal crushers, piston rods, locomotive main and side rods, springs, shear knives—A few of these steels are:

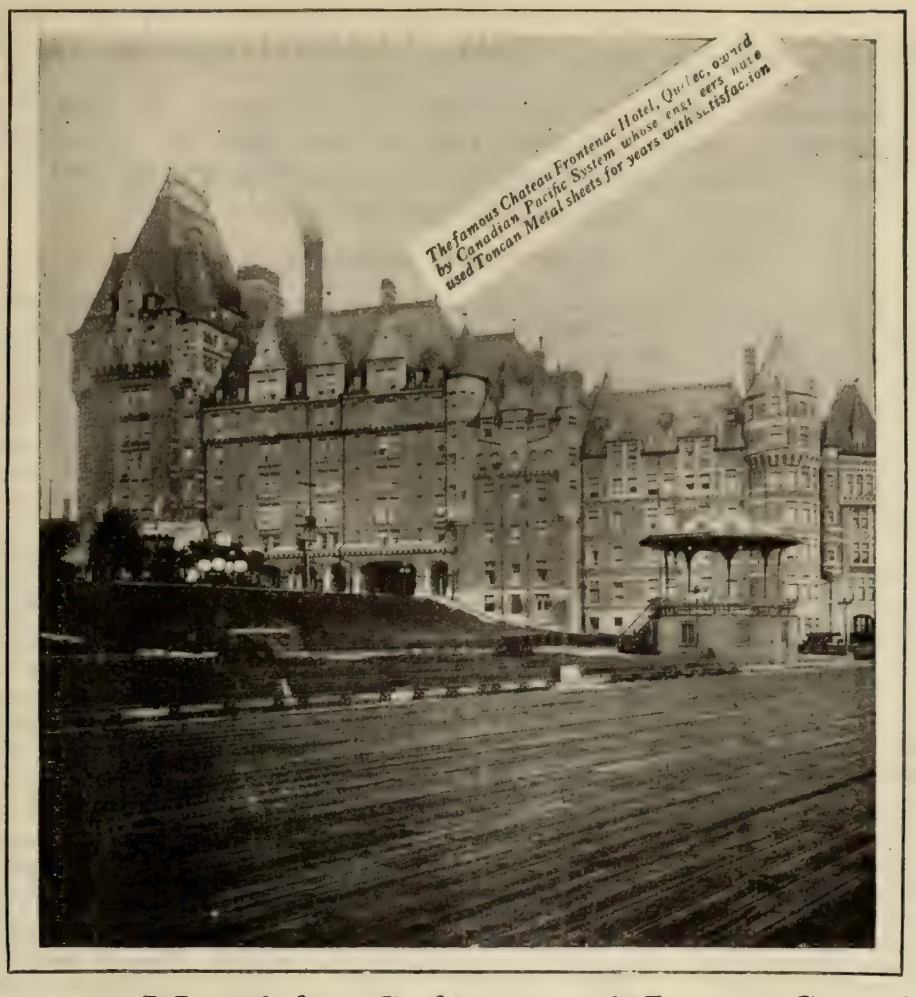
Chrome-Vanadium	**Hi-Carbon**	**Magnet Steels**
Nickel	**Chrome-Nickel**	**Special**
Chrome-	**Silico-Manganese**	**Analyses**
Molybdenum	**Chrome-Carbon**	

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UNITED ALLOY STEEL

Open Hearth and Electric Furnace Alloy Steel for Railroads, Automobiles, Edged Tools and Agricultural Implements

If interested tear out this page and place with letters to be answered.



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Toncan Metal is anti-corrosive and, therefore, it was used for the roofing and flue work for the famous Chateau Frontenac Hotel, Quebec, because its long life makes it most economical. It has served here since 1915 and is still in excellent condition. Thousands of installations both in Canada and the United States testify to Toncan Metal's lasting qualities. Those made over twelve years ago are still good.

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Siding	Skylights	Tanks
Eaves Trough	Window Frames	Lath
Conductor Pipe	Smoke Pipes	Refrigerators
Flashing	Water Pans	Washing Machines
Valleys	Ventilators	Enameled Products

CORP'N, CANTON, OHIO U.S.A.

In Canada: Toncan Metal is Galvanized by Dominion Sheet Metal Corp'n. Ltd., Hamilton, Ont., Fabricated by The Pedlar People Ltd., Oshawa, Ont.

If interested tear out this page and place with letters to be answered.

Development of British Machine Tool Industry

Progressive Design Policy With a Continuance of Traditional Quality Has Been Followed Out — Gear Machinery Has Made Rapid Strides—Also Grinding Machines, Automatics and Other Lines of Tool Equipment.

BY W. L. FISHER, Editor Engineering Production

IT WAS customary a dozen years or so ago, to think of the British machine tool trade as being a little old-fashioned. That is to say, it was admitted that British machine tools were fine, solid appliances, embodying as a rule irreproachable material and labour, yet it was considered that they suffered somewhat from the draw-back of crudity in design. Such tools, whether lathes, shapers or what not, were regarded more with respect than admiration by progressive manufacturing engineers, and go-ahead firms desirous of entering upon competitive repetition manufacture on an interchangeable basis, invariably went to America for a good deal of their shop equipment. In the finer precision work and the equipment of the tool room, many German products were pre-eminent.

All this has now changed. The products of British machine tool makers cover every conceivable requirement. Further, these machines are as good and in some cases much better than those of their corresponding foreign rivals. Whatever a manufacturer's requirements be, these can be satisfactorily met by machine tools of British design and manufacture.

In equipment for gear production especially, and also in grinding machinery, vast strides have been made, and the same applies to a lesser degree to precision lathes and tool-room equipment. In turret lathes, automatics and plain centre lathes, there are excellent British machines, and among those who know, it is generally agreed that development generally has been little short of remarkable.

The Post-War Situation

While much of this progress has been due to the war, the war has, however, been not altogether an unmixed blessing to the British machine tool trade. While it enabled and even forced progress, and many quite small firms found it possible to develop to a large and stable basis, the end of hostilities unfortunately left the industry with an appalling situation to face. Firms found themselves with vastly increased establishments but with their markets gone, not only gone temporarily but for some years ahead.

What means will be adopted by the industry as a whole satisfactorily to extricate itself from such a position remains to be seen. That drastic methods will be resorted to there is very little doubt. There will certainly be reduced establishments and outputs, and economical combinations of makers to eliminate waste competitive effort. In any case, whatever takes place the British machine tool industry is, of course, too big a thing to go under and its leaders too alert to sacrifice any of the traditional quality, either of material or workmanship. They are also thoroughly alive to the ever-changing character of modern engineering manufacture, and there is no doubt that the excellent design of to-day will be kept up to date to the very last hour of modern requirements.

Question of Design

Machine tool design, of course, reflects manufacturing conditions. The United States were of necessity pioneers in the automatic and semi-automatic fields, because they had, in the main, to carry out their manufacture by unskilled or semi-skilled labour, making the very best use of what skilled labour there was available. This led to the employing of the really skilled worker chiefly on the making of tools and the setting up of machines to be run by semi, or unskilled labour.

Various factors have tended to bring British engineering manufacturing conditions more and more into line with the intensive production of other countries, so that British engineering generally, will we hope be able wholly to support the modern and complete machine tool industry that we now have with us.

Detail Development

Regarding the detail development of British machine tool design, a very extensive change has taken place. The British tool of to-day has undergone a complete metamorphosis, and like its competitors, its very shape or contours are quite different from forerunning designs. Individual parts are of an improved formation, making for a better balanced structure, free from dirt-gathering nooks and corners, and the box section casting with all structural webs on the inside is the general rule. A smooth external appearance, free from sharp corners, is another characteristic, and metal is more carefully disposed, so that a correct degree of strength and rigidity is secured. Machines are now built to stand heavy cuts at high speeds, and this has greatly influenced headstock design, where bearings are of increased size. The old cone pulley has been almost entirely replaced by all-geared heads.

Grinding Machines

In grinding machines, much the same applies, and extreme accuracy, with capacity for running at very high speeds is combined in an exceptionally rigid structure. Simplicity and centralisation of control is a principle generally applied to all machine tools, and gear boxes are also a general feature. The dimensions of slides and ways are more liberal, and it is customary to guard these from chips and grit, and in some cases to fit them with oil covers. British grinding machinery has undoubtedly advanced tremendously, and there is little doubt that in this particular sphere the British tool is pre-eminent the world over.

Automatics have considerably advanced in design, and in this field there have been many interesting departures. Presses have also developed, and British turret and combination turret lathes are now generally admitted to be of a very high order indeed.

In gear cutting machinery there are many unique designs of British origin. It is in fact in this class of work that greatest progress has been made. This applies not only to machines used for the cutting progress, but also to the subsequent grinding after hardening process, which is now accurately and economically carried out on equipment of British design and manufacture.

Gear shapers of the generating type of British origin are now a feature of the industry, both for helical spur and helical bevel manufacture. One type of machine, developed for the production of gears of large size, cuts double helical wheels with both sets of teeth united in the solid at the apex, and without tool clearance. Altogether, a brilliant and unique record of achievement stands to the credit of British brains in this work.

Shapers and many small auxiliary machines of British manufacture are now of an excellent grade, and forging machines and equipment have also undergone marked development. There are some excellent British foundry moulding machines.

Much of the development that has taken place has been due to the formation of the Associated British Machine Tool Makers Ltd., under the auspices of which many of the leading machine tool firms have co-operated to form a logical manufacturing policy. Broadly this consists in allocating the manufacture of some single machine type to a certain firm. In this way they are enabled to specialize on a single product with really excellent results. Further, much wasteful competition is eliminated, and the development of each individual type of machine tool is much speeded up.

In general then, it may be said that while the character of the products of this industry is pre-eminent, the commercial situation is serious, and anything therefore that Overseas engineers can do to assist the flow of business to the Mother Country, will be appreciated.

Development of Toronto Telephone System

Telephone Was Invented in Brantford—First Sound Heard in 1875 — Many Important Developments Have Taken Place — Toronto Alone Has Over 100,000 Phones.

By FRANK KENNEDY
Toronto Manager Bell Telephone Co., of Canada

WHO was the inventor of the Telephone? where and when was it invented? The answer to these questions is liable to provoke a spirited controversy, especially if the discussion happens to be between a citizen of the United States and a Canadian.

The invention of the Telephone has perhaps done more than anything else to change the world in its business relationships, its social intercourse, and in welding together the different units of the great human family, and naturally it is a matter of pride to be able to claim the inventor as a member of any one country. We in Canada have that honor and so that this point may be clear let me say I have the personal assurance of the inventor—Dr. Alexander Graham Bell, that the Telephone was invented in Brantford, Ontario.

The first sound was heard June 2nd, 1875; the first sentence was transmitted March 1876, and on the inventor's 29th birthday—March 1876—the Telephone was patented. In 1878 the Toronto Telephone Despatch Co., (with a $3000.00 capital, 60 shares at $50.00 fully paid up) was organized by—Chas. Potter, Mrs. Chas. Potter, Melville M. Rosebrugh, Dr. A. M. Rosebrugh, and Hugh Neilson.

The company's business was that of installing private lines and the first installation was a line from the office of the late Sir Oliver Mowat, Simcoe and Wellington Sts., to his office in the old parliament buildings, Simcoe and Front Sts. Late in the same year (1878) the company placed in operation an exchange switchboard, residences of officials in the company only were connected at first.

In following the evolution of the telephone service it is very interesting to note that the first contract signed for commercial service was received early in 1879 from McGaw and Winnett, Queen's Hotel, Front St. West, present site, and Mr. Winnett, the present proprietor of the hotel, has the unique distinction of being a continuous subscriber during the time the system has developed from one to 100,000 telephones in Toronto.

Six Speak at Once

The exchange was located at 10 King St. East, upstairs, and the ground floor was occupied by a wholesale stationery establishment. Party lines with eight and ten subscribers on a circuit were used principally. The type of switchboard was manufactured by Davis & Watts of Baltimore, and as far as I can learn they were the first to take up the manufacturing of telephone switchboards. The board had six circles each with a dozen buttons and a dial or arm which would be turned to make connection with the desired button or subscriber; only three connections could be made at once, or in other words only six people in Toronto could be speaking at the same time. Push button battery bells were used for signalling.

Later another board known as the "Jones Switch" and manufactured I think in Cincinnati was used for individual lines, and on this connections were made by means of plugs. Ringing was done by a foot pedal in much the same manner that you would operate a a grind stone. The total number of employees was four—H. Neilson, M. M. Rosebrugh, A. Stark, and a boy or man for night operating as a twenty four hour service was given. In April 1879 the company had but 40 subscribers.

No long distance or out of town service was given until October 1881 when the line to Hamilton was opened. The rate for a party line was $24.00 per annum. Hand telephones only were furnished. It was somewhat similar to the present receiver you hold to your ear. You would speak into it, and then transfer it to your ear to receive reply. If two hand telephones were furnished to avoid this transferring from mouth to ear, the rate was $36.00 per annum.

In 1880 and 1881 rate for a separate line and Blake transmitter was $50.00 per annum per line ½ mile or under in length, and $5.00 per annum per ¼ mile was charged for distance beyond the ½ mile limit.

When the company was using the Blake transmitter the opposing interests used an Edison transmitter and as a result of the conflict in interest between these transmitters one of the greatest patent suits in history ensued and Bell's claim to the fundamental patent was upheld. The present Bell Telephone Company of Canada was formed in 1880 and absorbed the existing exchanges at Hamilton and elsewhere.

Late in 1881, or early in 1882, the exchange was moved from 10 King St. East, to the Mail Building, the number of subscribers at this time being 400. The operating room was about 20 ft x 12 ft. The Manager's office was located in the same flat in a room 12 ft x 12 ft. The Manager in those days did practically all the clerical work connected with the business. On May 24th, 1884, a fire occurred and subscribers now numbering 800 were deprived of service. A building was rented immediately on Bay St. approximately where the Molson's Bank now stands and a temporary service given. Subscribers were



This Telephone is a Duplicate of The First Instrument Through Which Speech Sounds were transmitted electrically in 1875.



One of The First Switchboards. Note That it Was Operated by Men

inconvenienced for only two or three days. The new board which was placed in the Mail Bldg. ofter the fire, was the first multiple type board installed in Canada.

On April 1st, 1886 a second fire took place in the Mail Bldg. and 1200 to 1500 subscribers were out of service from one to four months. Subscribers' lines in these days were single with grounded return and the introduction of electric street lighting and the electric street railway caused serious trouble on account of induction, and to remedy this it was necessary to change from single to metallic lines or in other words to use two lines in place of one thus doubling the wire mileage.

Multiple Metallic Switchboards

The business had grown rapidly. A new building was erected at 37 Temperance St., and in June 1894 the new multiple metallic switchboard with self restoring drops and other improvements over the old type was cut over and the staff moved from the Mail Bldg. The first North or Yorkville Office as it was known in 1883-1884 was located in a room about 15 ft x 12 ft. in a building at the corner of Yonge and Cumberland Sts. occupied by the Federal Bank.

In 1885 this office was moved to a building on the west side of Yonge, opposite Isabella, 1891, the location was changed to the corner of Yonge and Bloor, May 1902 to Hayden St. and Dec. 4th, 1911, to the present location, Asquith Avenue. Parkdale exchange was opened March 1890 at 1249 Queen West in a small room over a tailor's shop, and in 1912 was moved to the present site Cowan Ave. near Queen.

The business has expanded rapidly until at the present time we have eleven exchanges, the Adelaide building also housing the long distance department. The entire plant in Toronto could not be replaced for less than $16,000,000.00, and is operated by approximately 3200 employees. The development gives almost one telephone to every five persons in the City.

When you have a telephone installed in your office it gives you access to our entire plant which is valued at over $50,000,000.00. Should you have occasion to talk between Toronto and Montreal equipment to the value of $115,000.00 is in use exclusively by you, and the party to whom you are speaking.

If the cables or trunk lines connecting the eleven exchanges were connected in on continuous line it would reach 1.6 times around the earth at the equator. The following figures will I think give concisely the magnitude of the plant:

Number of telephones now, 100,000; miles of wire in service, 269,397; miles of wire underground, 222,668; percentage of wire underground, 83%; length of underground cable, 367 miles; length of streets occupied by conduit 121 miles; number of manholes, 1,271; number of 'phones on Jan. 31st, 1907, 18,944; number of 'phones on Jan. 31st, 1910, 28,154; number of 'phones on Jan. 31st, 1915, 57,304; number of daily calls, approximately 1,000,000; number of long distance calls daily 5,400; "Information" calls daily 9,745; busiest hour during day 10-11 a.m.; number of calls handled in that hour, 103,000; number of employees, 3,204; total yearly payroll, $3,706,858; number of operators, 2,200; number of trunk lines, 6,600; number of long distance circuits, 272; number of residence 'phones, 60,024; and number of business 'phones, 39,976.

It is estimated by our engineers that in 1927 we should have in operation 17 exchanges, and 180,000 telephones. We are glad to have anyone visit our buildings. They will always be welcome and we feel they will be amply rewarded by finding the visit most interesting and instructive.

NEW TYPE OF CONCRETE ROAD

A British road engineer has developed a new type of concrete road. He lays the concrete in alternate portions and does not fill the intervening spaces until the material in the first portions has set and contracted. Further, he makes the edges of each portion exactly vertical by means of special appliances. This new method results in the roadway being split up into straight close joints instead of a number of irregular cracks. When the coating of tar is applied it fills up these narrow joints, which act really as expansion joints. In actual practice the joints are not straight across the road but at an angle, in order to prevent the whole weight of a heavy load resting on the edge of one slab. Reinforcement is of course employed to strengthen the concrete, but in no case is it taken across the joints.

A new and somewhat novel tunneling machine has made its entry into the world of industry. It comprises a boring head and a rotating tail arrangement by means of which the lining is placed. Experiments have been made with it in Philadelphia.



A Modern Switchboard Operating Room

Developments in the Pulp and Paper Industry

This Industry Continues to Show Progress—Canada's Exports of Pulp and Paper Have Increased from $120 to $163,655,344 in Thirty Years—Paper Machinery and Methods Have Advanced

By EDWARD BECK
Secretary of Canadian Pulp and Paper Association

DESPITE temporary setbacks, due to the universal period of liquidation through which all industries are passing, the pulp and paper industry of Canada continues to show progress and development. Ranking second in point of the amount of its invested capital, third in the value of its products, the industry occupies first place among Canada's purely manufacturing exporting industries and will long continue as one of those to which the Dominion must look for growth in its external outgoing trade. It is in its export trade figures that the history of the growth of the industry is most readily traced. In three decades—from 1891 to 1921—Canada's exports of pulp and paper have increased in value from $120 to $163,655,344. To-day over 85 per cent. of the production is exported, and indications are that this proportion will increase.

Striking as has been the increase during the last 30 years, the last decade shows also a rapid though steady progression as illustrated in the following table of exports of pulp and paper for Canadian fiscal years (April 1 to March 31) 1912 to 1921, inclusive:

	Paper & Mfg. of	Chem. Prep. Woodpulp	Mech. ground Woodpulp	Total
1912	$ 3,885,881	$ 1,587,533	$ 3,506,770	$ 8,980,184
1913	6,341,088	2,100,842	3,408,702	11,850,632
1914	12,690,549	2,923,083	3,441,741	19,055,373
1915	15,500,064	4,806,622	6,801,011	27,107,697
1916	20,042,806	4,459,539	3,575,537	28,077,877
1917	26,107,824	14,032,920	6,371,133	46,511,877
1918	37,865,330	19,133,813	6,487,079	63,486,222
1919	49,165,795	30,226,856	4,479,915	83,872,566
1920	63,253,419	32.998,500	8,383,419	104,635,338
1921	92,103,307	55,060,219	16,491,818	163,655,344

Last year these exports were distributed approximately as follows: United Kingdom 7.2 per cent.; United States 79.5 per cent.; other countries 13.3 per cent.

While the above figures include paper of all kinds and woodpulp, the largest development has had to do with the production of newsprint paper, which is used in the publication of newspapers and in other ways.

Mills in Operation

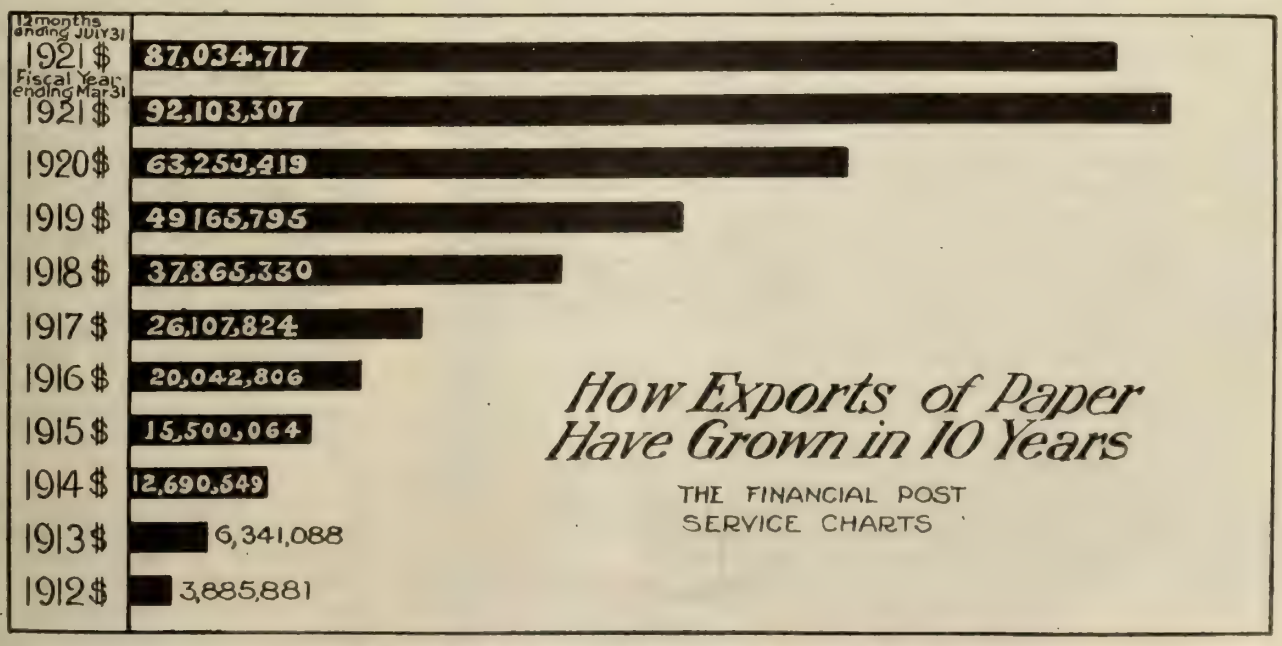
There are fifteen newsprint mills in operation in Canada at present, with a total daily capacity of 3,412 tons or just over 1,000,000 tons a year. When it is considered that United States mills, in 1920, produced a total of merely 1,511,000 tons, an idea may be formed as to the growing importance of this branch of the industry to Canada.

Of the daily capacity of 3412 tons, 525 tons (or 157,500 tons annually) represent the product of new machines installed during the last year. During 1922, when extensions, now in progress, are completed, the daily capacity will be further increased by 240 tons, making the total yearly capacity of Canadian newsprint mills in 1922, 1,095,600 tons.

The largest market for Canadian newsprint is the United States. Owing to growing scarcity and increased demand in that country the U. S. Government in 1911 removed the duty on all paper valued at 5 cents per pound or less (the limit has since been placed at 8 cents) this action opened a large market to Canadian made paper.

In 1908, and the following two years, the Provinces of Ontario, Quebec and New Brunswick adopted, as a measure of self-protection, and to encourage home industry, regulations requiring that all pulpwood cut on the Crown lands of their respective Provinces must be manufactured into pulp or paper in Canada. This helped considerably to stimulate the industry and resulted in bringing United States manufacturers to Canada to erect mills for the purpose of converting into pulp and paper the wood they could no longer export.

Another means of tracing the growth



Graph Showing How Exports of Paper Have Increased Since 1912.

of the industry in Canada will be found in the successive census returns published by the Dominion Government.

In 1881 there were five mills in operation, capitalized at $92,000 employing 68 persons, with an annual production valued at $63,000. In 1891 there were 24 establishments, with a capital of $2,900,907, 1025 employees, and production valued at $1,057,510. In 1901 there were 25 mills in operation, capitalized at $11,558,560, employing 3,301 persons and turning out products valued at $4,246,781. In 1919, the latest census figures obtainable, there were 99 mills in operation, 33 of which manufactured paper only, 39 pulp and 27 both pulp and paper. Capital employed amounted to $246,581,300, distributed among the Provinces as follows:—

Quebec $124,101,164; Ontario $95,281,040; British Columbia $32,030,063; New Brunswick $11,960,778; Novia Scotia $1,208,255. Employees numbered 25,491, exclusive of woodsmen, and salaries and wages paid amounted to $32,323,789. Production was valued at $139,925,001.

The items of production were:

Pulp for sale.	Tons	Value	
Groundwood	300,205	$ 8,976,579	
Soda fibre	3,174	297,113	
Sulphite fibre, bleached	100,132	9,425,836	
Sulphite fibre, unbleached	263,866	19,885,590	
Sulphite fibre	124,550	9,839,172	
Other products		137,798	$ 48,562,088
Paper	**Tons**	**Value**	
Newsprint	794,567	54,427,879	
Book and Writing	58,228	12,571,000	
Wrapping	58,697	7,979,418	
Boards	137,678	8,892,046	
Other papers	40,065	3,882,500	
All other products		3,610,070	$ 91,362,913
		Total,	$139,925,001

The number of mills operating in Canada to-day exceeds one hundred. Authentic estimates of the capital invested place the amount at between three hundred and three hundred and fifty million dollars.

Advance in Methods and Machines

A big advance has been made in paper mill machinery as well as in manufacturing methods since the early days. In 1858 the height of efficiency in papermaking was thought to have been reached when a machine was installed at Georgetown, Ont., capable of running at the rate of 100 feet a minute. To-day the machines run at the rate of 600 to 1,000 feet a minute. Two of the new machines installed last year by the Abitibi Power and Paper company at Iroquois Falls, for the manufacture of newsprint, are the largest in the world. They are 232 inches wide and each is capable of turning out a sheet of newsprint paper over 18 feet wide and about 200 miles long every working day, or approximately 85 tons. Two new 166-inch machines in the Laurentide mill at Grand Mere turn out newsprint paper at the speed of over 1,000 feet a minute. They are generally regarded as being the last word in newsprint machines and were made in Canada.

In the early days rags were principally used in the making of paper. Woodpulp is said to have been first used by the papermakers of Europe and America, about the year 1860, but it was not until some time later that its use had become commercially successful. Finally after numerous experiments the chemist discovered that spruce and balsam were most suitable for the production of ideal cheap paper. This discovery led to Canada's predominance as a paper-producing country.

Many estimate, more or less authentic, have been made in Canada's pulpwood resources. The latest and probably the most reliable, gives a total of actually available spruce and balsam, after making all necessary reductions, of, roughly speaking, 306,000,000 cords of wood in Quebec, New Brunswick, Ontario and Nova Scotia with a possible addition of some 38,000,000 cords in the case of Ontario, dependent upon railroad development to make it available. Divided by provinces this estimate gives:—

Quebec	155,000,000 cords
New Brunswick	26,000,000 cords
Ontario	100,000,000 cords
Nova Scotia	25,000,000 cords
Total	306,000,000 cords

The same authority estimates Western Canada's pulpwood supplies at 340,000,000 cords; 255,000,000 in British Columbia and 85,000,000 cords in the Prairie Provinces.

This gives a grand total of 646,000,000 cords of more or less commercially obtainable pulpwood in the Dominion.

The present consumption of pulpwood is approximately two and one half million cords per year and an additional million cords are exported. As the consumption increases it is realized that the supply is not inexhaustible and some of the Provinces, as well as several of the manufacturers, are wisely engaged in extensive afforestation operations with a view to ensuring a permanent supply of wood.

Next to an adequate supply of accessible pulpwood the industry depends, for its successful operation, upon the possession of suitable water powers, commercially available and capable of economical development. Fortunately Canada is richly endowed in this respect, having the second largest hydraulic resources of any country in the world. It is estimated that our water power is roughly seventeen million horsepower, of which only about two million h.p. is developed. Eliminating five million h.p. located in inaccessible places or existing in small units, there remains approximately ten million h.p. yet capable of development. Of the present total water wheel and turbine power developed, 473,265 h.p. are used to operate pulp and paper mills.

When the picture is drawn of the current year's pulp and paper production and exports it will, probably for the first time, show a backward trend. This, however, is clearly a temporary condition. The industry must of necessity prosper or decline according as business in general shows inflation or deflation. The fall of 1919 witnessed a tremendous boom in advertising which kept up well into 1920 but in the latter part of that year, due to the general depression in business, the falling off was noticeable and has continued largely up to the present. There is no feeling of pessimism, on the contrary, confidence that the danger point has been passed is apparent. New uses are constantly being discovered to which paper may be put; the mills are wherever possible increasing the efficiency of their machinery and reducing operating costs, and as business in general gradually emerges from its present depression, the Canadian manufacturer of pulp and paper, with his plentiful supply of pulpwood and water power, has nothing to fear for the future of the industry either from foreign competition or other causes.

NEW AIR SERVICE

In spite of the difficulties which surround the development of a novel form of transport, the regular aeroplane service organized in Great Britain continues to expand. In the near future an additional service between London and Paris will be started. It is intended to arrange four regular services each way per day. These services will involve some portion of the journey being made in darkness. Improved lighting arrangements have been introduced at the aerodrome in order to enable night flying to be carried on in safety.

Ontario often prides itself with cause over its hydro electric development. Few citizens are aware perhaps that in 1920 Swedish hydro electric stations were developing 1,200,000 horse power. Equipment since added has brought the total close to 1,500,000 horse power.

Development of the Machine Tool Industry

The Engineer and Mechanic Are Chiefly Responsible for the Development of Machine Tools—Their Co-operation and Mechanical Ability Has Helped Us in Many Ways

By GENERAL, SIR ALEXANDER BERTRAM, of John Bertram & Sons Co.

THE PROFESSION of the Mechanic and Engineer was scarcely known until the middle of the 17th Century, when the important discovery of the application of steam by James Watt and its rapid development, called into existence a new class of mechanics who gave fresh impetus to manufacturing, by improvements to all kinds of machinery.

The ancients knew the principles of the inclined plane, the wedge and the screw and were able to move vast weights, but the improvements made in machinery in modern times, have enabled us to execute work of vast magnitude with a great saving of manual labor. In those days men were individualists and made things by hand. Man was proud of his work. Thus up to the end of the 17th century very little progress had been made in manufacture. The crudity of machine shop equipment as existed in those days can be contrasted with what is being accomplished today.

The progress in constructive engineering is always closely connected with the means of effecting improved work, and of these, the machine tool forms a most important feature. In order to carry on this development the mechanical engineer has brought forward three machine tools: viz., the turning lathe, iron planer and drilling machine. The principle of these three tools is worked into a great variety of machines.

In the year 1847 Edward Cresy published probably the first Encyclopedia of Civil Engineering and in this work he describes the above machines in detail. In the same year my father, the late John Bertram, was serving his apprenticeship with his uncle in Galashiels, Scotland, and on completion of his apprenticeship he married and sailed for Canada in 1852. He often related to the writer that when he was serving his apprenticeship he was compelled to drive the lathe by a hand wheel—the mechanic operated the machine by using a hand tool.

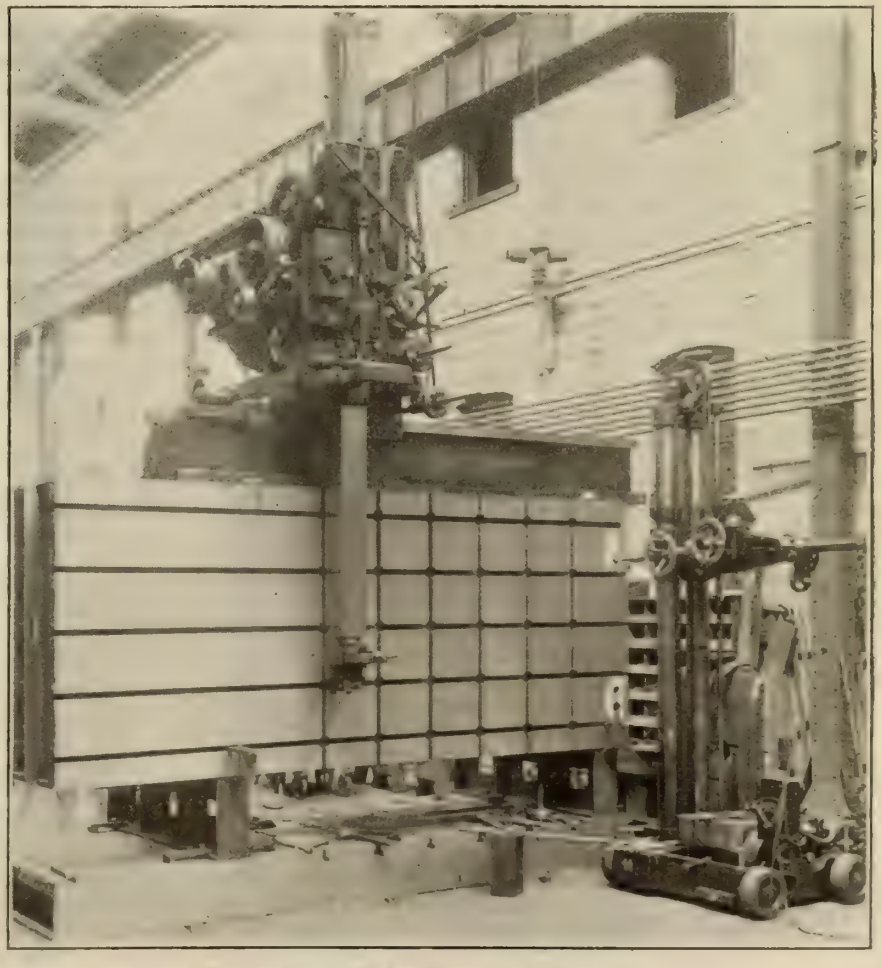
On his arrival in Canada, he, by the way, sailed on an Allan liner 450 tons and arrived in Montreal, sailing through the canals to Dundas, where he took a position with the late John Gartshore and there operated a New Haven lathe driven by belt and the saddle operated by a chain from one end of the bed to the other. There were no lead screws on lathes in those days, and one of the principal operations in this foundry was the making of stumping machine screws. The thread of the screw was pitched off by hand on the bar and the form of the thread chipped by hand, finally chased with a chasing tool. The brass nut was cast on the screw when finished and afterwards ground to a fit. My father's ability as a mechanic and engineer became famous throughout this part of the country, and in the year 1861 he joined partnership with the late Robert McKechnie, and afterwards completed probably the first modern turning lathe built in Canada, which was exhibited in Hamilton, Ont.

I wish to picture to the mind of the mechanic that this all took place 65 years ago when he developed the first lathe with a screw on the back of the bed for screw cutting, and the rod with a spline on the front of the bed for the purpose of turning, you can at once see that a great improvement had been made in the machine tool, and the responsibility of all these improvements lay with the mechanic. Too little credit is given the mechanic by the outside world for the great part he has taken in the improvement of machine tools and the production of machinery.

By the introduction of electricity and the development of high speed steel, wonderful changes have been necessitated in the strength and speed of these tools. The mechanic has been able to expand his sphere of operations to a much greater magnitude with results as shown in our wonderful Navy, which defended the World against the enemy, our railroad transportation, the development of hydraulic machinery to enable us to harness all our water powers throughout the country, the production of the Aeroplane and the many wonderful mechanical inventions of recent date.

His splendid co-operation and mechanical genius played no small part during the late war which enabled us to accomplish wonders in Canada where we outstripped the world in the production of munitions. His ingenuity at that time was recognized by everyone who came in contact with details of production.

A great future is before the mechanical engineer where by a thorough education and the development of his ability he will be able to further expand his sphere of operations as shown by his good work in the past.



Showing Some Modern Portable Tools in Use.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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B. G. NEWTON, Manager
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T. H. FENNER, Associate Editor
H. A. WILSON, Montreal Editor



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More People and Capital Needed

THE MOST casual student of public affairs can scarcely reflect on general conditions in Canada without concluding that more population and capital are two primary essentials, if resources are to be developed and heavy national debts liquidated. Whoever casts his eye ahead into the next year will see eight and a half millions of people carrying a financial load out of all proportion to the shoulders on which it rests. He will notice big railway deficits, in the past reaching a total of roughly $11,000,000 on the national lines in 1919 and 1920, inclusive of course, of operating and fixed charges. It is gratifying indeed to learn that these deficits are now being reduced month after month. He will find hundreds of millions of pressing debt, assumed for war purposes, which must be either paid as the loans fall due or be carried on by renewals, with big interest charges. At the same time he will observe that there are vast agricultural, mineral, forest and power potentialities still idle for want of brawn and sinew to develop them.

It must indeed be obvious that some progressive policy will soon have to be put into operation under which a desirable class of immigrants will be brought to the Dominion. Far flung arable tracks, embracing thousands of acres of fertile land, should not be left unsettled, when congested Europe is panting for breath and yearning for new opportunities amid healthy social conditions. It is a moral as well as an economic need that the scales of humanity should be better balanced.

That caution should be practised in selection, that methods of assimilation and nationalization should be sound and effective, are unquestioned. No one would advise indiscrimate action, but at the same time no tide can ever flow without of course being attended by some disadvantages. Agriculture is a basic industry, particularly in a country with such expansive borders as those of Canada. It is unlimited in its possibilities, but before the many millions of acres can be made to produce they must be peopled. Capital has a habit of following the tide of population, when that tide is directed toward productive pursuits, and if one could visualize three or even six millions more people scattered over the farm lands of the Dominion he would also see several more millions of money coming into this country, not alone for development purposes but in exchange for the agricultural products which Canada could export.

If indeed there be any avenue of escape for citizens of the Dominion from large railway deficits, high freight and passenger rates, burdensome public debts, and other financial ills, it lies in the direction of a time when they will have a few million more people to help them produce and consume, to buy and sell, to import and export, to ship and to travel, to create markets and promote greater national wealth. The small number of 148,477 immigrants who came to our shores during the last fiscal year, ending March 31st, 1921, is a mere handful of what could be absorbed and converted into wealth if a broad and progressive scheme were devised and carried out for the settlement of thousands of families on the land.

The Busy Bee Makes the Honey

TO ITS readers everywhere the annual number of Canadian Machinery goes out, not only as a comprehensive review of conditions as they have existed for the past twelve months, but with a distinctive tone of optimism for those to come. Indeed the New Year upon which we are to enter has much more to recommend it when it is introduced as a new opportunity, as a period which promises to open doors that have been closed and to bring with it some of the brightness of success rather than the gloom of industrial depression.

However unpromising the seasons have been through which business has been passing, to-morrow always brings possibilities that yesterday has carried away. Generally speaking, 1922 will be better than 1921 in proportion to the efforts pepole make to improve it. Trade, commerce and industry are strengthened, increased and extended by those who are aggressive. The busy bee makes the honey.

Canadian Machinery feels gratified over the co-operation of business firms in placing their goods before the buying public through its pages. It is by letting the world know what you have for sale that buyer and seller are brought together.

The year just closing has not been without anxiety and dullness. Markets have been slothful. Finance for many has been difficult, but nevertheless Christmastide was accompanied by widespread cheer and a hopeful horizon. We would like to have extended a personal greeting to every reader but as that was impossible we offer through these columns the hope that the immediate future will bring a better, stronger tone in the metal working industry in all its branches and for everyone engaged in it. Prosperity is often just around the corner from failure. The motto of every one engaged in business should be to go out and make the New Year put its best records on the right side of the ledger.

This annual review number is possible because there is a progressive element in business from coast to coast, an element in business which believes that little comes to those who sit down and wait, an element which wants the public to know what it has to offer in the mechanical field. We propose to look forward rather than backward, to achieve rather than rest. It is this spirit of action, of enterprise and of courage that we would like to pass on to subscribers and advertisers wherever they may be, along with the whole hearted wish that 1922 will be full of happiness and good fortune.

"Canada is better able to face the future than almost any other country in the world," said Sir Robert Kindersley, director of the Bank of England and Governor of the Hudson's Bay Company at a recent annual meeting of that corporation in London. There are few men outside Canada better able to speak on the business future of this country, for in addition to being one of the leaders in the commercial and financial life of Great Britain, he is head of a company that has been trading in Canada for over 250 years and has travelled it from end to end.

The Business Outlook for 1922

By Lt. Colonel J. B. Maclean

THE editor of Canadian Machinery tells me there is no subject in which his readers — executives, managers, superintendents, foremen and worth-while mechanics— are more interested than the business prospects for 1922. They are asking: to what extent can they keep their plants and employes working? Has liquidation run its course and are conditions improving?

To the first question I have no hesitation in answering that for those firms who would adapt themselves to present economic conditions the prospects are generally favorable for 1922 and improving in the years following.

To the second: a good many statements are appearing to the effect that not only have food and provision prices reached bottom but general costs and wages are there also, and a steady improvement is under way. But so far no man whose views command respect among experienced men has expressed any such opinion. Among men whose history shows their opinions are worth while, there is a very definite belief that general costs and wages must work lower and many think there will be no definite improvement for two or three years. It is true some big danger-breeding spots have been cleaned up. Financiers have co-operated more sympathetically than ever before with business, big and little. They, the financial institutions, have taken big losses. Hundreds of millions have been wiped out. One institution with world-wide connections has been helped to the extent of $120,000,000 and has itself taken a loss of over $50,000,000 cash. If that had not been done there would have been a great world-wide panic, bringing down thousands of old concerns and creating such widespread unemployment that would have taken years to repair.

No Ordinary Trade Depression

Canada is dependent largely on selling what we can outside the country; we are dependent upon foreign conditions. As one economist puts it: this is no ordinary trade depression but it has been partly brought about by bad politics and bad leadership designed to fool the public. They have created an entirely wrong impression among the masses throughout the world. They have forced the adoption of vicious policies and are preventing the carrying out of economic measures that would improve business and give employment. Mainly, they have kept costs of production up and prevented international war settlements. We cannot expect a real improvement until these problems are partially or wholly adjusted. The world owes Britain and the United States many billions of dollars. They cannot pay except in goods. To pay in goods means they must undersell British and United States manufacturers and producers. In accepting payment in this form, British and United States factories would have to close and there would be more unemployment. The efforts of Germans to sell goods to pay indemnities are already responsible for much unemployment in England and elsewhere. Men who are governed by experience and wisdom in these countries are advocating the cancellation of all war debts and the reduction of the German reparations. At present popular prejudices are so strong that Governments dare not propose any cancellations.

Canada has no debts worth mentioning to cancel, but as the United Kingdom and the United States are our two best customers we are very much interested in their prosperity. If business is bad, they will buy less of our products. France is our third, and Germany looks like our fourth best customer. Of course, there are other lesser factors but keep your eye on that world condition. It will help you to estimate the future of business.

Our internal conditions are distinctly more favorable. It is true that high costs of building and of manufactures and low prices of farm products, excessive taxation and the United States tariff, are still handicapping us. But they have recently been offset by two new factors: the change of Government, and the announcement that the C.P.R. proposed spending $20,000,000 to bring in 100,000 of the best type of British emigrants. There is perhaps a third—the announcement in The Financial Post by Mr. Fordney—the promoter of the tariff that hit Canadian farm products so hard—that he had inserted a clause specially to form the basis of a friendly exchange with Canada, looking to an increase of trade. Something may be done in this without injuring established Canadian industries.

Probably most of you were, like myself, supporters of the old Government until we realized they were like many a fine old firm. They had lost energy, initiative, enterprise. They were drying up. They were completely out of touch with their customers. They got a young general manager but held on to the big foremanships themselves. They had no life. They were out of date and refused to believe it. They would do nothing and prevented others from doing anything. You all know good old concerns like this that are gradually dropping out. The old Government ran their business inefficiently and taxed us more than any country in the world to pay for their waste. They brought us nothing in return. That is, their Minister of Trade developed no foreign busness for us. Nor in co-operation with the Minister of Labor did he help to bring down costs of living. The Minister of Immigration did nothing that you would notice in bringing in well-to-do immigrants who would be big buyers of your products for the next few years and new average buyers for all time. It is to immigration we must look chiefly in the immediate future for increased business. The new Government holds hope for improvement, but with the C.P.R., and its splendid business management, entering the field we have much to be thankful for.

Coming back to the first question, your own plant. There are some in first-class condition to-day. The majority are not. I believe the majority of this majority can greatly improve their position. It is possible for a lot of you to become great leaders in your industry. How? By following the methods of those who have been successful. You will find that, while differing in minor details, they followed exactly the same principles, viz., they put nearly all their waking hours into their work; they were economical but generous; they made the best product they knew how; they produced it at the lowest possible cost and then pushed the sales aggressively. They avoided getting into a rut as they grew older by gathering young men of the same type about them and listening to their advice on new developments.

I cannot name you two better examples of this type—the men whose careers can be studied and followed—than two very old friends of mine who recently passed out, John McClary, the great stove manufacturer of London, and Mr. McLaughlin, who built up the largest and best carriage business in Canada and switched five years ago—in co-operation with his sons—to the automobile industry.

Review of Hardware Quotations

Comparison Tables Indicate Readjustment of Values Still Continuing — Decline During Past Year Worthy of Particular Notice —Retail Merchants Prove Adaptable to New Business Conditions —Charts to Meet the Price Argument.

Written for Canadian Machinery by Hardware and Metal

ANY COMPARISON of prevailing quotations on hardware commodities with pre-war prices, indicates that the readjustment of values is still continuing to be a vital factor in the life of the hardware industry. This movement developed considerable momentum during 1921, and the extent of the decline in prices generally, has been more marked during the past year than at any time since the peak of inflation was registered.

The average price advance on hardware goods during the war and post-war periods, was much less in proportion when compared with some other lines. Hardware prices did not jump so rapidly, nor so high, but the increases were of a more gradual nature, reflecting the periodical tendencies of the basic markets. The degree of artificial inflation which was so apparent in prices on many commodities, was not evident in hardware goods to any marked extent. Just a few lines were forced exceptionally high; and this phase supplies an unusual factor tending to show a higher ratio on the average hardware price levels, than may be generally applicable. The usual advance was based upon solid reasons, such as higher costs of raw material; and chiefly because of this element which was noted during the period of price ascendancy, the urgency of deflation has not been so pronounced.

Lower Prices on Necessities

Another important factor in determining the trend of hardware quotations is found in the general classification of the majority of hardware lines as necessities. The rise in price was undoubtedly more apparent on luxuries, than any other class of goods. This reason is again of importance when considering the ratio and extent of decline during recent months. Although quotations on necessities did not soar to such dizzy altitudes, as did prices on luxuries, yet the former were the first class of commodities to attempt the return to pre-war standard values, and they have continued to lead the way in this respect. Hardware, both as a class, and also as regards to the majority of its numerous individual items, can be found in this category.

Price charts covering the past year, clearly indicate the startling ratio of decline in hardware commodities that has developed during 1921. Marked readjustment of this nature, is an exceptionally difficult period for all phases of industry. But the majority of hardware merchants have successfully weathered the storm. Failures among the retail branch of the trade have been exceptionally few, perhaps less than in any other branch of commerce.

This ability on the part of the hardware merchant generally, to become adaptable to changing business conditions, is attributed to the careful buying policy which has been adopted during the past few months, and also the manner in which the majority have closely followed the market trends. In some instances, smaller stocks have been carried, while the quicker turnover of stocks and more frequent purchasing have become accepted factors.

Diagrams or charts depicting price comparisons are usually spread over a period of years showing the movements to be gradually upwards or downwards, as the case may be. Various tables and charts compiled show that hardware prices have dropped during the last year to the same extent as several years inflation. In other words, prices in 1921 went back to the 1917 levels. And 1917 prices were not so far in advance of pre-war standards. It was towards the latter part of 1917 that hardware quotations commenced their upward climb; an ascendancy which continued during part of 1919 also, and throughout most of 1920. Of course, it must be remembered that such tables merely provide an average, and are not fully indicative of the various movements of individual lines. In many cases, prices are almost back again to 1914 levels. Others are merely temporarily prevented from further deflation owing to primary contributory causes such as freight rates; producing, operating and distributing costs. It is generally admitted that these latter factors are still much above pre-war levels, and such elements are naturally reflected in prevailing prices.

Adequate Comparison Available

Therefore, another consideration is suggested in the fact that price charts covering hardware goods would be even more illuminative if substantiated with similar charts or diagrams depicting the ratio of decline in such matters as transportation charges, and the cost of living. Adequate comparison is readily available, for personal experience in the subject of freight rates is a guiding force supported by fair memories and business records of easier freight costs. And likewise, both the merchant and the public are undoubtedly in an advantageous position to ably judge the extent of any relative decline in living costs that have recently developed.

These various matters, when fully considered, supply the retail merchant with a clear viewpoint of the prevailing price situation, and also many concise arguments whereby the viewpoint of the general public on these topics may be converted.

In 1918 the capital invested in thirty leading industries in Canada was $2,076,360,844. The value of exports was $2,311,831,449.

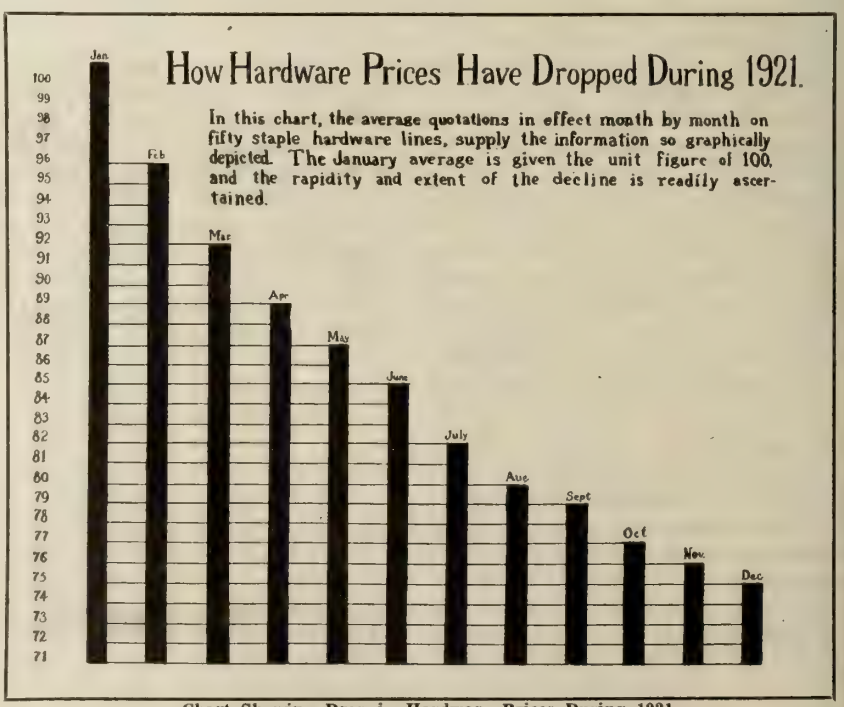


Chart Showing Drop in Hardware Prices During 1921.

The Salmon Fisheries of British Columbia

Early Settlers Made Salmon Leading Article of Diet—Commercial Distribution Started in 1876 — This Year Has Been a Poor One For Canneries.

By W. D. BURDIS, Secretary British Columbia Salmon Canners' Association

FROM the earliest times in Canadian history, the oceans which bound Canada on the Eastern and Western sides, and the innumerable inland seas, lakes and rivers, all teeming with edible fish, provided a valuable staple food for the people, and ultimately developed into a great addition to Canada's foreign trade. It was not until after Confederation that British Columbia changed its status from a small British colony on the Pacific to that of a Province of the Dominion. By reason of its incomparable wealth in minerals, lumber, and fish, it now gives promise of becoming one of the most important parts in the commonwealth.

The Pacific Ocean and the large rivers along the 7,000 miles of coastline of this Province, were found to abound in fish of all kinds, of which the most noted was salmon of many varieties, bred in British Columbia rivers and matured in the Pacific, and which regularly returned in immense numbers after four years to the parent streams to spawn and die.

Commercial Distribution

The early settlers made salmon a leading article of diet, but it was not until 1876, that means were devised for commercial distribution beyond the limits where the fish could be transported in a fresh condition. Previous to that year, salmon had been canned in sealed tins on the Columbia River, with considerable success, and in 1876, three small plants were installed on the Fraser River, where every season millions of salmon ascended to spawn, and 9847 cases of the famous "Sockeye" salmon were packed and marketed. The fame of the product rapidly spread. On Puget Sound (where the fish pass on their way to the Fraser), canneries sprang up, as well as on the Fraser River, and salmon canning became an established business, with markets for the product all over the world.

Gradually salmon canneries were established at various points along the coast of British Columbia, and Alaska, and other grades of salmon were put up, but the name of "Fraser River Sockeye Salmon" kept up its reputation of being the choicest food of its kind, and demand was always in excess of the supply.

Beyond Economic Reason

On the American side, traps, seines of great length and depth, and gill nets, were permitted and operated far in excess of any economic quantity, and though earnest representations were made to the American authorities and operators on Puget Sound to regulate operations with some idea of conservation, little or no success was attained. For every sockeye captured in Canadian waters, two were taken on the Sound, though all the fish were bred on the Fraser River and were only transient visitors in American waters.

In spite of this over-fishing, the sockeye did not show much signs of depletion till during construction of the Canadian Northern Railway alongside the Fraser River. Then down the canyon, all the debris of rock excavated was allowed by the Government to be dumped in the Fraser River, filling up the backwashes, wherein the salmon could rest after negotiating the rapids, before proceeding further. In 1913 a huge rock slide occurred at Hell's Gate (the narrowest point in the Fraser Canyon) and many thousands of tons of rock fell in the river, just at the time when the salmon were migrating up the river to the spawning grounds, and millions of sockeyes died without issue.

Governments Became Alarmed

The Dominion and Provincial Governments were greatly alarmed and took measures to remove the obstructions at Hell's Gate and other points, but the irreparable damage was done.

How great was that damage will be shown by the figures following, in which three of the four big years in each cycle, are given, for comparison, viz. 1913, 1917, and 1921, respectively, the intervening years representing the smaller packs in each cycle which occurred in all former years since the industry commenced.

The packs of sockeyes, on Fraser River, were as follows—since

1913	684,496	Big year
1914	185,483	1st off year
1915	89,040	2nd off year
1916	27,394	3rd off year
1917	123,614	Big year
1918	16,849	1st off year
1919	29,628	2nd off year
1920	19,691	3rd off year
1921	35,900	Big year

It will be seen that there has been a steady depletion. Unless drastic measures are immediately adopted for conserving the comparatively small numbers of sockeyes coming to the Fraser, this species will be annihilated.

A treaty with the United States was negotiated after an International Committee of both countries had thoroughly investigated the situation, and suggested action desirable to be taken on the Fraser and Puget Sound to restore the supply. This treaty was approved by the Canadian Government, but defeated in the Senate of the United States—a fact greatly to be regretted.

An Off Year in Canneries

The State of Washington has appointed a Commission to administer the fisheries, but no action has yet been taken to save the unfortunate situation. This year, only 13 out of the 33 canneries on the Fraser River were operated. Other denominations are Red Spring, Pink Spring, White Spring, Cohoes, Pinks, and Chum salmon, all of which run



Canning the Product in the Factory

largely on the Pacific Coast and are extensively packed. During the late war, every effort was directed to putting up all the fish possible. When the war ceased the various Governments had large stocks of the cheaper grades of canned salmon on hand. The sudden marketing of these surplus stocks greatly disorganized the salmon market and placed the canners in a very difficult position.

The stocks they had on hand were unsaleable except at prices much below the cost of production, consequently they were adverse to packing more than they could avoid. However, the stocks are gradually being absorbed and matters will correct themselves in time.

Fish, during 1921, in every district in British Columbia, has been very scarce, as well as in Alaska. This scarcity is exercising the minds of all those financially interested as to the future. The industry in this Province is greatly hampered by continually changing regulations, ordained by the Department in Ottawa, which is under the control of the Minister of Marine and Fisheries. Strenuous, but ineffective efforts have been made to have the Fisheries placed under a separate and distinct administrator, with a Board in British Columbia composed of experienced and competent men, to deal with the fisheries on this Coast, and this desire is shared by the operators in every other section of the Dominion.

It is felt that the Fisheries of Canada are of sufficient magnitude and importance to warrant a Department devoted to its care and conservation, and that the permanent prosperity of the salmon fishing and canning industries depends upon the concession of these reasonable presentments.

Operations of Department of Public Works

The Construction Department for the Dominion—Covers Extensive Field — Some Sixteen Hundred Harbor Works — Fourteen Thousand Miles of Telegraph and Telephone Wires, etc., Come Under This Department's Control.

By J. B. HUNTER, Deputy Minister of Public Works

IT IS SELDOM realized the amount of work which is undertaken every year in Canada by the Department of Public Works. This department is really the construction department for the Dominion, and builds harbor works, such as piers, wharves, breakwaters and dry docks; public buildings such as post offices, customs houses, examining warehouses, drill halls, etc., government telegraph and telephone lines, and operates an extensive dredging plant for the improvement of harbors and rivers.

On the completion of wharves and breakwaters, these works are transferred for administration purposes to the Department of Marine and Fisheries and, in harbors of national importance, are in turn by that department placed under the jurisdiction of harbor commissions, where such exist. Ten years ago, the departmental expenditure on construction and maintenance was $11,807,000 and, as an indication of the increase in the construction of public works during the next few years, it may be mentioned that, in 1915, the expenditure increased to $29,283,000.

However, on account of the outbreak of the world war, it became necessary for the administration to adopt a policy of the strictest economy and to reduce the expenditure as nearly as possible to a maintenance basis, with the result that in the following years the outlay on Federal works under the charge of this department was reduced as follows:

In 1915, to	$19,539,000.00
In 1916, to	16,161,000.00
In 1917, to	14,055,000.00
In 1918, to	12,902,000.00

Within the past five years, the important works executed by the department have been the reconstruction of the Parliament buildings at Ottawa, the massive architectural dignity and beautiful interior finish of which will be a matter of pride to Canadians for all time; the construction and equipment of military hospitals for the treatment of returned soldiers, and the completion of works in the large and more important harbors on the Atlantic and Pacific coasts, and on the Great Lakes.

The works now under the control of the department comprise some 1,600 harbor works, 4 dry docks, 450 public buildings, and 14,000 miles of telegraph and telephone lines.

The maintenance of all these works in a serviceable condition has become a considerable undertaking, entailing a large expenditure, and, until there is an improvement in the present difficult financial situation, it is unlikely that canal and harbor development—other than the completion of such works as have already been commenced, will be undertaken. The new Welland Canal, when finished, will render necessary the improvement of the more important harbors on Lake Ontario and the development of a port of trans-shipment at its eastern end.

Larger schemes of development, such as the deepening of the Upper St. Lawrence, which has been, and still is, the subject of investigation and study by the International Joint Commission, will, in all probability, be forced to wait an increase in the resources of the country; and, until Canada's population grows to an extent that the trade and commerce of the country demand increased and improved transportation facilities by water, it should be the earnest endeavor of all Canadian producers to utilize the existing works and facilities to the maximum of their capacity.

Not more than one half of the population of Canada is living on the land. Cities and towns have grown faster than the rural communities.



Sorting and Grading Sardines

Development of Canadian Lumber Industry

Many Advances Have Been Made in Equipment—Process of Manufacturing Lumber Has Changed Considerably—Horizontal Resaw Now Used in Place of Circular Type

By G. B. VAN BLARICOM
Editor Canada Lumberman

IN THE Canadian lumber industry there have been many advances during past ten years in way of equipment, time and labor-saving processes, efficiency of operation, reduction of overhead expenses and facilities in handling, piling, shipping and distributing forest products. It is doubtful, though, if the number of sawmills in the Dominion is greater than in 1910; in fact, according to the returns received from the Federal Bureau of Statistics, there were nearly one hundred fewer plants in operation during the past year than there were in 1910-11.

Owing to the recession of timber supplies, the locations of plants are gradually being removed from the frontier of the provinces to the interior. This change of base is rendered necessary in order that driving conditions may be as short as possible and the industry carried on at close range to its raw materials. Many mills, which flourished a few years ago with a cutting capacity of from 100,000 to 200,000 feet a day, are now numbered among the institutions of the past. Such plants may be found at Deseronto, Waubaushene, Midland, Trenton and other towns in Eastern Canada. In many cases the limits have been exhausted and there are no further economically available sources of supply; then, too, the fire hazard in sawmills is something that has to be reckoned with, and during the past decade numerous large enterprises have been flame swept. These have been rebuilt in a number of instances but, in other cases where the supply of logs in sight extended only over a few years, arrangements have been made by the proprietors to have the timber cut up in some adjoining plant.

Thus, the pioneer, open door, speculative pursuit of lumbering is constantly changing and shifting operations. The very nature of the calling demands and challenges action and optimism. It requires men of faith, vision and courage to enter upon an industry which, according to the vast capital locked up, yields potentially smaller returns than numerous other undertakings of an industrial character. The amount of money invested in sawmills in Canada is, roughly speaking, $231,000,000, whereas a decade ago this sum stood at $146,000,000.

Wood Products Cut are Reduced

It is a rather strange fact, but nevertheless true, that in 120, according to a statistical survey of the lumber arena, there were less wood products cut in Canada than ten years ago. Last year, 1920—the returns for 1921, not being yet complete—the number of feet sawn was approximately four billion board measure, while in 1910 the quantity exceeded this by fully half a billion. There has also been a corresponding decrease in lath, but shingles have shown heavy increases principally in the West. Of course, the value of the products turned out has augmented considerably notwithstanding the annual diminishing cut. The uses for lumber are growing all the time in spite of views expressed to the contrary, and as the supply has become scarcer, naturally price levels have ascended.

Building operations, except those of an industrial character, were largely deferred during the war, and since the cessation of hostilities there has been a lively evidence of activity in the erection of homes, particularly in the bigger centres of poulation. The outlook is that the requisition for houses will continue unabated during the coming months.

There have been many changes in the process of manufacturing lumber, until to-day we have the latest expression of sawmill construction in the plant erected recently by Gillies Bros., Braeside, Ont. This mill is located in the Ottawa Valley and represents the most up-to-date erection in the lumber line in Canada. It is entirely fireproof, being built of brick, steel and concrete, while all the equipment is electrically driven. A new epoch is thus ushered in in sawmill construction. There are forty-eight motors, single and in groups, scattered throughout the various departments, ranging from 1 up to 150 h.p. The mill has a cutting capacity of 150,000 feet a day and in dimensions is 75 x 190 feet. It is the last word in enterprise, construction and appearance.

When Gillies Bros. were asked what their object was in investing such a huge outlay in a sawmill, they intimated that their limits would provide raw material for many years to come, that they were desirous of eliminating all danger from fire and turning out accurately-gauged and well-sawn lumber.

It may be of interest to the manufacturing world to note that by reason of this fireproof mill, the rate of insurance was reduced from $4.50 to 35c per $100., per annum.

Thus the era of advancement widens and, while time and labor-saving methods have possibly not been as pronounced in the sawmill line as in some others, yet there have been distinct changes from the old ramshackle, out-at-the-elbows mill structure with its snaky and wavy lumber to the great, modern electrically lighted plant with its huge output and up-to-date installations.

The process of manufacturing lumber has, certainly, made strides, and so has the art of the millwright, and, while it is not likely that many fireproof sawmills will be constructed, owing to the transitory character of the lumber industry in so far as the majority of sites is concerned, still there is about all progressive lumber plants to-day an air of neatness, attractiveness and productivity that is commendable. The yards are well laid out, the shipping facilities are splendidly arranged; all up-to-date structures are painted on the outside and whitewashed in the inside. Everything is provided in the way of sanitation, safety of operation, cheerfulness of surroundings and unity of effort. These outstanding facilities all make for economic operation, augmented capacity and decreased overhead.

The question naturally arising to one looking more at the mechanical end of the industry than, perhaps, to any other, is what constitutes efficiency in the sawmill? The three factors given by a leading manufacturer are—Plan your mill to save labor and eliminate waste; use the most effective and up-to-date equipment and give careful schooling and supervision to employees and operators of the machines.

In the last ten years there have been many changes, and one of the biggest has been the employment of the horizontal resaw instead of the circular resaw. The character of the mechanism has also had to be altered in a number of plants owing to the smaller run of logs. A decade ago 12-inch logs were common at the mill; to-day the general average is below this. The smaller log is due to closer cutting on the limits to eliminate dangers from fire and because of their proximity to the streams.

Evidences of Progress

The steam-feed system for the rapidly traveling carriages, the live rolls, transfers, chain conveyors, automatic trips, over-hung slash tables, automatic stamping hammers and other features mark the progress of the last few years, while in the yards heavy lifting has been practically eliminated. In several mills the lumber, as it is carried along in the sorting shed, has a runway considerably higher than where the sorters stand. This eliminates heavy work. The boards are placed in separate piles or bunches on turn-table lorries and hauled out to the yards by oil-burning locomotives. The lumber is then cranked off the roller-top lorries on to the piling frames, between lumber piles. The

average mill yard now contains many miles of standard gauge railway.

In the design or layout of many plants consideration has to be given to the character of the timber to be sawn, the use of by-products, etc. So far as efficiency is concerned, much depends on the layout of the mill, and the employment of modern machinery and placing it where it can be most conveniently and economically operated.

It was in 1890 that the first band sawmill in Canada was built by the Waterous Engine Works Co., of Brantford. This mill was especially designed for the eastern trade and went to the Gaspe Peninsula. In the course of the following three or four years the firm built several of these band mills, some of which were placed in Ontario plants. Most of them have disappeared but one is still doing duty in the Knechtel Furniture Company's factory at Hanover, Ont. It is understood that it is in good condition and performing as effectively as it did away back in 1892. This however, is reverting to a period anterior to the last decade.

Another feature in the improvements that have been made on sawmill resaws, is the spring cushion straining device, wherein a powerful compression spring is made use of with means provided for varying and indicating the strain to suit the different widths and gauge of saw blades.

Savings by Modern Equipment

Other alterations in connection with vertical sawmill resaws are in the shape of set works for positioning the feed rolls. Additional machinery of comparatively recent date constitutes not only vertical band resaws but twin and gang band resaws, which are said to have about twice the output of a single band resaw. Their use has naturally resulted in a saving of labor, increased the output and reduced the cost of production.

As already indicated, one of the outstanding features of the sawmill practice within late years has been the introduction of the horizontal band resaw, which many mill men believe has come to stay and will be used more extensively in future. One feature of this machine is its adaptability to all classes of work. The advantages of the resaw over the ordinary log carriage, when producing lumber from small logs, are that the feed is continuous in one direction so that there are no losses of time such as take place on the reverse run of a carriage; neither is there loss of power such as when a heavy carriage has to be reversed. The resaw operator does not have to possess the same skill as the head sawyer in the mill, and no dogging arrangement is required on a resaw since the slabs are handled face down, which automatically tends to the production of accurate lumber. Another argument in its favor is the thin saw kerf. As timber becomes more scarce, increasing attention is being given to the enormous waste that takes place in converting logs into lumber, and an important saving can be made by using equipment that will handle thin saws and thereby decrease the large loss that now goes into sawdust.

The fact that the use of the resaw and band saws, gang edgers, etc., has increased rapidly during recent years demonstrates that time and labor-saving methods are coming to the front, and one leading operator remarked recently that it would not surprise him to hear of a law being passed compelling lumbermen to use thin blades in the production of lumber, to conserve Canada's diminishing timber supply.

MARKETS SHOWSIGNS OF STRENGTHENING

Grocer and Primary Markets Reviewed—Tea Was First To Recover from Depression Period—Other Lines Are Improving

By J. L. WYCKOFF, Editor Canadian Grocer

DURING the past year, like other businesses, both retail and wholesale grocers have been passing through a depressed period and although at the beginning of the year stocks were fairly well reduced, heavy losses were sustained well into the middle of the year. At that period of the year, with perhaps the exception of sugar and farm produce, market conditions commenced to show signs of recovery. Prices too, owing to the liquidation of stocks, had reached bottom and in many instances to several points below replacement values. Up to this time merchants and wholesalers were buying in lots of only sufficient size to meet immediate requirements.

The first six months of the year fairly well cleaned up depressed stocks and with primary markets commencing to show signs of strengthening, the trade started to have a little more confidence and while the trade generally speaking continued to buy moderately, there appeared to be an improvement in the tone and on some lines such as canned vegetables, teas and jams, the movement was decidedly for the better.

Teas were one of the first commodities to recover. It will be remembered that the first of the year had a carryover of the largest stock of tea in the history of the business. Producers of teas at once started to curtail the production with the result that at the present time the production of teas is about 200,000,000 pounds short of a normal year. This curtailment has had the effect of steadily advancing prices and at the moment prices are some fifteen to twenty cents higher than at the beginning of the year. The markets continue in a strong position and there is every reason to believe that prices will go still higher as there appears to be a decided shortage on many grades.

Coffees, owing to distressed financial conditions in Brazil, were a little slower to recover but the last quarter of the year the markets have developed stronger tendencies with higher prices materializing which are likely to continue well into the new year or until the new crops are available.

Canners and packers of jams adopted a different principle this past year in that they only packed sufficient to fill orders that were previously booked. These future orders being very limited, packs were excedingly small as compared with previous seasons. This therefore resulted in a firm market for these lines and since the opening prices were named, many advances have been registered.

In flour and cereals, the markets held fairly steady to firm until the new crop was marketed and the market broke. Since then stronger tendencies have developed.

The feature of the sugar market has been the heavy carry-over of the last year's crop. The appointment of the Cuban Finance Committee to market the crop and their efforts to maintain a set price was a factor that drew outside sugars into the market at lower prices and resulted in Cuban sugars remaining unsold and created an unsettled condition. Prices for raws rapidly dropped and with the commencement of the making of the new crop Cuban sugar, the market had reached the lowest point since 1902. Canadian refined sugar although dropping to some extent, is still considered too high on a replacement basis and further reductions will no doubt be registered.

Everyone is fairly familiar with the drastic reductions taking place in farm products but these too, have recently taken an upward movement, the hog market especially strengthening very materially and from present indications is likely to hold which is also reflected in a steadier market for bacon. With these conditions existing and with spot stocks none too large the trade can naturally look upon the turn of the year with a greater degree of confidence.

A freak boiler explosion, of a most extraordinary character, recently took place in a plant at New Jersey, near Newark. The boiler, of stationary locomotive type, had long been out of service, and an inspector went into the fire box to look for defects. Soon he heard a fearful report. The furnace sheet had ripped open for a distance of about 36 inches directly through a weld which had been made in the sheet. It is thought that the sheet had been overheated in the welding process, had crystallized and consequently was under too great a shrinkage strain. It was found on examination that the defective part was practically free from scale. The accident shows up what dangerous stresses may result from improper heating in welding processes.

Iron and Steel Industry in Great Britain

In 1913 the Steel Business Was at Its Peak—1915 Saw Government Control—In 1918 the 1913 Production Figure Was Passed Easily—1920 Witnessed the Turning Point—Coal Strike in 1921 Caused Great Damage to Steel Industry

By D. ADAM, B.Sc., Assoc. I.M.M.
Assistant Editor The Engineering Review

BETWEEN 1911 and 1913 the iron and steel industry in Great Britain was on a rising curve of prosperity that reached its highest peak in 1913. In that year the output of pig iron was 10,260,000 tons and of steel, 7,664,000 tons, figures that had never previously been reached; while prices had not been so high since 1900 when the South African war influenced the market. Towards the end of 1913 there were indications that this high level could not be maintained. Germany, by means of subsidies, was making a strong bid for increased export trade and competition was growing keener. As an instance of the competition the British steel maker had to face may be mentioned that in 1913 the Rhenish-Westphalian Coal Syndicate granted a bonus of 1.50 marks per metric tin on fuel obtained from the syndicate to produce iron for export; the Pig-iron Syndicate granted an export bonus of 4.75 marks per metric ton on pig iron bought from the syndicate for the manufacture of goods subsequently exported, and the Steel Syndicate granted a similar bonus of 15 marks per ton. This subsidy policy in Germany raised her in 1913 to be the largest exporter of steel in the world with 5,664,000 tons. Great Britain followed close with 5,049,000 tons, though her total output was only about 57 per cent. of the German output,

Then in that memorable August of 1914 Germany decided that she could best further her ends by exporting her iron and steel in another form and the rivalry between Essen and Sheffield was translated to the field of battle. The politicians said "Business as usual" in the belief that some soothing words of reassurance were required to prevent panic. But already in 1915 it became painfully evident that something more than the usual would be required of the iron and steel industry if we were to withstand the torrent of steel that Germany was pouring on our trenches in France and Belgium. The Ministry of Munitions took control and the whole iron and steel industry of the country became more or less a Government department.

Output of Steel

The output of steel was increased from the 1913 figure of 7,664,000 tons to 9,540,000 tons in 1918 and estimates for 1919 had allowed for a further increase to 10,000,000 tons. Throughout the period of the war the prices of British iron ore, pig iron and steel were controlled. Shell steel was fixed in June 1915 at £15 per ton and early in 1916 commercial steel was given a fixed price which varied from £11-2s-6d per ton for joists to £12-10s for boiler plates plus a subsidy varying from 10s per ton in 1916 to 15s per ton in 1918. With the subsidies, therefore, the war price of commercial steel was nearly double the price ruling in the period 1911-13. The ratio of the war to the pre-war price must not, however, be taken as an accurate index of the difference in the cost of production, for during the war the government not only purchased the bulk of the steel output but, directly or indirectly, supplied the bulk of the raw material. In other words the government simply paid the steel makers a reasonable profit and took on itself the responsibility for any loss there might be between the raw ore and coal and the finished steel.

That there was a loss was evident when control ceased early in 1919 and prices were left to the free play of economic forces. Ship plates, for instance, which had been controlled at £11-10s per ton, rose immediately to £17-10s and nine months later in February 1920 were at £23-10s. The highest prices were reached about the middle of 1920 when steel was soaring to about £30 per ton under the influence of the post-Armistice boom. Then came the descent into the valley of trade depression in which we now are, with a fall in the price of steel to £25 per ton in January 1921 and to £10 per ton in December 1921. These figures cannot be accepted as a mathematically accurate index of the course of prices, since the pound sterling, in that period, was itself a variable quantity, but they serve to indicate approximately the "curve of prosperity" in the iron and steel industry since the termination of the war.

The year 1920, with a steel output of 9,000,000 tons, was the turning point. With the demand falling and a succession of labor disputes output and prices fell rapidly until, in consequence of the disastrous coal strike in the middle of 1921, the whole iron and steel industry closed down. Since the settlement of the strike a few blast furnaces have been re-started "to keep things going," but international exchange and the scanty home demand have, so far, proved an insuperable barrier to economic recovery and the British iron and steel industry is in the trough of a depression such as it has never before experienced. The output of steel for the first nine months in 1921 was only about half that of the equivalent period in 1920 and exports were lower in the same proportion.

Loss of Certain Markets

At the present time what is hitting the industry hardest is the loss of the European and Near East markets, through currency depreciation in these countries. British steel cannot compete in price with German or Belgian steel and only by the promise of early delivery have orders been secured. Nevertheless there is a vast latent market for steel in Europe which requires only some stability in international exchange to vitalize it and provide an outlet for British steel mills. This market, when awakened, should compensate for the loss of India, which now supplies nearly the whole of her own requirements and for those markets which have been captured in whole or in part by the United States.

It has been suggested that a closer commercial union between the overseas Dominions and Great Britain would make her economically independent of the continent but actually a large market for British goods in Europe is an essential preliminary to expansion of Imperial trade. About fifty per cent. of the iron ore used in Great Britain for steel manufacture is obtained from the continent, Spain being the chief supplier. If this could be obtained from Canada, either as ore or pig iron, a market would be developed that would allow of enormous expansion in the exploitation of Canadian mineral resources. It may be argued that Canada can make steel herself and, as occasion arises, supply Europe direct; but Great Britain's geographical position, the supremacy of London as a financial centre and, above all, the existence of steel making plants with a capacity of 9,000,000 tons a year make the proposition a sound one on strictly business lines, apart altogether from ties of kinship between the different parts of the Empire. The attempt has already been made to form a business partnership between steel makers in Great Britain and the coal and iron ore producers in Canada, but it was too premature for the reason that Europe is not yet in a condition to absorb the steel output that would result from the combination. A time more favorable to such co-operation will come. Though the British steel makers are more concerned just now with finding a market for their products than with finding the raw material to make them, it is not too soon to draw the plan of a campaign that will unite the two countries as closely as in those other days when steel of a high explosive kind was the chief demand of Europe.

Keeping Up With the Growth and Development

Many Heavy Passenger and Freight Locomotives Have Been Purchased During Last Five Years—Latest Type Develops Maximum Power With Marked Saving in Fuel.

THE CANADIAN Pacific Railway have maintained their motive power, rolling stock, and maintenance and repair equipment in keeping with the growth and development of locomotives and cars. This policy has involved continual improvement and betterment. The following paragraphs indicate to what extent this policy has been carried out during the past five years.

During the past five years the railway company have built and purchased a large number of heavy passenger and freight locomotives. These locomotives represent the latest development in the art, and are the finest type of motive power to be found upon the Continent. Both freight and passenger locomotives are the heaviest and most powerful in the Dominion. As an indication of the improvement and development in design it is of interest to note that these locomotives develop their maximum horsepower with a very marked saving in fuel.

In addition to the new and heavy power, the older locomotives have come in for their share of improvement, and many of them have been modernized, and their performance and fuel economy greatly improved by improvements in design. Some of these include re-designing valve motion to better distribute the steam to the cylinders, the application of brick arches in fire boxes to improve combustion, the application of superheaters to increase the volume of the steam, the application of automatic fire doors which prevent cold air from getting into the fire boxes and lowering the temperature of combustion, the application of power reverse gears which enables the engineman on switch engines or way freight engines to reverse the direction of movement easily, vastly improving the efficiency of the unit.

For a number of years all new locomotives have been equipped with vestibule cabs which completely enclose the engineer and fireman and protect them from the inclement and cold weather, and by making them very comfortable, enable them to do their work more efficiently. In addition quite a number of locomotives operating in bad water districts in the West have been equipped with tender tanks of very large capacity. These tanks hold 10,000 Imperial gallons, and enable locomotives to run past water stops where the water is not good, and where previously it was necessary to stop and take water. This results in decreased maintenance and better service, as bad water is a very large factor in boiler maintenance and operation.

Compound air compressors have been applied in large numbers to the locomotives, enabling air to be compressed and supplied for the air brakes and for air operated auxiliaries much more economically than with the simple type of compressor.

Freight Equipment

During the past five years, the railway company has built and purchased a large number of freight equipment cars. Of this number the greatest proportion are box cars of 60-ton capacity. These are very large and modern cars, being 42 ft. 1½ in. over buffers, having an inside clear length of 40 ft. 6 in., an inside clear height of 9 ft. and an inside clear width of 8 ft. 6 in. These are a single sheathed steel frame box car and represent the latest development in the art, being equipped with all steel ends and outside metal roofs. Where freight commodity is handled in bulk, and the distances are long, the large locomotive and large car are a very important factor in bringing down the cost of operation.

During this same period a large number of modern refrigerator cars were built. Other classes of car that have been built are steel ore cars, cabooses, flat cars, tank cars, coal cars and automobile cars, all of which were built in the company's own shop in Montreal. In addition quite a number of snow plows, flangers and ballast spreaders were constructed to replace older and less efficient equipment.

At the same time improvements have been made to existing equipment by adding steel ends, outside metal roofs, metal carlines, heavier couplers, improved door fastenings; all these improvements being of such a nature that they not only increase the life of the car, but keep it off of the repair track, thereby decreasing the cost of maintenance.

Passenger Equipment

During the past five years, a large number of steel passenger cars have been added to the equipment. These cars have steel frames and are finished on the outside in steel, but the interior is finished in wood, which adds to the general appearance and to the comfort, and which represents the latest development in the art of passenger car building. These are all exceptional cars and have been described at considerable length in the technical press. The passenger carrying cars have in them all facilities for the comfort of the passenger.

Improvements to passenger equipment during the same period have been considerable. A great many cars have been rebuilt and refinished in such a way as to add to their life, increase the comfort of the passenger and decrease the cost of maintenance. Many cars have had electric lights added to them, replacing the gas system. Screens have been placed in sleeping car windows, electric fans have been placed in dining and sleeping cars, smoking rooms have been remodeled, making them larger and adding to the facilities therein, improved ventilating systems have been applied, improved heating systems including a system whereby the passengers in sleeping cars can control the heat for each berth, rear end cars equipped with free cup vending machines, etc.

Shop Buildings

During the last five years the machine tool equipment has been added to, old machines being replaced with more modern machines enabling work to be turned out better and more cheaply. A number of shop buildings have been increased in size and equipment added to facilitate the handling of locomotives and cars, all of which results in economy. In addition, a great deal of attention has been given the reclamation of scrap material of all kinds. Bolts and nuts, lanterns, shovels and wheel barrows are reclaimed. Oil cans and various containers for liquid are manufactured from old paint cans. The addition of autogeneous welding equipment has facilitated the work of reclamation as well as repairs. Thin scrap metal plate is manufactured into washers and cotters. Scrap bar iron is straightened and rerolled into usable sizes. All scrap is sorted and that which can be repaired economically is reclaimed and used again, greatly decreasing the cost of maintenance.

FLYING IN A FOG

The maintenance of a continuous service by aircraft depends upon several factors, one of the most important being the ability to fly during foggy weather. Direction-finding by means of wireless telegraphy has been of great assistance in this direction, but a much more elaborate and promising aid has been recently devised by a British engineer. The apparatus consists of an upper row of lamps controlled by a gyroscope, and by an air speed indicator, the pilot is given all the information he needs to fix his position during fog. Point-to-point flying can therefore be undertaken with the certainty of reaching the desired destination. The speed of the machine through the air, the rate at which it is turning, the direction of sideslip, and the movement required to keep the correct course, are all recorded. Experiments with this apparatus have been going on for over 18 months and manufacturers are said to recommend its use with confidence.

Many Important Factors Must be Considered

To Get Credit the Manufacturer Must Convince Banker That He Knows His Business—Can Buy His Raw Materials Wisely—And That His Labor and Production Costs Are Reasonable

By J. W. TYSON, Editor Financial Post

SINCE THE days of Shylock—if not before—bankers have been unpopular. This is not hard to understand. Every person is inclined to rate his credit higher than may appeal to a disinterested party and particularly to a person asked to advance money on it. And then if the banker in exercising his judgment makes a loan which cannot be repaid when due the borrower feels that, like Antonio, he is the victim of spite. As a matter of fact, it must be plain that banks and bankers do not want "revenge" on their customers. Shylock was a poor banker—he was not even in the meat business. What any competent bank desires is to get back the bank's funds in accordance with the terms of the loan, together with a fair rate of interest. To renew loans means frozen credits and that is a reflection of business stagnation. To enforce the letter of the bond means to take over the business involved and that is the last thing that the bank or the banker wants to do. Banks deal in credit. They want to merchandise all the credit they can because the turnover means profit as in other lines of business. The more successful the merchant or the manufacturer the better they are pleased. To force the customer into liquidation usually means that the bank has to go into the retail business or the manufacturing business until assets can be realized on—and that is about the last thing they want to do.

When, therefore, it is stated that the banks have curtailed their current commercial loans during the year by about $160,000,000 there is a general impression in business circles that this is the explanation of the depression which has been experienced. As a matter of fact this reduction of about 12 per cent. —and it has been greater than indicated in the case of manufacturing and trade because of the increased demands of agriculture—is the effect of the readjustment, and not the cause of it.

The dominating factors in business are physical rather than financial. For a time war credits resulted in world-wide inflation through the high prices which necessity involved. Then came the realization that the nations must set their houses in order. Instead of huge government consumption at high prices it became necessary to find normal markets. For a time war funds in the hands of individuals and demobilization expenditures by governments maintained public buying but this finally subsided. War-burdened European nations were not in a position to buy our agricultural products at war prices. Prices slumped. Our farmers found their profits shrinking to the disappearing point. We are now experiencing the process of getting prices for manufactured products down to a basis where normal consumption can again be encouraged. Until that time depression in industry seems bound to continue. The weather conditions in Western Canada during the harvest season served to aggravate the situation in a market to which the manufacturer looks to provide the difference between minimum and maximum production. At the same time markets for manufactured products are largely closed because of the return of Europe to industrial activities and the lowering of manufacturing costs with the necessity of finding markets for the products of factories which were so long engaged in making munitions.

Thus we have at present a situation in which the popular idea that industrial depression is caused by the attitude of the banks is far from the real explanation. Quite true, the banks could lend more money on commercial credits at the present time. But could they lend it profitably? Careful students of the situation opine in the negative. In order to get credit a manufacturer must not only be able to convince the banker that he knows his business, but that he has bought his raw materials on a sound basis, that his labor and other production costs are reasonable and that he can find a market for his products on terms to show a satisfactory margin of profit. If the manufacturer can do those things he should not have any great difficulty to get a line of credit. To give credit on any other basis is not good for either the borrower or the bank.

Adjustment of Physical Factors

It is then an adjustment of the physical factors that is desirable. If raw materials can be brought down to a sound market basis and labor transportation and other costs adjusted so that goods can be produced at costs which will encourage normal consumption by farmers and others who are experiencing curtailed buying power, then there should be no reason why the bankers should hold tightly to the purse strings. But until such adjustments are made the attitude of the banks will no doubt reflect the industrial outlook and if in addition there is some tendency to take a conservative view of the unsettled outlook it is hardly a matter for surprise when recent experiences are considered.

The matter of bank interest rates on loans is another point on which there is at times considerable dissatisfaction on the part of manufacturers and other borrowers. This dissatisfaction naturally develops during a period, such as that recently experienced, when capital becomes more plentiful and quotations on money rates in New York, London and other financial centres show lower levels. Little is heard, however, it might be pointed ont, about the advances which take place at other times and which, like the declines, are not reflected in the rates which are charged by the Canadian banks.

Recently a rate of 5½ per cent. has been quoted in New York. A comparison with Canadian rates is not fair from many points of view. In the first place the 5½ per cent. rate quoted is one that is not generally applicable. On the other hand the general custom in the United States in regard to such loans is radically different from that in Canada and results in a net rate that is considerably higher than the nominal one quoted, around 5½ per cent. A short time ago when a customer of a Canadian bank applied for a loan in New York from a Canadian bank, he was informed that the bank was not accustomed to loaning to its Canadian customers there to any extent, feeling that it should use any cash available there for strictly call loans, which could be turned into cash on a few hours' notice. This course they would not like to take with a Canadian customer and in order to preserve their policy of keeping their funds in New York in a liquid state they advised him to apply to United States banks. He did so and found that while he was allowed a loan he could withdraw, as a matter of fact, only 80 per cent. of it. Twenty per cent. he was compelled to leave with the bank as a form of cash balance, or "free money," on which he would receive no interest. Apart from that, interest of 5½ per cent. was being charged him on the full amount, so as a matter of fact he was paying over 6½ per cent. for the money he was using.

The Canadian practice is entirely different. As a general rule the loan for commercial purposes is honored to the extent of 100 per cent. of the credit provided by the bank so that if the rate is 6 per cent., which is the prevailing one, the borrower pays only 6 per cent. instead of paying also for a balance which he is not allowed to use.

But altogether apart from present conditions which in themselves are not unfavorable to the Canadian borrower, there remains the fact that during the past few years, not only during the war but afterwards, interest rates rose sharply in New York, while the Canadian banks continued to lend money and to extend credit for exactly the same rate as prevailed many years ago. The rate of 6 per cent. remained practically

(Continued on page 168)

Believe Spring Will See an Improvement

Although Production of Steel Has Dropped Rapidly During 1921 The Present Decline Will Not be of Long Duration—Things Must Be Brought to Economic Level Before Upward Tendency Begins

By J. M. ELSON

FROM BELCHING smoke-stacks blazing furnaces and the noise of almost ceaseless activity, reaching a hundred per cent. production in 1920 down to comparative quiet and from only 50 to 65 per cent. production in 1921, is the story of rapid decline within twelve months of the steel industry in Canada and the United States. As for 1922 the outlook, just now, does not appear any too bright though there are reasons for the belief that the spring of next year will bring an improvement.

As steel and iron enter so largely into numerous lines of business the steel market has long been taken as a sort of barometer for financial, commercial and economic conditions so that the public mind has acquired the habit of looking to this industry as a man looks at the sky to see what the weather is likely to be. When the furnaces of these plants are going full blast it is a pretty good criterion of the health of trade generally. When they are allowed to cool off and there is a small list on the pay roll it can be assumed that there is more than one cloud in the industrial sky.

It will be recalled by those who observe these matters that last year was one of the most prosperous that the steel plants of Canada have known. They were kept going, often to capacity, to fill the orders that came to them. The industry, like several others, reached its peak. But just as the commercial tide flowed, so it ebbed and all this year it has been running out, leaving on the shore mills of vast proportion and very large capital investment with a greatly reduced volume of business to do. The suddenness of the downward tendency in prices for their products has been as sharp as that experienced in any department. The figures quoted above showing a falling off of fifty per cent. in some plants is an index as to what has occurred in associated branches of business. Until there is an improvement in building, in railway purchases, in automobile manufacture, harvest machinery requirements and other allied industries where these heavy metals are constituents, leading men in the steel world cannot feel very sanguine over their own prospects.

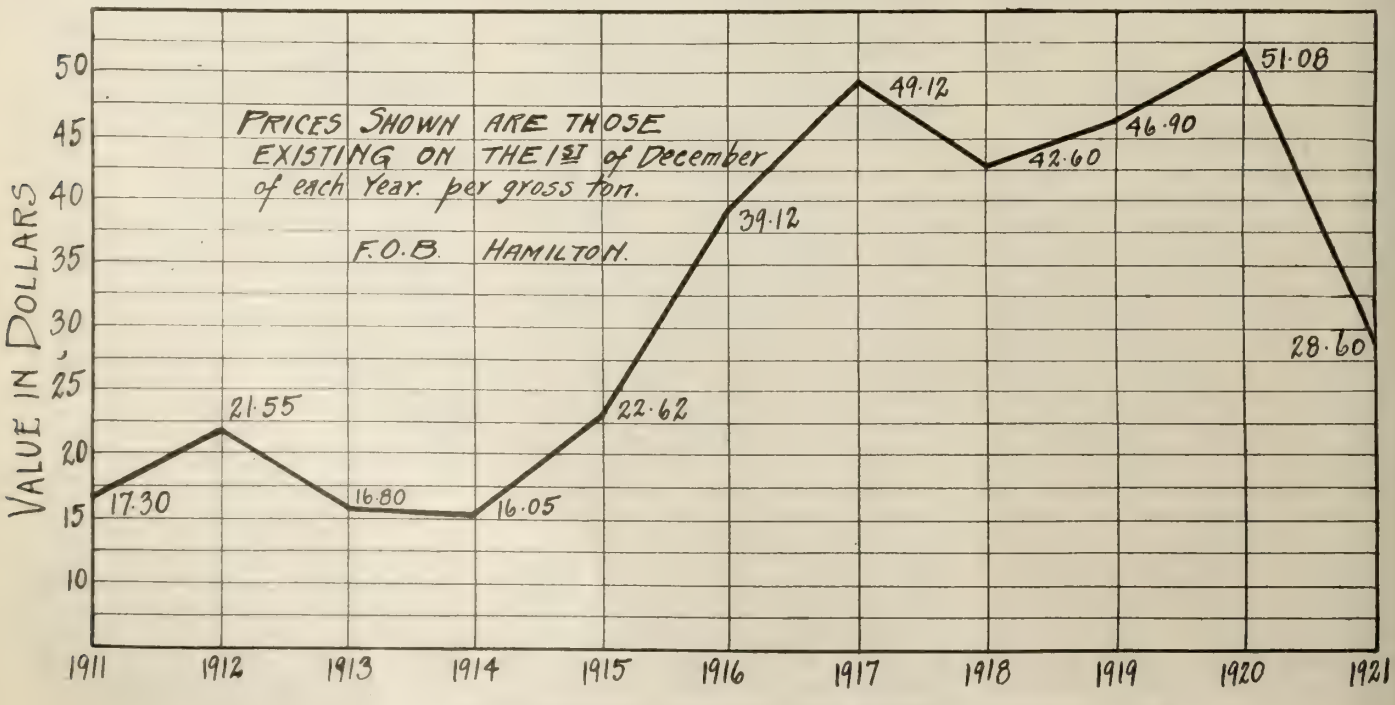
By men in positions of high responsibility it is stated that the potentialities for a revival and for a gratifying increase in the steel business are existent in Canada, but fundamental principles have to be recognized and applied before the doors of purchasing agents are open for large orders. High freight rates have imposed a burden which tends to restrict the market. Labor costs and the availability of money must also get more to normal. As long as too many weights are loaded onto one side of the scale the other side cannot come up.

For many months now people have been buying in small quantities and from month to month. Firms today order thirty and forty tons of material from the steel mills where before they ordered three or four hundred tons. The same ratio of purchase is said to prevail in nearly all departments of trade. The obvious consequence is dullness in the manufacturing end as well as in the wholesale and retail departments of business life.

A fairly intimate view of the steel situation was secured by Canadian Machinery through the courtesy of Mr. Robert Hobson, President of the Steel Company of Canada, whose principal plant extends itself over a wide area of Hamilton, Ont. Mr. Hobson was recently in New York, meeting executives of the steel industry in the United States. The consensus of opinion there expressed, he observed, was that little improvement in the trade is expected till about March next. Some views were given, in fact, that business could scarcely be expected to return to anything like normalcy till new crops were grown.

Answering the questions about his own company, Mr. Hobson said they had been able to keep up around a 65 per cent. production because they turned out steel in finished products such as screws, wires, nails, wrought pipe, forgings, angle bars, spikes, etc. In this way a more diversified and constant market could be served than was available for mills whose product was principally in rails and other heavy forms. nevertheless the decline experienced in business this year had been very sharp and serious.

"High freight rates and generally



Graph showing how prices have been for 1921.

stiff costs for labor and for the raw materials used in making pig iron all tend to keep up prices in metal products," commented Mr. Hobson. "It costs as much for freight to make a ton of pig iron as we were formerly able to sell a ton of pig iron for. Until these heavy charges come down it is apparent the price of pig iron will be up. To be more specific, pig iron sold for $14.50 per ton before the war. Now our freight on the raw materials going into a ton is $14.50 alone. In fact very few firms can sell pig iron today at from $19.50 to $21.00 per ton without sustaining a loss. Some of the plants in the United States are able to sell at these figures but they own their mines and some of them own their water-borne freight carriers."

Remarking on production costs in industries generally, Mr. Hobson said that they will be kept up to an unsound level as long as workmen are indifferent to the meaning of efficiency. "Until men give one hundred per cent. of labor," he said, "for one hundred per cent. of pay it is impossible to get things down to a proper economic level. In this connection, however, I want to say frankly that the workmen in the employ of our company should be given credit for their business sense and fairness. They have faced facts in a reasonable, tolerant mood. They have taken necessary reductions in wages with a sane spirit. As a result the maximum of employment can be given in dull times. They have put more efficiency, too, into their work. I am glad to say this for them, but I regret it cannot be said of all workmen in Canada and the United States."

Touching upon trades in which steel is largely used, Mr. Hobson remarked upon the fact that shortage of money in the country had lessened the production and sale of automobiles and had restricted building operations. Poor crops in the west and low prices for farm produce had placed the farmer in a position where he could not buy implements as he did a year or so back. All of these circumstances had helped to cripple steel, but like other business men he held that the potentialities of Canada were great and perhaps a good crop in 1922 would go a long way toward restoring the monetary and trade strength.

BUSINESS CONDITIONS IN FARM MACHINERY INDUSTRY

By A. M. ALLAN, Editor Canadian Motor Tractor And Implement Journal

THE farm machinery industry just now is passing through one of the most trying periods in its history. The year just gone will long be remembered. It saw varied and dramatic changes, from highest peak of optimism during the first three months, to an almost unprecedented gloom about the beginning of the last quarter. Mid-summer saw most of the farm implement factories either shut down or working on a curtailed basis. Since that time there has been no considerable improvement. There has been a slight activity by certain manufacturers, but those who are operating are producing mostly for export markets and for stock rather than for actual orders.

At the beginning of the year prospects for business were good and business actually done during the first three months compared favorably with that of the corresponding period of the previous year. It was noticeable though that sales were harder to make. Those dealers who were content to carry on with the order taking methods of 1920 did not meet with much success. But on the other hand dealers who got down to intensive selling were able to show an increase. This inactivity on the one hand and activity on the other struck a balance compared with that of 1920.

Manufacturers and dealers all spoke of a resistance to sales. This resistance became stronger as the year advanced until by spring and early summer it became well nigh unbreakable in some districts.

The cause of this resistance in the main was the drop in the prices of farm products. During 1920 the farmer farmed the most expensive crop ever produced. His labor costs were tremendous, but as he had been getting $2.50 a bushed for wheat and was looking for $3 wheat he was not worried much, figuring that with a bumper crop ready to harvest at high prices he was due to make large profits. Then the crash came. Wheat suddenly took a tumble. In the course of a few weeks it was down to $2 a bushel and by the turn of the year it reached as low as $1.87. The farmers' refusal to buy was not so much on account of his unwillingness but because of economy in order to liquidate his obligations, and the necessity of growing the new crops at a cost within the current market values.

The western farm machinery dealers have had a harder row to hoe than their brothers in eastern Canada. The fall in prices affected the west to a greater extent owing to the fact that wheat is the principal product of the western farm. The farmers in old Ontario and Quebec operate largely mixed farms giving them a bigger margin of security.

The farm machinery sales for 1921 in Ontario will be perhaps about 65 per cent of 1920. The west won't show more than about 35 or 40 per cent. In Quebec and the Maritime provinces sales have been poor.

During October, November and December, there has been some activity in engine and cutting box sales owing to the abnormally large corn crops. This only applies to Ontario, Quebec and the Maritimes.

There has been little implement or tractor production during the last year. Dealers have had difficulty in selling tractors and the numbers sold were few

New prices have recently been announced for 1922. With the lower prices manufacturers and dealers are hopeful that the new levels will induce the farmer to buy. The farmer is beginning to realize that other commodities are gradually coming to a price level more nearly approximating that of his own products, the psychological effect of which may tend to bring him again into the market as a buyer.

The outlook for 1922 is for a volume in dollars and cents about equal to the volume of 1921, which in view of price reductions would mean an increase of 25 to 30 per cent. in tonnage. If this is accomplished the industry as a whole can pat itself on the back.

We believe the worst has been passed but there will not be any considerable improvement until another crop is harvested.



A Typical Farm Scene in Canada.

How Can Canadian Factories Economize

Some Important Questions Ably Answered—Manufacturers Are On Their Toes and Keenly Realize the Present Situation—Methods of Reducing Manufacturing Costs

HOW can Canadian factories economize, so that production costs can be reduced?

"Have you had any difficulty during the past year securing raw material? Has labour been difficult to handle? Have you had success with some profit sharing or bonus plan? How does the efficiency of labour compare with that of 1914?

"Taking into consideration the fact that what Canada needs is population to develop her resources, should there, in your opinion, be any arbitrary restrictions placed on immigration?

"Do you believe that truck haulage for short distance shipments is better than railroads?

"When, in your opinion, will buying reach normal? When that time comes do you imagine that the existing conditions of machine tool equipment in factories throughout this country will necessitate to any large extent the purchasing of new and more modern equipment?

"What relation do you think wages should bear to production costs?

"Do you believe the present home markets are sufficient to keep Canadian factories busy, or do you think Canada should go after export trade? If you feel that securing export trade is of sufficient importance, what lines do you believe should be extended?

"What do you think of the railroad situation in relation to trade? Would lower freight rates help the business situation?

"In your opinion what are the best lines for Canada to develop in the near future?"

Believing that readers would be interested in hearing opinions on the above questions, we have secured from various manufacturers some interesting viewpoints. Here is what they say:—

BELIEVES IN PRINTED RECORDS

By F. E. MUTTON, General Manager International Business Machines Co.

ANSWERING your various questions in order I would first of all emphasize the fact that Canadian factories can economize and reduce production costs by having printed record of time spent on each operation by each employee. Further, costs can be reduced by eliminating in a great many cases at least 10 per cent. of the present staff. The other 90 per cent. will work harder and work faster. This applies to the entire staff of any organization aside from the sales force. Costs can again be reduced by having a proper time system, control of office staffs, and bringing about punctuality. This in many cases is a great loss which naturally adds to costs.

We have no difficulty in securing raw material or labor, and I do not consider that arbitrary restrictions are necessary as related to immigration, but I do believe there should be restrictions which will have such a tremendous bearing on the future population of Canada.

Truck haulage for short distances is, to my mind, better than railroads.

I feel that buying may reach normal conditions by the summer of 1922, though with ourselves for most of our product, buying has been normal the last three or four months. In one of our divisions, buying this year has been considerably above normal. We have no apprentice system.

I do not consider that home buying alone will keep Canadian factories sufficiently busy. Canada should certainly go after export trade. Lower freight would certainly help business, but I am not in favor of government control of railroads.

The amount of wealth which annually vanishes in smoke is amazing. Every year there are upwards of 33,000 forest fires, involving some 12,500,000 acres of timberland and costing in loss about $20,000,000, occurring in the United States.

CANADIAN FACTORIES ARE UP-TO-DATE

By P. FORD-SMITH, Manager of Ford-Smith Machine Co.

IN ANSWERING your questions let me say first of all that I believe Canadian factories are run economically at present. Those that are not are either out of business or are on their way. What we need here is the quantity of goods so that we can get better production methods. This means the growth of the country with its proportional demand. In this connection, I might say, as having had experience both in United States and Great Britain, that few people realize the difficulties of trying to run a business, at least in the machinery line, on the small quantities of any item which the Canadian trade requires.

We have had no difficulties with material or labor. The efficiency of labor is improving all the time. To my mind we can do with all kinds of immigration, but it should be closely supervised.

It is pretty difficult to say when buying will reach normal. I do not think that there will be extensive buying of new machine tool equipment for a very considerable time, maybe two or three years.

To my mind Canada certainly needs export trade along certain lines. Lower freights, like any other lower charges will certainly help business.

SHOULD TURN OUT WORK PROMPTLY

Personnel of Every Factory Should Permit Quick Turnover of Orders—Canada Requires Increased Population

By W. G. HARRIS, President Canada Metal Co.

IN MY OPINION, the personnel of every factory should be kept at a point that will permit orders to be turned out promptly, keeping only men who will give a fair day's work.

Our raw material has been abundant, and at lower prices. Labor gives no trouble, for with many to choose from, those we employ appreciate the steady employment we give. We have no profit-sharing schemes, and do not find it necessary, paying as we do, the best wages obtainable.

Canada requires increased population. In Great Britain today, many thousands are ready to come to this country, with a government system that will place men on the land, and keep them there.

Truck haulage or radial railway, we find very convenient and quick, in that goods shipped can not only, in many cases, be received in the cities and towns, but delivered at the customer's store, without delay, at no more than rail cost.

In the building of homes, it would not take much to make a very great rush in building, owing to the very high prices being paid for houses built some years ago. If money, cement, brick, labor and enamelware, were at a more reasonable price, there would be a boom that would carry prosperity to many other lines of trade.

The present home market would not build up in Canada, sufficient business to keep Canadian factories going, for while at present the countries that I visited in the past three months, such as Belgium, Holland, Germany, Switzerland, Italy and France, are striving to their utmost to keep all trade within their own borders, there is no doubt, if a within the empire policy was inaugurated, an export trade could be developed, and it is vital to big business, that it is developed.

The high cost of railroad freight and fares is a detriment to business, especially freight from the heart of Canada, to the

East and West, it being almost prohibitive. Lower freight rates would start things.

In reference to the best lines for Canada to develop her wheat, mines, clays, coal, asbestos and basic industries should be pushed. There is not a doubt that to-day, even with the handicaps that we have, that Canada under the British flag is the finest country in the world to live in, for in travelling the old lands, I found no better dressed, better fed, more law abiding or prosperous people than those in Canada, and I came home realizing more than ever, the great inheritance Canadians have.

MORE EFFICIENT MACHINERY NEEDED

By GEO. A. TRUE, President Northern Crane Works

TO MY mind the economies in Canada can be effected by using more efficient machinery, and by introducing labor handling machinery, such as cranes, hoists, etc. Aside from that, labor rates and overheads must be reduced.

We have had no difficulty in getting material; no difficulty in getting labor or handling it; no chance to try bonus plan effectively owing to too small volume, and labor is more efficient as compared with 1914, although this may be due to better equipment.

I would say "Yes" to question No. 3, and "No" to No. 4, while I do not care to make any predictions regarding your query No. 5.

Answering No. 6, I would say "Yes" in a limited form. It is of benefit, or we wouldn't use it. I doubt if present home markets are sufficient. There is difficulty in developing the export trade, for Canada must get her material prices down on a basis with United States prices in order to be effective in the export game. In conclusion I certainly believe that lower freight rates would help business.

PRODUCTION COSTS HAVE BEEN REDUCED

Many Economies Can Be Effected by Careful Analysis of Cost Statements—Improved Supervision of Workmen and Greater Attention to Quality of Raw Materials

By W. C. FRANZ, President Algoma Steel Corporation

TO YOUR question No. 1, I would reply that our experience has been that production costs have been reduced in a great many of the industries during the past year, and the principal items affecting this reduction are lower rates of wages and increased efficiency of the workmen. Many economies can be effected by careful analysis of cost statements, improved supervision of workmen, and greater attention to the quality of raw materials. Modern methods of handling material show reduction in expenses, but in most cases very careful study should be given to any new and improved equipment.

We have experienced no difficulty in the past year in securing sufficient stocks of raw materials. Labor has been very reasonable, and we have had no difficulties with our workmen. A large number of our employes receive bonuses on basis of tonnage produced. Labor efficiency, while not yet at pre-war standard, has made great progress during the past year.

My opinion in respect to arbitrary restrictions on immigration is that some limit should be placed on immigration from foreign countries, and especially former enemy countries, and on the other hand, special attention given to the promotion of immigration from the British Isles and the United States, in order that the task of making good Canadian citizens should not become heavier than we can handle.

We have had no experience with truck haulage as compared with railroad transportation, so cannot venture an opinion.

It is most difficult to say when buying will reach a normal basis, but it will not be until six months to a year after the general public is convinced that liquidation of prices is fully accomplished. At present all factories are buying supplies on a hand-to-mouth basis and practically no new equipment except for replacement.

We have a system of apprenticeship in our shops, which is giving very satisfactory results.

I believe the present home markets are sufficient to keep Canadian iron and steel manufacturers busy. We are not interested in export business on account of our location.

I think the railway situation has a very important effect on trade in general, and believe a reasonable decrease in freight rates would stimulate business quicker than any other one thing.

Canadian manufacturers should, in my opinion, first give attention to the domestic market in the development of industrial undertakings. The large volume of imports, especially from the United States, shows the extent of possible business to be done. Considerable progress has already been made in the production within Canada of finished products from the raw materials from our mines, forests and farms, and speaking as a steel producer, we would like to see all classes of finished steel produced in Canada so as to take care of home markets and cut down the imports, and we are very much interested in the production of finished steel products from iron ores mined in Canada. Every assistance should be given the prospector and mining company in their efforts to locate and render merchantable our own ores.

EACH INDIVIDUAL FACTORY IS A PROBLEM BY ITSELF

Canadian Factories Compare Favorably in Economical Administration and Production with Factories in Other Countries

By T. R. DEACON, President of Manitoba Bridge and Iron Works

YOU HAVE compiled a list of questions, which to answer the same in detail is rather a tall order. However, here is my opinion on the various subjects:

In replying to question No. 1, I would say that this would depend entirely on each individual factory. As a general rule I think that Canadian factories will compare favorably in economical administration, and production with factories in other countries. Each individual factory is a problem by itself

We have had little difficulty in getting material this year. We have had no trouble with labor. Since a few months after the big strike in 1919 we have had a plant council in operation in our plant, with very satisfactory results. It has increased the efficiency of the shops very materially, and has practically eliminated all friction as the men's representatives are taken into confidence in discussing policies of the company, and the results have been entirely beneficial.

I have grave doubts as to whether any benefits would accrue in Canada from allowing immigrants to arrive in the country during the winter months, or say prior to the first day of April, unless they have ample means to take care of themselves. Immigrants arriving during the winter months without funds and without experience are bound to become a burden on the country.

I do believe that for fairly heavy loads, say 2½ to 5 tons, and with good roads, where the stuff can be loaded at the shops or warehouse and be delivered at the other end exactly where it is wanted, that truck haulage is a considerable advantage over railroads in that it obviates two handlings of the material, once off the trucks on to the railroad, and again off the railroad to point of consumption, besides ensuring prompt delivery.

I have no idea when buying will reach normal. I think that the solution of this problem lies with the policy of the United States. They stayed out of the war for three years until they accumulated a large part of the gold reserve of the world. As soon as the war was over and they had all their customers' gold they shoved up their tariff walls, refused to sell goods except for gold, and would not allow their customers to ship

in goods in exchange. As their customers had no more gold they could not purchase their goods, resulting in closing most of the factories in the United States, and they are now in the position of King Midas with the golden touch. Until they are willing to make some arrangements with the other nations to let this gold go back into the use of the world, conditions, in my opinion, will mend but slowly, and if by any means we had a government in Canada who attempted to make an experiment with Free Trade, the result in my judgment would be disastrous. A general collapse of industry from one end of Canada to the other would result which would react over other lines.

In mentioning the relation of wages to production, I think this depends entirely on the class of goods produced, and no general rule can be laid down.

All factories in Canada that are situated within reach of tide water and in a position to export, should go after export business. This includes every line that can be sold at a profit abroad.

I am probably the only man in Canada who does not know how to solve the railroad proposition. To me it appears under present conditions insoluble. If it were not for the fact that any government has to depend on votes, I have no doubt enormous savings could be made in the operation of Canadian Railways, when lower freights could be had, and there is no question that this would help business. The transportation charges on long distance haulage now is a crushing burden. The conditions under which the railroads are practically compelled to operate do not allow them very great latitude in the reduction of freights.

Primarily Canada should develop her agricultural resources; secondly her forest resources; thirdly her mining, and fourthly her maritime resources, fishing and transportation.

LABOR HAS BEEN EASY TO HANDLE

Believes in Piecework Provided Rates Are Sufficient to Give Good Wage—Normal Buying in About Another Year—Apprenticeship System Pays

By JOHN S. LEITCH, Managing Director Collingwood Shipbuilding Co.

I WILL reply to your questions in order: First, I believe that the best way to reduce costs in factories where numerous duplicate articles are produced is piecework. Paying for results provided the rates are sufficient to give a good wage to the workman or workwoman is an incentive to greater production.

We have had no difficulty in securing raw materials. Labor has been easy to handle. We have no profit-sharing system. We are very dull at the present moment but I imagine the efficiency of the labor would compare with 1914.

I believe, while Canada is very sparsely populated, only slightly over two people per sq. mile, I understand, yet I think it is wiser to wait and populate with a good clean class of people rather than bring in a lot of undesirables in a hurry. If we want a clean class of citizens the only way is to select them carefully.

I think for short distances, truck haulage is better than railroad. The goods would have to be loaded on a truck in any case, taken to the railroad station, there taken off the truck and put on board the car. At their destination, a short distance away, a similar operation would have to be undertaken, while with an all truck haulage there would be only one loading and one unloading. I should imagine that the truck haulage would also be much quicker as it is quite possible that the railroad company might want to wait until they had a complete carload before shipping, consequently an unnecessary delay. We have no truck business here so that my opinion is not based on actual experience.

I believe it will probably take another year before buying becomes normal. In the case of shipbuilding, ship owners who require vessels have been holding off and are still doing so waiting for labor and materials to cheapen. Steel is not likely to go much lower for some considerable time to come and labor is still a great deal higher than it was in 1914. I do not think any drastic changes would have to be made in the conditions of machine tool equipment in the average factory.

We have an apprenticeship system and believe this is the proper way to train mechanics of all kinds. When a boy knows that he is engaged to learn a particular trade I think it steadies him down, as ordinarily I found here that they wanted to change from job to job as the spirit moved them.

It is difficult to answer your question regarding the relation that wages should bear to production costs as no doubt every industry will be somewhat different.

I think Canadian factories should develop export trade wherever possible as it brings fresh money into the country.

Lower freight rates would certainly help business considerably. It is difficult for some industries to live in Canada without protection. Ships, for instance, can be imported free of duty. The newspapers recently stated that nine French ships had been bought by a Canadian owner. These vessels were built by the United States, sold to France, registered in Great Britain and can now be brought into Canada free of all duty. Old ships are continually being brought on the American side of the Great Lakes and the register changed to Canada. Canadian shipyards, therefore, instead of building these vessels for Canadian trade, can only look forward to carrying out any repairs which may be necessary from time to time. The Government has been asked for help from time to time but nothing has ever come of it.

MANUFACTURING COSTS CAN BE REDUCED IN TWO WAYS

Increase Output and Cut Down Expenses — Raw Materials Have Been Plentiful—Only Best Class of Immigrant Should Be Sought

By W. H. CRABTREE, Howard Smith Paper Mills

I HAVE given some consideration, and in replying I have been of course, influenced by the conditions obtaining in our own industry, but doubtless they are, to a certain extent, common to all industry. Answering your questions in order here are my views:-

1.—Manufacturing costs can be reduced in two ways:—a.—Indirectly, by increasing the output; b.—Directly, by cutting down expenses.

Let me first deal with:—(a) I quite appreciate there must be a possibility of doing this, in so far as the plant is concerned, and a market provided for the increased product which it would turn out. But if the product be a standard staple one, the export fields should be exploited, even if it is necessary to sell at mill or factory cost on that portion of the output which it is found necessary to export. This increase of production will result in the plant specializing on grades or lines which it finds itself peculiarly adapted to make, and this will result in a lowering of the expense cost on its entire output.

(b). In considering the direct way of reducing expenses. Apart from putting each plant on as efficient a basis as seems possible, from a knowledge of conditions obtaining in our own industry, I am convinced that very material savings could be affected in Canadian factories by a free exchange "between kindred industries" of departmental costs, of information respecting working conditions, classes of materials used, etc. Some factories may be much more efficient in certain ways than others, but may show much greater costs in other departments. Leaving out the question of policy, if the plants could adopt the way of the most efficient in the respective departments, great economies would result.

My answer to question No. 2 is that raw materials have been plentiful. Labor has on the whole adopted a very reasonable attitude, and has taken the reductions which it has been found necessary to make, in the right spirit. We have had success with our employes on a basis of piece work, but this seems to be the only way that works out satisfactorily, aside from a per hour rate. The efficiency compares very favorably with 1914.

Regarding your question No. 3 I do not believe any arbitrary restrictions should be placed on immigration, but only the best class should be sought, and some practical form of investigation and examination should be put into force to in-

sure against a class coming in unworthy of our great country.

In replying to question No. 4 I would say that this would depend largely on the conditions of the haul distance, and whether a return load could be counted upon, time saved, service to customers, etc.

Answering No. 5, I believe buying will have reached normal within a few months. It has increased very materially in the past two months, and I feel confident that this condition will grow till normal is reached. I am of the opinion that the equipment of factories was overdone during the past few years, and that it will be some time before demand will overtake production, on "generally speaking" all lines. "No," is my belief to question No. 6.

Question No. 7 is a somewhat complex one. It depends largely on the industry and the nature of its product. Generally speaking, it would be safe to say that about 50 per cent. of the production costs would be represented by labor or wages.

My reply to your question No. 1 would embrace No. 8 also. I do not feel that the home markets can keep our factories fully occupied at all times. We should seek foreign markets, especially for such natural products as pulp and paper, asbestos, nickel, etc.

To question No. 9 I would say that the lowering of freights would certainly help business in a very marked way. The railways, in my opinion, will have to cut wages and otherwise bring down expenses in the same manner as industry. This will result in increased freight for them, which will generally benefit the country as a whole.

Answering the last question I believe that Canada can make no mistake in the development of her natural products, and thus bring into play the power of her latent wealth.

CANADA WILL HAVE TO EXPORT MORE

By W. INGLIS, President John Inglis Co.

YOUR questions are not easy to answer. In fact the very ones you ask me are some of the things we are trying to thresh out ourselves at the present time, and it is very hard to answer such questions when we do not know what is the best thing to do ourselves; but one thing is certain—Canada will have to export more, wages will have to come down, rents and living will have to come down, and railroad and water freight rates will have to be lowered before business will get back to anything like normal.

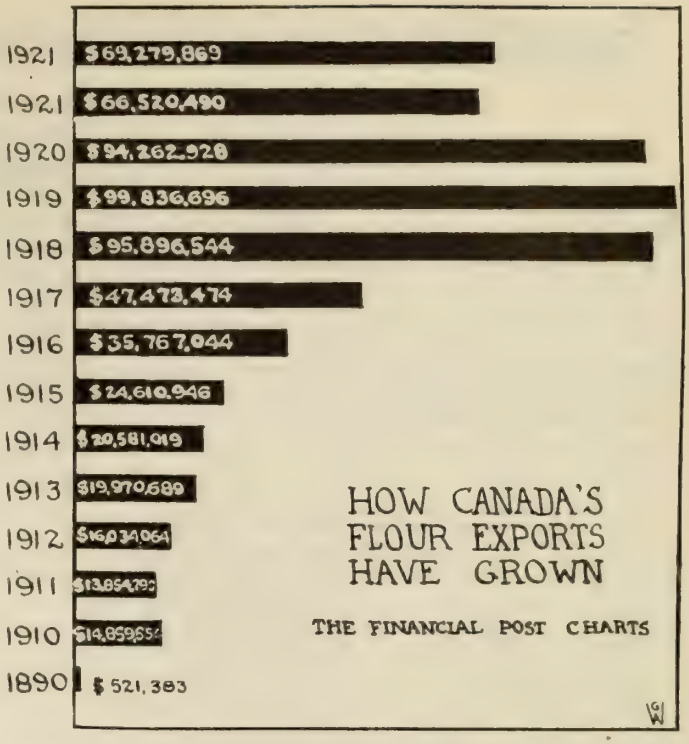
ECONOMIES CAN BE EFFECTED

No Trouble With Raw Material—Satisfactory Immigrants Only Should Be Obtained—Lower Transportation Needed

By C. H. WATEROUS, Waterous Engine Works

IN LOOKING over your questions I find many of them not easy to answer. However I will take them in the order in which you ask them. First, I believe that economies can be effected in some instances, probably very large ones, but individual factories would really have to answer the question for themselves.

We have had no trouble in securing raw material, and labor has not been difficult to handle. We have never tried profit sharing, and a bonus plan only to a limited extent. As our business has been quiet, especially for the last half of the year, it would be difficult to say that labor is more efficient than it was.



We should say that there should be no restrictions placed on satisfactory immigration, but care should be taken to keep out, as far as possible, undesirables of any nationality.

For a great many things, probably short distance haulage by trucks would be more satisfactory than by rail. It saves hauling to a railway and again delivery at destination, and delivery can probably be made in very much less time.

In our opinion, no factory can find out when buying will reach normal, and we should imagine it will be some time, after buying becomes normal, before factories will feel like investing very largely in new equipment.

We have an apprentice system, but have had a great deal of difficulty in getting apprentices for a number of years. This may now improve with improved conditions, but time can only tell that.

Relation of wages to production costs depends so much on the character of material produced that it is very difficult to answer this question. Even in our own lines it varies very considerably. It would appear as though the Canadian home markets at present were not sufficient to keep all industries employed. Export trade is very desirable, but it is somewhat troublesome to secure and keep. The best export trade for a new country like Canada, is to bring all the desirable people possible from abroad into Canada as settlers, you then really bring your buyers into your country where you have reasonable control of the business, instead of finding these customers in a foreign country, the markets for which you cannot control.

We believe there is no doubt but what lower transportation, both for freight and passengers, would be a very great help in reviving business.



Agricultural Implements Show Improvement

Power Machinery Has Become Considerable Factor During Last Decade—Crops Are Now Handled More Efficiently—Tractors Have Proved Their Usefulness—Credit to Canadian Industry

A GLANCE at conditions prevailing in agriculture discloses that there have been many improvements made in various kinds of implements during the last ten years; that power machinery has become a considerable factor in saving labor and that retail prices, while reaching their peak in the early part of 1921, have lowered a good deal during the latter half of the present year. Manufacturers of farm implements and harvesting machinery have found the domestic market decidedly restricted in its purchasing ability and for some time back have been either closed down temporarily or running at part time.

Many Improvements Made

There has been quite an advance made in many respects in the kind of implements manufactured and in their usefulness on the farm. As a result, grain and other crops are handled more efficiently and with less of the human element than formerly. For instance, the introduction of the tractor, the kerosene engine, the small thresher, headers, shockers, etc., are indicative of what has been done to facilitate and increase work on the soil. Laborers and farm hands have been growing rapidly less in numbers during the past fifteen years and the wages paid have accordingly gone up. Necessity has therefore urged numerous betterments in mechanical devices to make up requirements.

With regard to specific implements it may be said that binders have shown less improvement than some others. Certain equipment has been changed so that grain of all descriptions is being handled more efficiently than formerly but as a whole there has not been the marked advance in this machine as found in some of a simpler nature. Binders cutting an 8-foot swath share a larger proportion of the trade than they did ten years ago when the 7-foot machines were common. Mowers have likewise been developed in the same way. They have been made especially adaptable to take care of very difficult grass crops in the Northwest, notably Alberta and also on the marsh lands of New Brunswick and Nova Scotia.

Tractors are among the machines which have come considerably into use, the sale being quickened during the war when greater production was urged. A number of firms then engaged in manufacture here and importations from the United States were considerable. The most popular sizes were the 12-25 h.p., the 15-30 h.p. and the 8-16 h.p., the larger ones being used principally in the Northwest and on the larger farms of Eastern Canada. At the present time there is a steady but moderate sale which is expected to increase when agricultural conditions improve. Defects in make have been gradually overcome till to-day most of the tractors on the market are reliable. They have been made adaptable to belt power and many farmers use them for threshing, grinding feed, filling silos, etc., the lower h.p. in each case being the power developed as a traction machine and the higher h.p. being that from the pulley.

Along with tractors came a demand for the adaptation of many implements to be used with them. Often implements were found not to be strong enough for such purposes and consequently had to be strengthened in many parts. Thus the use of tractors had the effect of making a demand for larger capacity machines than had been used with horses. Especially was this the case in connection with drills, harrows, cultivators, plows, mowers and binders. Along with the above mentioned adaptations it was found necessary to equip all implements with self-raising or power-raising devices. This applied particularly to plows, cultivators, disc harrows and drills.

Improvements In Other Lines

Among other lines is the fertilizer drill for sowing grain and grass seed. During the past few years an attachment consisting of an additional box for holding fertilizer, so that it may be sown along with the grain, has come into play. Export business has demanded these things for many years but they are now coming into general service in Canada.

To lessen the toil of loading hay in the field onto wagons, two types of hay loaders have been fully developed. These great labor savers work efficiently. They are in use everywhere even where acreage is small.

The side rake and tedder is a combination which has also become popular. Formerly a dump rake was employed and, when occasion demanded, tedding was done by a separate machine. Now the combination machine permits separate or combined use. It has proved to be of great advantage to the farming community because of its adaptability.

Ten years ago the raising of corn was not very general in Canada, but the acreage has been increased yearly. The machinery for handling this crop has kept pace with demands. Reliable corn planters, corn cultivators and corn binders are made in sufficient numbers to meet the trade.

During late years the stiff toothed cultivator has come



Showing the Value of the Tractor on the Modern Farm.

into prominence, principally for cultivating summer fallow and for the stubble fields of the Northwest. Previously the spring tooth machine was popular. Potato diggers are other machines which have seen considerable development, as a result of constant demand for reliable implements to do this work.

Betterments in Harvest Equipment

Similarly there have been striking advances made in threshing machinery. The old threshing bee, so well known to older people, has found itself displaced in many districts by small threshing machines, suitable for the work of one large or two or three small farms. By the changed method vexatious delays, such as were often experienced under the old syndicate system, are eliminated.

Headers and shockers are among improved equipment supplies. In some parts of the Northwest, particularly in southwestern Saskatchewan and southeastern Alberta, the former has come into general service. It has been found that headers do their work economically. While their adaptation in Canada has been of comparatively recent date, they have been highly developed and widely used in other countries, notably the Argentine Republic. Shockers have not yet got out of the experimental class. Many kinds have been tried but thus far it is claimed their economic merit is rather doubtful. Many minds have been working to effect improvements and if machines of undoubted efficiency could be made their utility would be welcomed in the large wheat fields of the Northwest.

With respect to plows not much has been added to their design except that the heavier models have been adapted for use with tractors. Combustion engines, developed to run entirely with kerosene, have been a development consequent of the high price of gasoline. The gasoline engine of from 1½ to 8 h.p. which came into the place of the windmill on many farms has in turn been supplanted by the machine which will use the cheaper fuel.

Credit to Canadian Industry

During the past few years there has been developed and manufactured in considerable quantities in Canada a combined reaper-thresher. This machine not only cuts the grain, but cleans it, threshes it and puts it into bags ready for the market. In the history of the agricultural implement trade no other machine it is said has equalled this for economy in the handling of grain. It cannot be used in Canada, but is the chief implement for reaping the grain in countries where the grain can be left to ripen on the stalk, such as Australia, Argentina, Algiers, etc. Considerable quantities of these labor-saving and grain-saving machines have been exported from Canada to the countries named, where it is acknowledged that the Canadian-made implement is superior to any on the market.

The Barometer of Trade

Discussing the production and merchandising phases it is remarked that no changes in retail prices of implements in Canada were made during the early part of the war. Cost of labor and material then were low. Even after they advanced the manufacturers maintained the lower production quotations. Gradually, however, retail prices advanced year by year till 1921 saw the highest figures yet reached. Sales of Canadian-made implements were large till the low level of about a 40 per cent. business was done. High prices for the implements and low returns for all kinds of farm produce were responsible.

Notwithstanding the scarcity of labor and difficulty in getting supplies of raw materials during the last two years of the war, the output of Canadian implement factories was well sustained. Domestic trade was well taken care of and some export business was done, showing the ability of Canadian plants to meet all home trade demands with the exception of tractors. Soon these machines will be built, too, in quite sufficient numbers in our own country.

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Trend Slowly Toward Better Industrial Conditions

ACCORDING to information coming from responsible sources, trade and industrial conditions are slowly improving in Canada, Britain and the United States. The process is slow but positive. Pronouncements have been made by men of recognized standing in the Republic showing that the trend of events there is upward, though no marked evidence of improvement is looked for much before March next. In Canada the external trade records show a gratifying betterment, the balance for November being most substantial, almost enough, in fact, to wipe out the adverse balance accumulated during the spring and summer months.

Furthermore, in this connection British Government Trade Commissioner Field who within the last few days completed an extensive tour of Ontario to get facts from captains of business and industry, has reached the opinion that the worst of the depression is over and better things may be expected. Reports reaching him from Britain also indicate that broadly the industrial situation there has taken a turn for the better. Progress is slow, but it is certain. For the year coming it would seem there will be much more room for the hustling optimist than the grumpy pessimist.

Ten Years Progress in Wood Working Industry

Development Comprises Many Lines Such as Furniture, Pianos, Phonographs, Sash, Doors, Interior Woodwork for Buildings, etc. —Improvements to Machine Design and Manufacturing Methods

By W. A. MARSHALL

THE woodworking industry comprises many different lines, such as furniture, pianos, phonographs, sush, doors, interior woodwork for buildings, etc. While manufacturing processes are not exactly the same in each there is enough similarity in methods and equipment to discuss progress under a general heading. Looking back over the past ten years the most outstanding development is seen in the manufacture of phonographs.

This industry is distinctly an achievement of the decade just gone. During the last three or four years the demand for these instruments was so great that manufacturers had to check up production methods carefully to see where they could increase output. As a result many short-cuts were discovered and much new equipment installed. Today woodworking operations in the larger phonograph factories are on such an efficient basis as to be an example for other wood producing plants.

Neither has furniture manufacturing been at a standstill. There have been some new plants erected and many additions made to those existing. The manufacturers wisely formed an association six or seven years ago. Through it a great deal of progress has been made in installing efficient cost systems. It has also been helpful along other lines, through elimination of destructive competition, promotion of national advertising campaigns and in creating good-will in the trade. On the whole the industry is on a much more stable basis, and there is a better tone to it than formerly.

Advance in Many Branches

The same is true of the sash and door and interior woodworking plants, in fact of all branches of woodworking. Realizing that accurate cost records must be kept and that practical systems must be put into effect to provide these records, there have been inaugurated important changes in manufacturing methods.

First in importance, I think, comes the development of kilns for drying lumber. The immense acreages of lumber that used to surround the average plant manufacturing wood products are no more to be seen unless the owner happens to be conducting a lumber merchant's business as well, or unless he has failed to install a modern dry-kiln.

Several types of dry-kilns are on the market, all good. The feature which distinguishes them from the old type, which was really nothing more than a hotbox, is that lumber can be taken green as received from the sawmill or from the lumber company's storage yard and thoroughly seasoned for use in from ten days to two weeks. The time depends on the kind of wood, whether of a porous nature or otherwise, and the amount of moisture contained. Volumes have been written by experts on lumber drying but in a general way the modern method consists of turning live steam into the chamber containing the lumber, saturating it up to a certain point and then drawing off all of the moisture by successive degrees of heat treatment and proper air circulation.

This rapid process makes it unnecessary for the manufacturer to stock the quantity of lumber he was obliged to carry when it had to be air dried, or yard seasoned. He can better anticipate his requirements and does not have to tie up so much money.

Lumber Handling Facilities

Facilities for handling lumber after it has been unloaded from the railway cars have also been much improved. Local systems of trackage and cars have eliminated a good deal of piling and repiling that formerly involved great expense for labor. In some up-to-the-minute plants lumber is piled directly from the railway cars on to yard cars and allowed to remain there till dried. It is then rolled into the dry-kiln at one side, out the other, dry, and into the plant, not being unloaded until it is removed by the workmen at the saws to be cut up for manufacturing purposes.

In the plant proper straight line production has been greatly assisted by the introduction of electric motors. Numerous woodworking factories throughout Canada use individual drives. This type permits machines to be set in any position. This cannot be done when the power is taken from line-shafts. Straight line production is considerably harder to achieve in a woodworking plant than in the average metal making and for this reason:—stock feeds through the machine from front to back. On an iron planer the metal to be planed is secured to the bed and is planed by the heads travelling back and forth. When the job is finished the stock is removed at the point where it was put in the machine.

Advantages obtained in the placing of machines by the use of individual motor drives, either direct connected or operated with short belts, are therefore great. Builders of woodworking machinery have during recent years made commendable strides in developing the directly connected motor. Machines like moulders, double-end tenoners, continuous feed glue jointers, etc., completely motor driven are now obtainable. Some of these machines have as many as five motors direct connected to the spindles or feed mechanisms. The machines are perfectly self-contained except for the wire that transmits the "juice." They can be placed in any position desirable for continuous routing.

Ball Bearings a Feature

Ball-bearings are another feature of modern woodworking equipment. Experiments with these have been conducted over the last ten or twelve years until now the manufacturer who buys a woodworking machine equipped with ball-bearings, and they are available for a great many operations, need have no fear of getting a trouble maker. Cutters in woodworking machines must revolve at tremendous speed to do good work. That is why ball-bearings have been so widely adopted.

Take, for instance, on a shaper. The spindles on ball-bearing shapers can be, and are, run at speeds varying from seven thousand to ten thousand R.P.M. The result is almost perfect work, needing very little sandpapering to give a surface smooth enough for varnish. With the old shapers, running at comparatively slow speeds, around 3000 to 3,500 R.P.M. perfectly smooth work could not be produced. The knife marks were plainly visible and had to be removed by sandpaper. This meant hard labor and it cost money.

Another advance worth while has been made in planers. The old type planer had a cylinder carrying two knives. To produce good smooth work, which meant having the knife marks close together, the machine had to be operated at slow feed. If the operator attempted to speed up he only succeeded in producing lumber with a surface like a wash-board. Increased speed simply meant so many more knife marks per inch. With the old machine knives when dull had to be removed to be ground.

The planer of the last few years has many improvements. It has a cylinder carrying three or four knives as required. It has an electrically driven grinding attachment mounted on the machine. Then, to insure all four knives cutting accurately, the machine is provided with a jointing attachment for jointing the knives to a true cutting circle.

The I. T. S. Rubber Co., 26 Alpine Avenue, Toronto, Ont., will build an addition to its tire plant to cost about $60,000. W. Jefferies is superintendent.

Decade of Progress In U. S. Steel Industry

Capacity Has More Than Doubled in Ten Years—Prices From 1911 on Steel Bars — Plates — Black and Galvanized Sheets— Foundry Pig Iron—Coke—and Bessemer Steel Billets

By B. E. V. LUTY, Pittsburgh Correspondent of Canadian Machinery

TEN years ago the steel industry of the United States had a steel ingot producing capacity of about 26,000,000 gross tons a year. To-day it has a capacity, as commonly estimated, of about 52,500,000 tons, so that the industry has doubled, in point of tonnage, in ten years. From the earliest time up to 1908, when there was a serious backset, the pig iron production of the United States had a habit of doubling, on an average, about every ten years. Inasmuch as steel supplanted iron, becoming the dominant rolled material early in the decade of the eighteen nineties, its production increased more rapidly than by a doubling every ten years, to 1908. The prospect then was that the rate of increase thereafter would be moderate, but the war changed this.

It should be noted that while capacity for producing steel ingots and castings doubled from 1911 to 1921, pig iron capacity did not, having increased from about 28,000,000 tons to about 45,000,000 tons. The smaller proportionate increase was due chiefly to the fact that the needs of the iron foundries did not increase as rapidly as the needs of the steel works. The foregoing references are to capacity not actual production, for the entire productive capacity now existing has never been fully engaged, the highest annual outputs have been made as long ago as in 1916 in pig iron and in 1917 in steel ingots and castings.

At the beginning of 1912, ten years ago, the iron and steel industry of the United States had just begun to revive after a period of slight depression. Demand increased steadily in 1912, while prices rose until October or November. Then the brakes were set on prices by leading manufacturers, for fear of a runaway and disturbance to the market, and things ran along smoothly until late in 1913, when there occurred a decided slump in demand. There was a good volume of new construction in 1912 and 1913, equally of steel works and of plants for the fabrication and working up of steel.

GALVANIZED SHEETS

No. 28 gauge galvanized sheets, Pittsburgh; averaged from daily quotations.

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	†1920	1921
Jan	3.35	3.43	3.67	3.55	3.50	3.50	3.20	2.90	3.47	2.86	2.80	4.75	6.50	6.25	6.05	6.10	5.70
Feb.	3.42	3.45	3.75	3.55	3.40	3.50	3.20	2.86	3.50	2.95	3.09	4.80	6.75	6.25	6.05	6.90	5.45
Mar.	3.45	3.45	3.75	3.50	3.25	3.50	3.20	2.80	3.50	2.95	3.40	4.93	7.00	6.25	5.93	7.25	4.98
Apr.	3.45	3.45	3.75	3.50	3.25	3.50	3.20	2.87	3.45	2.89	3.40	5.00	7.40	6.25	5.70	7.30	4.85
May	3.40	3.45	3.75	3.50	3.15	3.50	3.20	2.94	3.40	2.79	3.60	5.00	9.00	6.25	5.70	7.60	5.00
June	3.30	3.54	3.75	3.48	3.15	3.45	3.00	2.95	3.38	2.75	4.80	4.80	9.75	6.25	5.70	7.40	4.80
July	3.25	3.55	3.75	3.43	3.15	3.30	3.00	3.01	3.31	2.75	4.65	4.40	10.50	6.25	5.70	7.90	4.10
Aug.	3.23	3.55	3.75	3.40	3.20	3.25	2.93	3.12	3.25	2.87	4.40	4.20	10.35	6.25	5.70	8.15	3.94
Sept.	3.25	3.55	3.75	3.42	3.25	3.20	2.90	3.25	3.17	2.97	3.68	4.20	9.75	6.25	5.70	8.50	3.83
Oct.	3.30	3.57	3.75	3.45	3.35	3.20	2.87	3.35	3.08	2.96	3.57	4.50	8.90	6.25	5.70	8.50	4.00
Nov.	3.33	3.65	3.75	3.50	3.44	3.18	2.84	3.40	2.98	2.88	4.07	5.34	6.37	6.25	5.70	7.30	3.92
Dec.	3.35	3.65	3.75	3.50	3.45	3.20	2.85	3.40	2.85	2.80	4.75	6.27	6.25	6.13	*5.70	5.80	4.00
Av.	3.34	3.55	3.74	3.48	3.30	3.37	3.03	3.07	3.28	2.87	3.85	4.85	8.21	6.24	5.78	7.39	4.57

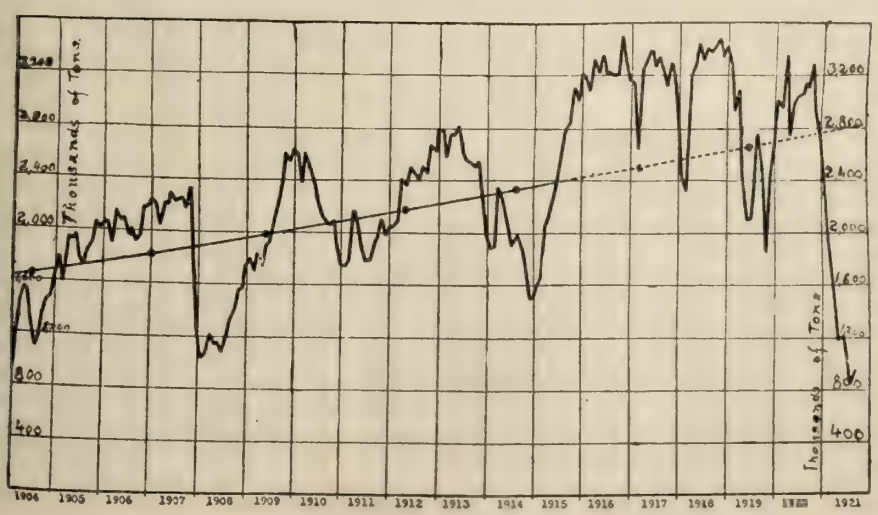
*Premiums for prompt shipment.
†Independent market; Steel Corporation price remained 5.70.

In the fore part of 1914 the steel industry of the United States was in a state of severe depression, involving producers and consumers alike. In July of that year there were definite indications that a revival of some proportions was setting in. The inception of the world war the next month plunged the industry into deeper depression. During the closing months of 1914 the question men so often ask each other, "How's business?" was replaced by the question, "How long do you think the war will last?" There was no business, so that it was not worth while to ask how it was, and the common thought was that there could be no good business during the war.

BLACK SHEETS

	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	†1920	1921
Jan.	2.30	2.37	2.60	2.50	2.45	2.40	2.20	1.90	2.32	1.86	1.80	2.60	4.50	5.00	4.70	4.60	4.35
Feb.	2.30	2.40	2.60	2.50	2.35	2.40	2.20	1.85	2.35	1.95	1.80	2.60	4.63	5.00	4.70	5.05	4.22
Mar.	2.35	2.40	2.60	2.45	2.20	2.40	2.20	1.80	2.35	1.95	1.80	2.73	4.90	5.00	4.58	5.65	3.95
April	2.40	2.40	2.60	2.45	2.20	2.40	2.20	1.85	2.35	1.90	1.80	2.89	5.88	5.00	4.35	5.70	3.90
May	2.35	2.40	2.60	2.45	2.15	2.40	2.20	1.90	2.35	1.85	1.80	2.90	6.73	5.00	4.35	5.90	4.00
June	2.25	2.48	2.60	2.45	2.15	2.35	2.00	1.90	2.29	1.81	1.76	2.90	7.50	5.00	4.35	5.75	3.86
July	2.20	2.50	2.60	2.43	2.15	2.25	2.00	1.96	2.25	1.80	1.74	2.90	8.00	5.00	4.35	6.50	3.46
Aug.	2.18	2.50	2.60	2.40	2.18	2.20	1.91	2.03	2.20	1.88	1.85	2.90	8.00	5.00	4.35	6.80	2.94
Sept.	2.20	2.50	2.60	2.40	2.21	2.15	1.90	2.12	2.12	1.98	1.91	2.91	8.00	5.00	4.35	7.00	2.83
Oct.	2.25	2.52	2.60	2.42	2.30	2.18	1.85	2.20	2.04	1.96	2.03	3.23	7.32	5.00	4.35	7.00	3.00
Nov.	2.28	2.60	2.60	2.45	2.36	2.15	1.84	2.25	1.98	1.88	2.30	3.72	5.06	5.00	*4.35	5.83	2.92
Dec.	2.30	2.60	2.60	2.45	2.40	2.18	1.85	2.25	1.85	1.83	2.53	4.40	5.00	4.82	*4.35	4.43	3.00
Ave.	2.28	2.47	2.60	2.45	2.26	2.29	2.03	2.00	2.20	1.89	1.93	3.06	6.29	4.98	4.43	5.85	3.53

*Premiums for prompt shipment.
†Independent market; Steel Corporation prices remained 4.35.



Monthly Production of Pig Iron in United States from 1904.

FOUNDRY PIG IRON, BUFFALO

No. 2X foundry, f.o.b. Buffalo furnace.

	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.	1919.	1920.	1921
January	16.25	15.25	14.25	13.62	17.25	12.51	13.00	18.00	35.00	33.50	32.25	42.17	31.25
February	16.10	15.15	13.90	13.75	16.97	12.77	13.00	18.00	35.00	33.50	32.25	44.17	30.17
March	15.60	17.00	14.25	13.75	16.54	13.13	12.49	18.52	35.56	33.50	30.78	44.25	29.01
April	15.25	16.50	14.00	14.00	15.71	13.50	12.44	19.00	39.84	33.50	28.00	46.25	27.17
May	14.75	16.00	13.80	14.00	15.33	13.32	12.92	18.90	43.08	33.50	28.00	46.25	25.40
June	14.60	15.50	13.75	14.00	14.18	12.76	12.83	18.50	46.65	33.50	27.00	46.25	22.45
July	15.00	14.75	13.63	14.11	13.76	12.75	12.58	18.50	50.64	33.50	27.81	46.25	20.68
Aug.	15.75	14.50	13.75	14.50	13.95	12.93	13.58	18.50	50.00	33.50	28.35	48.97	19.48
September	16.10	14.50	13.75	15.50	14.00	13.00	15.18	18.97	48.76	33.85	29.00	51.25	20.08
October	16.50	14.50	13.75	16.64	14.00	12.46	15.50	20.20	33.39	35.25	30.06	49.52	20.50
November	16.75	14.50	13.69	17.19	13.71	12.08	16.48	27.06	33.50	35.25	33.63	42.93	19.82
December	17.00	14.50	13.50	17.61	13.07	12.88	17.77	33.56	33.50	35.25	39.19	34.71	19.50
Average	15.80	15.55	13.84	14.89	14.87	12.84	13.98	20.63	40.41	33.97	30.53	45.23	23.69

BESSEMER STEEL BILLETS, PITTSBURGH

Averaged from daily quotations, Pittsburgh.

	1907.	1908.	1909.	1910.	1911.	1912	1913.	1914.	1915.	1916.	1917.	1918.	1919.	*1920.	1921.
Jan.	29.40	28.00	25.00	27.00	23.00	19.75	28.40	20.00	19.25	32.50	63.50	47.50	43.50	48.00	45.00
Feb.	29.50	28.00	25.00	27.00	23.00	19.50	29.00	21.00	19.25	34.00	65.00	47.50	43.50	48.00	42.00
Mar.	29.00	28.00	23.00	27.00	23.00	19.75	29.00	21.00	19.30	41.00	68.00	47.50	41.77	62.50	39.00
Apr.	30.12	28.00	23.00	26.75	23 00	20.25	27.50	20.75	19.50	45.00	75.00	47.50	38.50	65.00	37.00
May	30.30	28.00	23.00	25.85	22.92	21.00	27.00	20.00	19.50	43.00	88.00	47.50	38.50	65.00	37.00
June	20.62	25.92	23.00	25.00	21.00	21.25	26.50	19.50	20.00	42.00	95.00	47.50	38.50	65.00	35.00
July	30.00	25.00	23.50	25 00	21.00	21.50	26.50	19.50	21.40	42.50	95.00	47.50	38.50	62.50	32.00
Aug.	29.25	25.00	24.16	24.60	21.00	22.15	25.75	20.17	23.50	46.00	84.00	47.50	38.50	62.50	30.25
Sep.	29.37	25.00	25.00	24.25	20.60	23.75	24.50	20.75	25.50	47.00	70.00	47.50	38.50	60.00	30.00
Oct.	28.20	25.00	26.00	23.65	20.00	25.75	22.50	20 00	26.00	48.00	55.25	47.50	38.50	57.00	30.00
Nov.	28.00	25.00	27.15	23.25	19.00	26.75	20.50	19.25	26.20	52.75	47.50	47.50*41.00		53.00	29 00
Dec.	28.00	25.00	27.20	23.00	19.25	27.00	20.00	19.00	30.73	56.96	47.50	45.10*47.00		45.00	29.00
Av.	29.23	26.33	24.58	25.20	21.40	23.37	25.60	20.08	22.51	44.23	71.15	47.30	40.52	57.79	34.60

* Independents' market; Steel Corporation price remained 38.50 until about Sept. 1, 1920, when it became 43.50.

Ten-year, pre-war average, 1904-1913, 24.83.

that would naturally exist as long as the war lasted.

In June, 1915, the Brier Hill Steel Company, Youngstown, O., announced that it would build an additional open-hearth, furnace and the announcement was hailed as something remarkable, the resumption of steel works building. Afterwards open-hearth furnaces were built in blocks of six, eight or more. In August the trade awoke to the fact that the steel mills were practically filled with orders, and nearly everyone was surprised. These recollections are very vivid in the mind of the writer because the views then entertained seem so strange in the light of what happened afterwards.

Early in January, 1916, Chairman Gary of the United States Steel Corporation gave an interview to the press, in which he said that prices were advancing too rapidly, and gave counsel, "Stop, look and listen." Events showed that prices had only begun to advance. At that time they were just level with the prices attained in 1907, prices which had not been reached at any time since, but from that time on they almost tripled, being in July, 1917, almost three times the top prices between 1903 and 1916. Then, with the United States Government's war control impending, prices began to recede a trifle, the control, by an agreement between the War Industries Board and the manufacturers, becoming effective later in the year.

A composite finished steel, or weighted average of the important products, shapes, plates, bars, wire, pipe, sheets and tin plate, compiled by the writer gives in a nutshell a general comparison of finished steel prices in the United States, as follows:

TEN-YEAR AVERAGE

1904-1913	1.80
1913 average	1.72
Low, Dec. 31, 1914	1.42
High, July, 1917	5.80
Government Control	3.80
Industrial Board adjustment, March 21, 1919	3.25
High, 1920	3.80
Dec. 31, 1921	2.25

Thus present prices are very high.

During the latter part of the war widely divergent views were held as to the future of steel, after the war. Some expected a great period of construction activity, requiring immense quantities of steel. Others expected a period of several years of depression. Neither view was really correct. The desire to build, to expand, was present, but the circumstances were unpropitious. Costs were too high and trade was disjointed. The compromise was a period of inflation, in 1920, when business seemed to be booming but was transacted under such difficulties and at such high cost, and left so much costly material to be liquidated, that the business turned out to be not nearly as profitable as it had appeared to be. The year 1921 had to be devoted to readjustment.

It is perfectly plain, from a survey of what has occurred in recent years, and a careful consideration of what has actually been occurring in the closing months of 1921, that 1922 is going to be a year of very decided activity, taking industry and commerce as a whole. Those who do not hold this view are thinking of particular industries, which may not be as active as industry in gen-

FOUNDRY COKE

Connellsville foundry coke, per net ton f.o.b. ovens, prompt shipment.

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Jan.	2.00	2.10	4.30	2.48	2.10	3.90	10.93	7.00	6.85	7.00	6.75
Feb.	2.10	2.15	3.10	2.47	2.15	4.00	12.10	7.00	5.54	7.00	6.15
Mar.	2.15	2.50	3.15	2.46	2.13	3.85	11.90	7.00	4.75	7.00	5.63
Apr.	2.10	2.75	3.15	2.43	2.13	3.75	10.12	7.00	4.63	13.10	5.15
May	2.00	2.65	3.00	2.40	2.15	3.56	9.90	7.00	4.65	14.00	5.10
June	1.95	2.40	2.90	2.40	2.20	3.35	11.70	7.00	4.75	16.00	4.67
July	1.90	2.50	2.90	2.30	2.25	3.30	13.42	7.00	5.08	19.00	4.20
Aug.	1.90	2.45	3.00	2.30	2.28	3.30	14.25	7.00	5.64	19.15	4.20
Sept.	1.85	2.85	2.90	2.25	2.42	3.45	12.55	7.00	6.16	18.25	4.34
Oct.	1.85	3.75	2.75	2.20	2.62	5.35	7.00	7.00	6.24	17.25	4.40
Nov.	1.90	4.20	2.65	2.10	3.10	9.16	7.00	7.00	7.05	10.60	4.17
Dec.	1.95	4.50	2.60	2.05	3.50	10.35	7.00	7.00	7.28	7.75	4 .00
	1.97	2.90	3.03	2.32	2.42	4.78	10.66	7.00	5.72	13.01	4.90

STEEL PLATES

(Tank plate, Pittsburgh) Averaged from daily quotations.

	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
Jan.	1.40	1.15	1.50	1.20	1.10	1.90	3.61	3.25	3.00	3.00	2.65
Feb.	1.40	1.11	1.45	1.21	1.10	2.16	3.75	3.25	3.00	3.37	2.35
Mar.	1.40	1.11	1.45	1.18	1.15	2.53	4.33	3.25	2.88	3.50	2.10
Apr.	1.40	1.20	1.45	1.15	1.20	2.75	4.50	3.25	2.65	3.50	2.16
May	1.40	1.25	1.45	1.14	1.17	2.83	4 50	3.25	2.65	3.42	2.20
June	1.35	1.26	1.45	1.10	1.15	2.90	7.10	3.25	2.65	3.33	2.06
July	1.34	1.30	1.45	1.11	1.22	2.90	9.00	3.25	2.65	3.29	1.93
Aug.	1.30	1.37	1.44	1.18	1.26	2.94	8.96	3.25	2.65	3.25	1.84
Sept.	1.28	1.40	1.40	1.19	1.33	3.00	7.05	3.25	2.50	3.25	1.67
Oct.	1.19	1.47	1.36	1.14	1.42	3.07	3.25	3.25	2.56	3.00	1.59
Nov.	1.11	*1.50	1.29	1.09	1.63	3.33	3.25	3.25	2.65	2.83	1.51
Dec.	1.13	*1.50	1.20	1.05	1.75	3.53	3.25	3.10	2.65	2.65	1.50
Av.	1.31	1.30	1.41	1.14	1.29	2.82	5.21	3.24	2.71	3.20	2.05

STEEL BARS

(Base price, Pittsburgh) Averaged from daily quotations.

	1911	1912	1913	1914	1915	1916	1917	1918	1919	†1920	1921
Jan. ..	1.40	1.15	1.40	1.20	1.10	1.87	3.00	2.90	2.70	2.65	2.35
Feb. ..	1.40	1.11	1.40	1.22	1.10	2.06	3.00	2.90	2.70	2.98	2.13
Mar. ..	1.40	1.10	1.40	1.20	1.15	2.36	3.27	2.90	2.58	3.33	2.00
Apr. ..	1.40	1.15	1.40	1.15	1.20	2.50	3.39	2.90	2.35	3.33	2.06
May ..	1.37	1.20	1.40	1.14	1.20	2.50	3.64	2.90	2.35	3.10	2.10
June ..	1.25	1.21	1.40	1.12	1.20	2.50	4.00	2.90	2.35	3.02	2.08
July ..	1.24	1.25	1.40	1.12	1.27	2.50	4.50	2.90	2.35	3.02	1.88
Aug. ..	1.20	1.30	1.40	1.18	1.30	2.56	4.50	2.90	2.35	3.12	1.75
Sept. ..	1.18	1.31	1.40	1.19	1.35	2.60	3.88	2.90	2.35	3.11	1.67
Oct. ..	1.13	1.39	1.39	1.15	1.43	2.62	2.90	2.90	2.35	3.00	1.60
Nov. ..	1.07	*1.40	1.30	1.11	1.63	2.76	2.90	2.90	*2.35	2.90	1.56
Dec. ..	1.12	*1.40	1.22	1.05	*1.75	2.93	2.90	2.78	*2.35	2.35	1.56
Av. . .	1.26	1.25	1.38	1.15	1.31	2.48	3.49	2.89	2.43	2.99	

eral, or are thinking in terms of large profits, when profits are likely to be relatively small, and gained with difficulty, by hard work and the use of the most modern and efficient appliances and methods.

When in August and September of 1921, the talk about "unemployment" was at its height, it turned out that the proportion of men unemployed was not so large after all, while those who were in employment were working much harder, individually, than in 1920. The physical volume of business in the United States was large. Throughout 1921 the volume of "bank debits" (debits to individual accounts at banks) showed a lag of only 15 to 20 per cent. below those of 1920, whereas the declines in prices and reductions in wages and salaries would account for a larger decrease than that. This may seem strange, crease than that. This may seem strange, but the figures are indubitable. The activity was of quite a different sort.

It is one thing to expect full industrial activity in the United States in general, and another thing to expect full employment for the entire steel producing capacity. The census report shows that the number of persons gainfully employed in the United States increased by 9 per cent. from 1910 to 1920. The steel producing capacity has doubled since 1910. Evidently there is a chance for everybody to be at work without the entire steel making industry being fully employed. The machine shops, agricultural implement factories, railroads, automoblie shops, sheet metal shops and the like can all be busy without the steel making industry being fully employed.

Worst is Over in Engineering Industry—Slow Recovery Made

IT IS NOW more or less generally felt that for the engineering industries, as for some of the others, the worst of the depression is over and a slow recovery is being made. In several sections of the industry orders are now coming in more freely, and although it is true that considerable unemployment still exists, various factors, such as the easier financial position, the reduction in prices that has taken place over the last few months, and the extension of the Exports Credit Scheme, are likely to increase the feeling of restrained optimism which now exists. Prices are firm, and in most coses no further fall is experted. On the contrary, as quotations have in some cases been made somewhat below cost, a slightly improved tone in the market is likely to lead to a hardening of prices to a slightly higher basis than at present; buyers are, therefore, urged not to delay the further placing of their orders for machinery and engineering products." This statement was made to Canadian Machinery by F. W. Field, H. M. Trade Commissioner, Department of Oversea's Trade at Toronto.

"Another factor tending to have the same effect," continued Mr. Field, "is the progressive increase in the price of Continental materials and the undoubted increases which will take place in the future. The order books of Continental firms are now approaching completion, and sellers as well as buyers are unwilling to accept distant deiveries with the prospect of increase in cost before delivery is effected. On the best authority, therefore, it would appear that no advantage can be anticipated by the further withholding of orders.

"Orders are specially anticipated in the next few months, in connection with the further recovery of industry, in all parts of the world. In case, the following industrial plant is likely to be wanted on a larger scale than hitherto:—Steam engines, pumps, machine tools, woodworking machinery, coffee machinery, rice machinery, mining machinery, transporting machinery, agricultural machinery, textile machinery, rubber machinery, oil extraction plant and other produce treating machinery.

"These trades have, of course, suffered worst during the depression, not because the goods were not wanted, but because, generally spaking, the buyers could not offer to pay quickly for their goods. The interval has been utilized by the manufacturers to develop their methods and their products, so that the buyers, who are now coming along, will have improved materials, even though the prices in their own currency may seem large.

As an instance, the question of coffee machinery was recently considered. Owing to the over production of coffee and the difficulty of placing it on the market it was impossible during 1921 to sell coffee machinery in any large quantities. At the same time, a number of would-be purchasers overseas sent particulars of alleged improvements on the Britih manufactures, and comparison of British designs with the best foreign competitive lines were made. In many cases it was found that the overseas product, where not merely a copy of the British machine, had differences which could not be called improvements, as in most cases they had already been tried and rejected by British manufacturers. The continuous improvement, which normally takes place in connection with the industry of coffee-making machinery, has undoubtedly been quickened through the depression, and this recent survey has been most convincing in showing that British coffee machinery has nothing to fear by comparison with the products of other countries.

Canadian external trade for the month of November showed a continued trend toward favorable totals. The balance in favor of exports was indeed substantial, almost sufficient, in fact, to wipe out the adverse balance which was piled up in the spring and summer. For the month mentioned imports reached a value of $64,271,434 and exports $86,533,862 as compared with imports of $98,671,116 and exports of $147,508,002 in November 1920. For the eight months ending November 1921, imports were $502,521,047 and exports were $502,152,675.

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Condensed Lap Joint Table: 1 I; p. 35; Sept. 22 1921.
Welding of a Caulking Edge on a Boiler or Tank: 1 I; p. 36; Sept. 22, 1921.
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Some of the Possibilities of Welding: A. M. Bar-ry; p. 25; Dec. 15, 1921

The Year 1921 Has Been Great Clean-Up Period

Manufacturers, Wholesalers and Dealers End the Year With Clean Stocks—Trade Will Reflect Consumer Demand and Consumer Demand Somewhat Depends on World Conditions—An Altered Buying Policy

By E. DEWITT HUTT, Editor Dry Goods Review and Men's Wear Review

BUSINESS records will probably show that the year 1921 was the great "clean-up" year for manufacturers and dealers in men's wear and dry goods lines. No matter what the year 1922 may have to write on its unrevealed pages of history, it can safely be assumed that it starts out with clean stocks—generally speaking—and that the volume of business will be quickly reflected in the trading that goes on between the dealer and manufacturer or wholesaler as the case may be. Conditions that are world-wide rather than strictly Canadian in their aspect will, in a large measure, govern the consumer demand during 1922. We are no longer an isolated people, self-contained and self-containing; we are an integral part of the comity of nations. It makes a difference, after all, whether the volume of the world's business seeks its ordinary channels, or whether its progress is interfered with by revolution here and there, unstable conditions somewhere else, and hardship and even stark famine in another quarter of the globe. The world's business to-day is so international and inter-dependent that the buying power of the average Canadian consumer is, in a measure, governed thereby. Some of our basic products, such as wheat, are price-fixed by world markets. The cost of producing wheat in Alberta or Saskatchewan or Manitoba has little or nothing to do with the price of wheat in Winnipeg; wheat is a world commodity and its price a world price. And the price received by the western farmer for his wheat is the dominating factor in his buying power, and the buying power of the west is, in turn, a dominating factor in the progress of Canadian business. In taking a peep, therefore, into the year upon which we are soon to enter it is well to bear this in mind. It is not mere foolish patriotism and claptrap to say that Canada, at this time, is the most favored country in the world. We believe it to be literally true; the statement can be verified by every returning traveler from any country in the world. At the same time, let us not forget that normal times in this country depend upon normal times in many other countries. If there is any consolation ever in the fact that one's neighbor is worse off than one's self, then Canada has abundant cause for consolation and can pass into the year 1922 with a light and confident step.

January 1921

January, 1921, commenced for the men's wear and dry goods dealer, with heavy stocks, a considerable proportion of which was high-priced merchandise. A good deal of apprehension prevailed in many quarters. A very trying time had just been passed through on account of the luxury tax which had been removed only a few days before Christmas Day of 1920. The baneful effects of this tax were still casting a shadow over the in-coming year. The public, urged on by a superficial press, were demanding lower prices, lower than were justified, having regard to a safe and sane readjustment.

Decline on Its Way

By this time, however, the decline was well on its way so far as its certainty was concerned. World conditions established the fact that it had to come. Over-burdened countries that had engaged in the war were already incapable of entering the world's markets for their legitimate requirements, and the succeeding twelve months have not alleviated their condition in this respect. Many of the leading Canadian wholesale and retail firms had already taken heavy losses on their merchandise and were straightway operating on a replacement value basis. But it is safe to say that the great bulk of the retail trade did not start to cut on their merchandise till January 1921. It was but natural that the trade "get from under" with as little loss as possible; and who shall say that it has not been better for the financial stability of this country that the decline has spread over a considerable period and that the shock has been absorbed rather than taken all at once? The records go to show that the number of failures has been much smaller than was expected in the early part of the year.

The Clean-up Begins

Speaking for the bulk of the trade, the great clean-up began in January of the year now drawing to a close. Sales were the order of the day from coast to coast and radical price-cutting was seen in many quarters. An altered buying policy was very noticeable; in fact, there had been evidences of this even before the turn of the year. Some of the most progressive houses began operating on a thirty days' basis; others on a sixty. The agitation for a four-season buying policy was swallowed up in practice—dealers began to buy not four times a year but some of them as often a month. The "hand to mouth" policy has now become pretty well an established policy with most buyers; in some cases, it might be pointed out, to the detriment and loss of prestige of their own house. Sales have been lost because commitments have not been made on certain lines of merchandise that have reached a fairly stable basis. It is safe to assume, however, that a careful buying policy will be followed for many months yet.

Stocks Now Clean

There is a unanimity of opinion from many quarters now that stocks all over the country are well cleaned up. The Financial Post recently sent out a questionnaire to hundreds of bank managers all over the country asking them about the conditions of stocks in their respective communities. Their answers have all been to the same end—that stocks are clean. Not a few managers state that these stocks are lower than they have been in many years. Our actual contact with retailers all over the country confirms this unanimous opinion of bank managers. The number of small orders that keep pouring into wholesale houses week after week from all sections of the country is a clear indication of the condition of stocks. It appears to us that this is a hopeful omen for the coming year's business. Whereas January, 1921, began with heavy stocks and the grim necessity of liquidating them on a declining market with consequent losses, January, 1922, will begin with clean stocks and fairly stable markets, and a chance to merchandise stocks with fair profits in sight.

THE MATHEWS CAR UNLOADER

The Mathews Gravity Co., Port Hope, have marketed a car unloader, the latest addition to their line of conveying equipment. The new machine is of solid steel construction throughout, and special consideration has been given to the importance of absolute rigidity, balance and portability, protection of bearing and bushings from coal dust, sturdy adaptability to speed under hard usage, and general fool proofness. It is built in two sizes, one having a length of 17 ft., 6 ins., 12 in. rubber carrying belt, and the other 20 feet with 16 inches rubber belt. A two horsepower electric motor is used, or where preferable a gasoline engine may be adapted. The wheels are 48 inches. Tests of the unloader in actual use have shown very satisfactory service.

Credit is a Vital Force in Modern Business

Credit A Vital Force in Business Transactions—What Would Happen Were Credit to Stop — Where and How is Credit Data Obtained—Commercial and Trade Agencies as a Reliable Source

By WILFRED G. ASTLE

CREDIT is a most vital force in all modern business transactions. It has grown to such an extent that practically all business transactions are done by credit. People of the country are conducting their business almost upon faith as to the solvency and belief in the integrity and honesty of the individuals or corporations with whom they are dealing. This goes to prove that credit, from the standpoint of successful business management, is a subject of tremendous importance.

The word credit comes from "credo" and every transaction performed by credit involves the belief on the part of one man in the integrity and character of another man. What is credit anyway? It is one of the biggest forces in the modern business world. It consists of all the stocks and bonds dealt in on the world's stock exchanges; all the world's huge national and state debts; all the tremendous international trade balances, one way or another; all the bills and accounts receivable on all the ledgers in the world; and very nearly all of what is called money in the world. All these things are only different forms and expressions of that wonderful thing which we call "Credit." It will start enterprises, build railroads, make civilization, wage wars, and do all sorts of things.

Suppose for a moment that all credit was stopped and suddenly removed from the modern business world. What do you think would be the result? Any attempt to do such a thing would instantly result in chaos. All the gigantic wheels of the world's commerce would instantly come to an absolute standstill; indescribable misery would suddenly seize upon the entire civilized world, and man would rapidly lapse into a state of barbarism. Think on these things. What would we do without railways, electricity, the printing press, and all the other numerous things? The loss of these things, much as we need them, would be nothing compared with the loss of credit. All the gold in the world would not be enough to settle the daily clearings of business.

The Credit Department of a Business

The credit department in a modern business organization must have three essentials. The first of these is the obtaining of reliable credit data concerning every customer on the books of the concern and all who are likely to become customers. Second, this information must be filed and recorded in such a manner that it will be on hand when it is needed. The third requires that the credit manager use this information intelligently when passing on a credit risk.

Where, and how, is the credit data obtained? There are quite a number of sources. For instances, you can secure this information from commercial and trade agencies; Dun's and Bradstreet's rating books; exchange information with other creditors; from your own salesmen; from statements submitted by customers; credit leagues and trade associations; newspaper items and general rumors, and from your own books—records of previous experience.

A prominent banker, speaking before a recent meeting of the National Association of Credit Men, gave two reasons why requests for credit information addressed to banks do not bring forth more satisfactory response. First, they were not properly made out, and second, that the source of information is sometimes betrayed. If the credit manager will ask any modern bank, telling them exactly what he wants, why he wants it, and give some reasonable basis on which to work the bank will make every effort to secure it for him. It is better to give your request to one bank and trust it to supply the information. What the bank fears most of all, is the failure of some concerns to observe the sanctity of credit information. This betrayal of information and its source has caused bankers to adopt the most trustworthy method of safeguarding it, and that is, closing the channels to a man who abuses its sanctity.

Commercial and Trade Agencies as a Reliable Source

The use of commercial and trade agencies as sources of credit information, is very reliable, and is increasing. Their usefulness and efficiency, however, depends largely upon the co-operation of the business men, because they are built upon the findings of investigators and the information furnished by credit departments. These agencies are exceptionally well qualified to obtain information which is of great service to their subscribers and which is not readily available from any other source The antecedents of an individual, co-partners or officers of a corporation can be gone into very thoroughly by investigators of the agencies to bring out especially what had been the previous records, commercial or otherwise, of the people reported upon. and how they were regarded for fairness and integrity. The value of this source of information demands of each participant absolute fairness and readiness to furnish any information that may legitimately be asked for. To be successful it must have the wholehearted co-operation of all.

"Exchanging credit information with other creditors," says the 'Business Progress Bulletin,' "has proved of such value that to-day the majority of credit men consider it the best means of securing information about present and prospective customers."

"The time is past when business men have felt that, in furnishing a competitor with this information, they were exposing business secrets and that the mention of the customers name meant the possible loss of an account. The standard of commercial ethics has been considerably raised during the past generation and to-day sources of credit information as well as the facts furnished are considered sacred. This condition has made a modern man realize that, in exchanging experiences with his competitor, he receives far more than he gives. It is mistake for any credit man to expect to receive credit information without making a definite statement of his own experience with the person inquired about when he makes his initial request."

The bulletin further states that "there are two ways of acquiring the name and address of other concerns selling a particular customer, if you are not a member of a credit interchange bureau. The first is from the list of references furnished by the customer himself; the second from the list of sellers secured by the salesman after hastily surveying the stock on the shelves of the prospect. The first method if unsupported by other information is probably the weakest foundation upon which to establish a credit foundation. But the fact that this is true does not reflect unfavorably upon the buyer or seller referred to. It is due, however, to the fact that unless the merchant maintains a reasonably satisfactory credit relation with some sources of supply he cannot stay in business and it is perfectly natural for him to furnish as references those houses with whom his credit dealings bear the closest scrutiny. The second method is a far better source of information, but it is limited to those classes of goods which are easily identified. Furthermore, there is apt to be difficuty in ascertaining whether they were purchased direct from the manufacturer or through a wholesaler or jobber."

The Credit Interchange Bureau

The Credit Interchange Bureau, fostered by the National Association of Credit Men, has great possibilities for getting credit information. It is not intended to be a substitute for the services rendered by the mercantile agencies which are useful in supplying information as shown in a previous section of this article, but among the ad-

vantages of the bureau are the following:—

Information concerning accounts which have been discontinued or have been paid when due.

It gives a knowledge of all merchants who are overbuying or buying through new channels.

You do not have to ask a customer for references, but you secure the experience of others and preferred references.

The source of information is confidential. Members make reports on customers and are known by number and not by name.

By using this service you can eliminate all undesirable customers.

All information is taken from live ledger accounts, therefore, it is dependable and reliable.

Factors of Credit

Leading authorities on the subject of credit place the factors which determine the credit risk in two classes. The man himself and the business. Under the first heading is considered the business morals of the debtor and his ability in, and familiarity with, the business in which he is engaged. The second heading—the business—is considered from the financial standpoint, divided as to assets and liabilities, and the profits or losses made in its operation.

As to the relative importance of these two factors—the man and the business—the authorities differ. Mr. E. St. Elmo Lewis, in his book on credits, takes the stand that the man—his character—should be considered secondary, and says:—

"If goods are the basis of all credit, character of the owner is and should be an after consideration. The very first question any credit man should ask, is, can he pay? The question of a man's ability to pay is becoming of greater ease of solution. The question of the intention or inclination to pay must always be shrouded in the nebulae of psychological theory. What is the applicant worth? is the crucial test. Then we shall test him by another. What sort of a man is he? Do we buy a law suit when we sell him goods? How much must we add for moral insurance against loss? Character is of vital importance in small concerns; of vital importance in concerns doing a large business on small capital, and it becomes of less importance as we progress into the field of corporations."

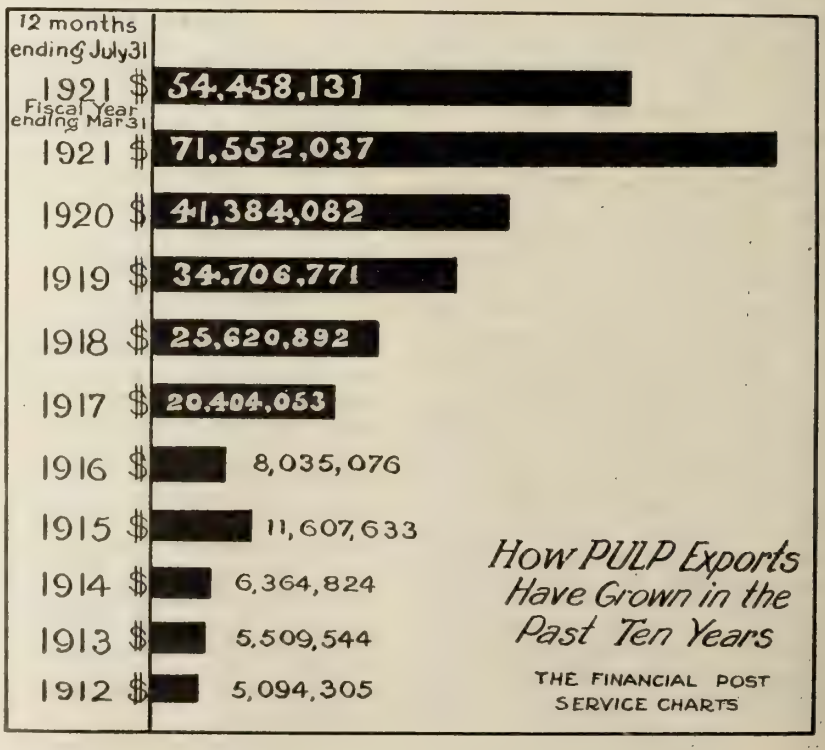
In direct contrast to the above contention are the views of Ernest Reckitt, as expressed in an address delivered before an organization of bank clerks. After naming the factors to be considered by the banker extending credit, he said:—"You will note that in enumerating these factors I place first, and purposely so, 'The Man Himself,' and I believe I am correct in stating that bankers are now placing more stress upon this point than ever before. The man of good character and intelligence, who is full of energy and perseverance, will not find it difficult to obtain a reasonable line of credit with his bankers, while the man who is deficient in these qualities, whatever his reputed wealth may be, will be looked upon with suspicion. It therefore behooves you to become students of human character as well as students of banking, if you are to fill the highest positions within your reach."

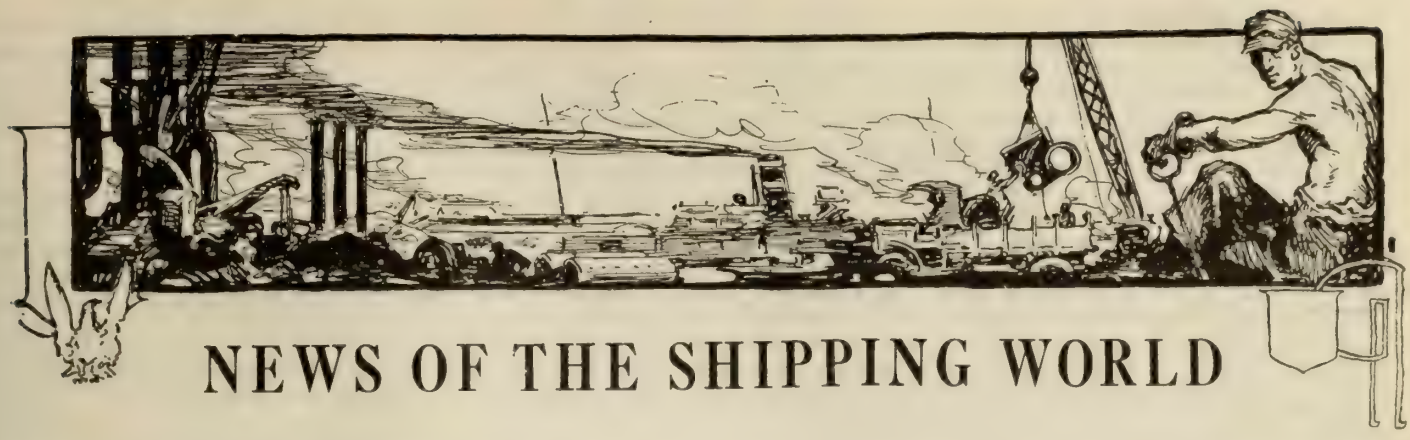
Without attempting to decide the relative importance of these factors, it can safely be stated that one of the first steps to be taken by the credit manager is to secure a financial statement from the applicant. The character of the statement might serve as a guide in determining the character of the man with which he has to deal. Never look a a debtor's quick assets and contrast them with his debts without looking very carefully at his character and qualifications for success. Make the debtor know and feel that honesty, integrity, industry, and good habits are part of his capital and strengthen his chances for credits, just as the reverse of these characteristics would injure his credit.

Credit is based upon confidence. This makes it necessary for all credit managers to constantly seek for reasons upon which to base this confidence. His strength is in his knowledge. He is the final conservator of the business. Others may be profit-makers, but the credit manager is the profit-saver in every commercial organization. The test of his success is measured by the average annual losses, the accounts receivable measured by the average number of days' sales contained in them; the average percentage of discounts, based upon receipts, and the general office expenses, if he has the management of the office in charge.

The credit manager needs three distinct characteristics in dealing with purely credit functions. First, a wide and general knowledge of business methods and business conditions, second, a keen insight and analytical mind. Third, tact in its broadest possible sense. The best credit manager is the one who will approve the largest percentage of orders and still keep his percentages of loss down to a fair average. One man might refuse half the orders which come to his house, while another would accept ninety per cent. of them, and both show the same percentage of loss. Who would be the best man? The ninety per cent. man, of course, because he certainly would be the more valuable man. A good first-class credit manager is an aid to the salesman. He does not try to find a good reason to decline an order. He always takes the opposite view and exhausts every resource at his command before rejecting an order. His duty is to be constantly on his guard. Always on the lookout for the slightest sign of danger. Always ready to take prompt and vigorous action to avert disaster to his concern, or to lend a helping hand to a customer.

English shoe manufacturers are said to be preparing to make sport shoes with raw-rubber soles, since it was discovered by tennis players on Far Eastern rubber plantations that the crepe or raw-rubber soles, lasted longer than those of the vulcanized variety, and were much more pliable. Rubber soles as commonly seen on different kinds of footwear, have usually undergone the vulcanizing process. It is thought that the new soles can be made to sell as cheap as the vulcanized article, even though made of pure rubber.





NEWS OF THE SHIPPING WORLD

THE LATE Glen liner "Glenapp" has now been completed after considerable alterations for her new owners, the Elder Dempster Line. From being a motor cargo vessel, she has been converted to the first motor passenger liner not only of the Elder Dempster fleet, but of any other. She has accommodation for 225 first and 140 second and third class passengers, and the saloons, cabins and staterooms are comfortable in the extreme. The West African trade is one of those where the same passengers to a large extent are carried a good many times in the course of a few years, and the average west coaster is an individual who appreciates all the comfort he can get. The exigencies of the climate force the residents to make frequent trips home for rest and recuperation, and they develop very strong likes and dislikes for particular ships and the personnel of those ships. The converted vessel has been christened the "Aba," a name well-known in the West African line, and she is expected to achieve a considerable amount of popularity among travellers between England and the coast. There is also an extensive trade at certain times of the year between Liverpool and Las Palmas, and Madeira, which are calling ports for the West African liners on their way out and home, and the people using the Elder Dempster line for this trip look for a high standard of comfort. This it has been the aim of the new owners to furnish.

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IT IS UNDERSTOOD that the United States Shipping Board, through their representative, Mr. Love, and Sir Ernest Raeburn, acting for the British lines, have reached an agreement in the controversy over the carriage of Egyptian cotton. The agreement has not yet been ratified at the time of writing this, but there is every probability that principals will ratify the agreement reached by the negotiators. Sir Frederick Lewis, speaking at the annual meeting of the Prince Line, alluded to the competition of the U. S. Shipping Board fleet, and recognized it as a competitor, but was not disposed to either belittle or magnify its possibilities. He saw no reason with goodwill and breadth of vision on both sides why the competition could not be carried on with fairness to both.

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THE VIEW of the shipping situation held by certain people in Germany it well illustrated by the following extract from a German newspaper, reprinted in "Syren and Shipping," London. It shows that the feelings of at least some of the German people are not those of resignation or repentance. The passage quoted is as follows: "The industrial expansion of Germany constituted in the eyes of our chief and most envious rival, namely England, a just cause for making war upon us, our enemy's object being to render German industry, and especially German ocean shipping, incapable of further competition. It was this envy that was the whole motive and driving force of the war. This is a fact which is emphasized in every line of the disgraceful peace treaty of Versailles and of the London ultimatum. But, badly hit though German shipping has been through the war that was forced upon us, it has not been destroyed, nor has German shipbuilding either. Already the ships of which we have been robbed are being bought back by German shipowners; new ships are on the stocks in German yards; they are rapidly being launched and plough the waves under the black, red and white flag. In England consternation reigns at this, but they are facts which England will have to face as best she may and the conditions which we are creating she will have to tolerate and adapt herself to, unless the execution of the London ultimatum should really attain its end, the industrial annihilation of Germany. In that case, however, not we, but the whole world will have lost the war." The "Syren and Shipping" merely offers to this the comment that the "consternation" which reigns in Britain will not interfere with British commerce and shipping. The Germans may build what they choose; we shall build what we need.

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AS AMONG men, so among ships, there are some that never seem to fit into the occupations in which they find themselves engaged. A curious case is reported in the shipping press of the steamer "Macedonia." This vessel has just been sold to French owners by the Holland General Atlantic Steam Navigation, a Rotterdam company. Her history is a peculiar one. Shortly after being built, she was sold to Greek owners to act as an emigrant ship, but the first Balkan war coming along soon after, she was sunk by gun fire, and her career as an emigrant ship cut short. She was raised in 1917, and taken to Rotterdam, where she was repaired and altered to make her into a pure cargo carrier. After this was done she was bought by a Dutch company for 3,000,000 florins. Instead of going into service, however, she remained laid up in Rotterdam for about two years until after the Armistice. At this time she was pressed into service to convoy French refugees from Rotterdam to Havre, and this necessitated her again being converted into a passenger ship. After finishing this little job, she was converted back into a cargo carrier, and this was hardly completed, when she was again converted, this time into a floating exhibition ship. These various conversions were represented by a mortgage of more than a million florins, but in spite of all these vicissitudes she is again to undergo a further conversion to make her suitable to her new owners.

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THE QUESTION of the eight-hour day at sea was brought up in the British House of Commons recently when Dr. McNamara asked the House to approve the action of the Government respecting the Draft Conventions and Recommendations adopted by the International Labor Conference held at Genoa last year. It will be remembered that one of these resolutions or recommendations had to do with the adoption of an eight-hour day for those employed on ships at sea, and that the British delegates accepted this as a standard to be aimed at, but were not able to agree to its immediate application. Before any such recommendation could become of any effect, it would, of course, have to be put in the form of legislation, which would take the form of an amendment to the Merchant Shipping Act. We fail to see how any such thing as an eight-hour day at sea could ever become a practical possibility, and furthermore what good would it do anyone that came under its effects, except in the way of increasing their pay by means of overtime? In ships of ordinary ocean-going type there is, for a large part

of the crew, what practically amounts to an eight-hour day, that is two watches of four hours, with intervals of eight hours between them. In the case of the firemen, where there is no ash ejector installed, it is necessary for the firemen to work a certain period of their watch below in handling the ashes, while the engineers, who are also supposed to work on the four on and eight off principle, usually find a job that requires doing in the time supposed to be off. Sailors usually work on a four on and four off basis, except a certain percentage known as idlers, who are on day work. They work usually about nine hours a day, which is no hardship. A man aboard a ship with too much leisure time on his hands is in a bad way and usually doesn't know what to do with the idle hours. He is liable to develop into a sea lawyer. From our own knowledge, derived from a number of years spent at sea, we cannot see where anybody is going to be benefited by such an arrangement, whereas on the other hand we can see where a lot of harm could be done to the shipping industry.

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LLOYD'S Annual Report for the year 1920-1921 has now been issued, and as usual contains a number of very interesting facts. Attention is called to the number of vessels fitted to burn oil fuel, the tonnage represented having increased from 1,310,209 in July, 1914, to 12,796,635 in July, 1921. The consumption of coal that would be necessary for these vessels if they were still coal burning, would represent 20,000,000, tons per annum or 8.7 per cent of the quantity of coal brought to the surface in the United Kingdom in 1920. The report also gives some chronological facts bearing on the use of oil fuel. Thus the first vessel fitted with an apparatus for burning heavy oil derived from shale was the "Himalaya" and an experimental voyage was made from London to Granton and back, the oil being carried in barrels on deck. The next instance recorded was that of the "Ani", and also of the "Sevan" which in 1886 were fitted to burn oil, the fuel being carried in the bunkers. Again in 1887 the "Charles Howard" was fitted with oil carried in bunkers, the result in this case also being a failure. It was not until 1892 that a vessel was successfully adapted to burning oil fuel regularly at sea, and in this year the "Bakuin" was so fitted, and continued in regular service with oil fuel. Dealing with the adoption of internal combustion engines the following interesting figures are given. In July 1914 the number of vessels classed as motor vessels was 297 of 234,287 gross tons while in July 1921 the number had increased to 1473, with a gross tonnage of 1,348,800. Of these vessels over 287 are of 100 gross tons and over, while of those of less than 1,000 gross tons, more than half depend entirely on their motors for motive power. It is noteworthy that with the exception of three steamers all those built in the United States during the year covered were fitted for oil fuel burning.

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COMMENCING December 3rd the Furness Withy Company have inaugurated a service from London, Leith and Swansea to Northern Pacific United States and Canadian ports. The first sailing is that of the "Mongolian Prince," and her cargo will consist of tinplate, the first instalment of 150,000 boxes comprising 25,000 tons. This order has been secured in competition with American firms by the Welsh tin plate makers. The return cargo will doubtless consist of the tinned goods which the tinplate furnishes containers for. The next sailing is advertised from London on December 23rd by the "Eastern Prince."

The trend of ship prices may be gathered from an auction sale held recently at the Baltic Mercantile Exchange in London by Messrs. C. W. Kellock and Company, at which three steamers, the "Madame Beatley," "Madame Lunid" and "Madame Midas" were sold. The "Madame Beatley," a steamer of 1131 tons built at Port Glasgow in 1907, with a deadweight capacity of 1720 tons, was sold to British buyers for £10,275 or about £6 per ton. The "Madame Lundi," with a deadweight of 330 tons, built in 1917, was sold to British buyers for £4,600 or about £14 per ton, while the "Madame Midas" built at Port Glasgow in 1904, carrying a deadweight of 3624 tons, was sold to Greek buyers for £11,350, or a little over £3 per ton.

POST WAR developments in the French merchant marine fleet have been against the retention of the fleet as a Government owned entity. The fleet has been sold, but under an arrangement which is beneficial to the Government and the purchasers. The French mercantile marine are the purchasers, by which is meant the whole of the companies carrying on shipowning, and these are represented by a committee. The terms of purchase allow of a long period over which payment can be spread, and in the interval the Government retains ownership. While they still have title to the ships, all maintenance costs, etc., are borne by the purchasers. The value of the ships was fixed by a firm of British experts, and was deemed satisfactory to both parties. There is an arrangement by which if the price of ships rises at the end of five years, the Government will get the benefit of the difference between the present selling price and the later one.

Fire Alarm Operated by Smoke

A new type of fire alarm has been invented in England. This device depends upon its action on the presence of smoke and is not affected by temperature changes which usually are the chief factors in the operation of most first alarms. The smoke detector, as it is termed, consists of a metal cylinder about 8 in. long and 2 in. in diameter, open at each end, so that air can circulate freely through it, and containing two rectangular metallic capsules, one of which is considerably larger than the other. The detector, only one of which is required for each apartment to be protected, is fixed in a high central position, to which the smoke on the capsules is to cause one to bend more than the other. The differential movement is employed to complete an electrical circuit through a relay, and, by means of the latter, a large electric bell or other alarm signal may be operated. The apparatus, says Scientific American, can be used either independently or in conjunction with detectors depending on temperature effects, but it is said to have the advantage over the latter, that its action is more rapid and reliable. In many fires dense smoke would be produced before any material rise in temperature occurred, and, moreover, the smoke would rapidly fill the whole apartment while the temperature rise would remain purely local for some little time.

Cement of Unusual Properties

Among other things which were put to special uses during the war was a cement of unusual properties which was applied by the French. Its high technical value in certain limited fields is worthy of attention. It is described by E. C. Eckel in Engineering News Record as being a lime aluminate, differing from normal portland cement in having an almost total absence of silica. It is prepared by actual fusion, not by mere clinkering; is almost white in color; and will harden with such rapidity as to make a good heavy-gun platform within 24 hours. So far as cost of manufacturing is concerned, the fused cement can obviously be made at least as cheaply as a normal portland. Its uses will be determined then, not by cost, but by its special characteristics, which give it value in certain fields of work, but limit its use in other lines. Considering the composition of the fused cement, its most remarable property, perhaps, is its resistance to the decomposing effects of sea-water and similar solutions, for until this Lafarge cement was introduced there was a tendency to ascribe the breaking up of portland cement in sea-water to its content of alumina, and to search for cements low in alumina.

Recent reports indicate that true mastodons made their appearance in North America at a much earlier period than the public has heretofore been led to believe. One found in Nevada is said to date back their existence to the Middle Miocene. Prior to this the earliest finding went back only to the Middle Pliocene.

The Selection of Steels For Automobiles

Successful Automobile Construction Calls For Proper Selection of Materials—Steel Used Depends Largely Upon Design Adopted —Ductility As Well As Elastic Limit Must Be Considered

*By W. E. JOMINY

ONE of the fundamentals of successful automobile construction lies in the proper selection of materials. However good the design may be otherwise, failure often results through the improper selection of materials by the designer. The selection of steels for automobiles therefore, will be considered. Questions of fabrication and design will be considered only as they affect this. The subject has been divided into two main parts. The first is a consideration of the various factors governing the proper selection of a steel for a given part. The second part is a discussion of the steels most commonly used in present day practice, giving the relative merits of each.

The kind of steel used in any automobile part depends largely upon its design. Lightness, distribution of metal, rigidity, ample radii at corners, tendency toward warping, all of which are embraced in the design of a part, largely control the steel which shall be chosen for the part. For example, most manufacturers use a high grade alloy steel for the rear axle shafts, yet there is a prominent maker of a medium grade automobile who uses ordinary open-hearth plain carbon steel for this part. Again there is a well known low-priced car, which has heat treated alloy steel connecting rods, while most manufacturers use heat treated plain carbon steel and one high grade manufacturer uses annealed plain carbon steel for his connecting rods. Obviously there is a great difference in the physical properties developed in these steels, but in any of the cases just mentioned, it is unlikely that the wrong material has been chosen. The differences in materials are largely the result of the different designs. There are a great many other considerations besides design in selecting the proper steel for a given part, but it is necessary first to know approximately what physical properties are required before any intelligent selection can be made. There are relatively few automobile parts in which the stresses can be figured accurately, but in many cases an approximate figure can be obtained. The required ductility for any part cannot be figured in any way, and for this reason there is much conjecture about this property, which is equally as important as the elastic limit of the steel.

Importance of Ductility

Many engineers pay little attention to the ductility required in any given part, and investigate only the elastic limit required. It should be emphasized that the ductility of a steel is equally as important a property as its elastic limit and that failures occur just as quickly, in fact usually more quickly, when the ductility is too low than when the elastic limit is too low. The minimum ductility required for any part must be determined by the cut and try method, since there is no way of calculating it. Fortunately for parts of like function the minimum ductility required is about the same, so that once determined it can be applied generally. For example, the leaves in a chassis spring should have an elongation of about 9 per cent. or better and a reduction of area of about 28 per cent. or more to function satisfactorily; and whether the spring is lightly stressed or heavily stressed, or whether it is used on a light touring car or heavy truck, the same minimum elongation is required.

Selection of Steel

To choose the proper steel for a given part then, we will first decide what minimum elongation and reduction of area it will be necessary to maintain, and then select those steels which, when heat treated to give an elongation over the minimum required, will give the desired elastic limit. Usually there will be half a dozen or more steels which will answer our purpose. If the part is subjected to large alternating stresses it may be expedient to further limit the possible number of steels for a given part by choosing those having high Stanton values and high impact values. Even limited in this way there will probably be several steels usable for any part from which must be chosen the most economical one to use.

In many cases properties other than structural are required, such as resistance to wear, resistance to burning, high tensile properties when hot, magnetic permeability, resistance to corrosion, etc. The same method of choosing steels for these parts can be used as mentioned above; the additional properties required simply limit the number of steels from which we must choose the most economical.

The most economical steel is not necessarily the one with the lowest first cost although this is a consideration along with the ease with which the steel can be forged, burned, annealed, heat treated, warped, straightened and machined. Ability of the mill to consistently produce the steel free from pipes, seams and the many inherent defects, as well as possible sources of supply all enter into the problem. These qualities are not easily ascertained and require careful study of their use on a production scale. Experiments carried out on a production scale introduce so many variables that it is difficult to arrive at accurate results. The large difference in shop methods, as well as the differences in the number of cars produced per day, are perhaps the main reason why all shops are not unanimous in the choice of one type of steel.

Chrome-nickel, straight nickel, chrome-vanadium and recently chrome-molybdenum steels each have their staunch supporters, and undoubtedly each excels the others under certain conditions. For any given shop there is generally

TABLE NO. 1.

	(a) Per cent	(b) Per cent	(c) Per cent	(d) Per cent	(e) Per cent	f) Per cent
Carbon	0.10—0.20	0.15—0.25	0.15—0.25	0.15—0.25	0.15—0.23	0.08—0.16
Manganese	0.50—0.80	0.50—0.80	0.50—0.80	0.50—0.80	0.30—0.60	0.30—0.60
Sulphur	0.045 max	0.045 max	0.045 max	0.045 max	0.045 max	0.045 max
Phosphorus	0.040 max	0.040 max	0.040 max	0.040 max	0.040 max	0.040 max
Chromium	.....	0.45—0.75	0.80—1.00	.....	1.00—1.20	1.00—1.20
Nickel	3.25—3.75	1.00—1.50	.....	3.25—3.75	3.00—3.50	3.00—3.50
Vanadium	.....	.....	0.15—0.20	.....	.....	.....

TABLE NO. 2

	(a) Per cent	(b) Per cent	(c) Per cent	(d) Per cent
Carbon	0.25—0.35	0.25—0.35	0.25—0.35	0.30—0.40
Carbon	0.30—0.40	.....	0.30—0.40	.....
Carbon	0.35—0.45	.....	.....	.....
Manganese	0.50—0.80	0.50—0.80	0.50—0.80	0.30—0.60
Sulphur	0.045 max	0.045 max	0.045 max	0.045 max
Phosphorus	0.040 max	0.040 max	0.040 max	0.040 max
Chromium	0.45—0.75	0.80—1.10	.....	0.60—0.95
Nickel	1.00—1.50	.....	3.25—3.75	2.75—3.25
Vanadium	.....	0.15 min.	.....	.....

*Author is metallurgist at the Studebaker Corporation, Detroit, and presented this material by title before the Indianapolis Convention of the American Society for Steel Treating.

one steel which proves most economical, and the tendency is to use this wherever possible. This tendency should not be criticized, because it is desirable to use as few steels as possible in a plant. A reduction in the number of steels used means a reduction in the heavy investment an automobile manufacturer has in his stock of steel. It also makes for better purchasing conditions, better production conditions and less chance for mixing steels. Summing up the manufacturer's metallurgical problem, we find that he wishes as few different steels as possible which will meet his shop conditions economically and possess physical properties to satisfy the requirements of his many parts.

Having these requirements in mind, the following list of steels has been drafted and is intended to cover the needs of a manufacturer who is making all his parts at his own plant. Only the relatively important parts are mentioned, but these steels should take care of all parts.

The Steel Used

(1)—A steel for sheets and strips of average importance. This is usually an open-hearth 0.10 per cent. carbon steel, the same as S. A. E. No. 1010. It is used for fenders, body plates, splashers, hoods and various stampings. It is finished in most any degree of smoothness desired and annealed in various ways to produce ordinary or extra drawing qualities.

(2)—A good machining steel for ordinary bolts, nuts, screws, studs and many other parts which are lightly stressed. A cold rolled or drawn bessemer steel of carbon content about 0.08 to 0.16 per cent, corresponding to S. A. E. No. 1112, is generally used. More attention is paid to the machinability of this steel than its strength. It is not considered a good carburizing steel, although it is used for this purpose by some makers of low-priced cars. Because of its easy machining qualities it is popular with men in charge of production work.

(3)—A plain carbon carburizing steel for such parts as camshafts, tappets, spring bolts, water pump shafts, front end gears, etc. Following is the common steel used for these parts:

	Per cent.
Carbon	0.15—0.25
Manganese	0.30—0.60
Sulphur	0.050 maximum
Phosphorus	0.045 maximum

This steel is easily forged and machined although its machining qualities are not as good as steel (2) given above. After carburizing it is necessary to water quench this steel to produce a scleroscope hardness of 75 or more. If the steel is properly heat treated the Brinell hardness of the core will not exceed 200. It is not customary to refine the grain of the core of camshafts, tappets or water pump shafts. In the case of tappets and water pump shafts it is not deemed necessary and in case of camshafts too much warpage is induced. Some makers use a steel ranging in carbon from 0.10 to 0.20 per cent for these parts. Better ductility results from the use of this steel but it is more difficult to machine.

(3-a)—Stampings, parts made from seamless tubing and frames are made from the same analysis steel given under (3). Frames also are quite commonly made from a 0.20 to 0.30 per cent. carbon steel, other elements the same as under (3).

(4)—A forging steel of medium carbon for parts not too highly stressed, commonly used for connecting rods, crank-shafts, front axles, spring clips, brake levers, etc. Many manufacturers use alloy steel for these parts and, as previously stated, the design largely determines which steel must be used. The medium carbon steel, however, is the most economical steel for these parts and if the design permits this steel will be used. If the design requires steels of higher physical properties some of the alloy steels which will be discussed later can be used. Following are the steels generally used in this group:

	(a) Per cent.	(b) Per cent.
Carbon	0.30—0.40	0.35—0.45
Manganese	0.50—0.80	0.50—0.80
Sulphur	0.050 max.	0.050 max.
Phosphorous	0.045 max.	0.045 max.

Both of these steels forge easily, respond well to heat treatment and are fairly easy to machine. Unless the sections are very irregular water may be used as the quenching medium. The Brinell hardness to which these parts are usually held depends again on their design but it will be found usually that when made from this steel connecting rods will have a hardness somewhere between 190 and 290, crankshafts between 217 and 290 and front axles between 190 and 260.

(5)—A steel for coiled springs, lock washers, etc. This steel will have the following analysis:

	Per cent.
Carbon	0.58—0.70
Manganese	0.70—1.00
Sulphur	under 0.050
Phosphorus	under 0.045

Where the size is suitable, coiled springs generally are coiled from wire of this analysis which has been tempered at the mill. After coiling, the springs are given a low draw at about 500 degrees Fahr. to remove the coiling strains and used in this condition. Whether tempered at the mill or heat treated at the spring plant, satisfactory coiled springs will have a scleroscope hardness between 55 and 70.

(6)—A steel for keys, coiled springs of thick wire and ball bearing balls. Following is the steel generally used here:

	Per cent.
Carbon	0.90—1.05
Manganese	0.25—0.50
Sulphur	under 0.045
Phosphorus	under 0.0.

This steel is also used in low priced cars for chassis springs.

(7)—An alloy carburizing steel for parts where resistance to high stresses as well as wear is a factor, as case hardened gears, piston pins, steering knuckle pins, differential crosses, ring gears, ball bearing races, etc. Here we find a diversity of opinion as to the steel required. The steels shown in Table No. 1 are most common.

Steel (a) is easy to heat treat and gives highly satisfactory results, producing a very ductile core. Unless carefully prepared, however, it is rather difficult to machine.

Steel (b) machines a little easier than (a), but does not give quite as ductile a core.

Steel (c) is a good carburizing steel, but due to the increasing cost of vanadium, the steel has a rather high first cost.

Steel (d) is easier to machine than (a) but does not give quite as ductile a core and requires a little more care in heat treatment.

Steel (e) requires careful heat treatment to produce a soft core and a hard case, and several concerns have not been able to use it successfully on a production scale. When properly heat treated however, this steel has good physical properties, and has been the salvation of some otherwise impossible designs.

Steel (f) gives excellent physical properties and is much easier to heat than steel (e). Where heat treating difficulties are encountered, steel (f) is often substituted to advantage for (e). Steel (f), however, is more expensive than (e).

All of these steels can be hardened to a scleroscope hardness of 75 minimum, using oil as a quenching medium, in fact, many manufacturers require a minimum of 80. Water can be used as a quenching medium for steels (a), (b), (c) and (d) for some sections, but because minimum warping is desired oil is generally used. Nearly all parts made from those steels are double quenched. An exception to this is the ring gear which is seldom double quenched because the high heat to refine the core produces too much warping.

(8)—A steel for the usually high stressed parts such as rear axle shafts, steering knuckles, propeller tubes, steering arms, connecting rod bolts, highly stressed studs, etc. Where design makes it necessary, front axles, spring clips and connecting rods are also made from this steel. Table 2 shows a wide range of steels used:

Where different carbon ranges are given it should be remembered that the lower the carbon content the easier the steel is to forge, anneal, machine and heat treat but also the lower the carbon the lower the physical properties of the steel.

Steel (a) is a popular steel. It forges rather easily, is not difficult to anneal, responds well to ordinary heat treatment, although in general requires oil quenching, and gives good physical properties.

Steel (b) forges easily, is easy to anneal, is easily heat treated and far less

sensitive of over heating than (a), (c) or (d). It can be quenched in water and gives good physical properties. Due to the high cost of vanadium, the first cost is rather high and because of higher heats required to treat it, is a little harder on the furnaces.

Steel (c) is rather easily forged, is not difficult to anneal or heat treat, but the hardness does not penetrate well in large sections. In small sections it gives satisfactory physical properties. This steel also seems to have more inherent defects than the others.

Steel (d) is rather difficult to forge, difficult to anneal, requires careful heat treatment but gives excellent physical properties. Usually when steel (d) is used in a manufacturer's plant it is because of some one particular part and he makes all his other parts in this group out of steel (a), (b) or (c).

Chrome-molybdenum steel has been introduced recently as an automobile steel with what seems to be a promising future. At the present time, however, it has not been sufficiently used in quantity production to include it in our list.

(9)—A steel for gears. This function requires all that we can get from a steel. We must have resistance to wear, to shock, and to very high stresses. There are still quite a number of cars made with carburized gears and in this case one of the steel under (No. 7) is used. The general consensus of opinion seems to be, however, that all things considered, the oil hardened gear is more satisfactory. The following are the more common steels:

TABLE 3

	(a) Per cent	(b) Per cent	(c) Per cent
Carbon	0.45—0.55	0.40—0.50	0.45—0.55
Carbon	0.40—0.50	.....	0.40—0.50
Manganese	0.30—0.60	0.50—0.80	0.50—0.80
Sulphur	0.040 max	0.045 max	0.040 max
Phosphorus	0.040 max	0.040 max	0.040 max
Chromium	0.60—0.90	.....	0.45—0.75
Nickel	1.50—2.00	3.25—3.75	1.00—1.50

Steel (a) is difficult to forge, difficult to anneal, hard to machine, must be heat treated with great care but gives excellent results. The steel with the lower carbon range eases these difficulties.

Steel (b) is a little easier to forge and anneal than steel (a) but in large sections the hardness does not penetrate as well as in the other steels. It does not have physical properties as good as (a).

Steel (c) is somewhat easier to forge, anneal and machine than (b) and has about the same physical properties.

Gears made from these steels and heat treated to a scleroscope hardness of 70 to 75 seem to give the best results.

(10)—A steel for chassis springs. We have already discussed the plain carbon steel that is used for lightly stressed springs. There are three other steels which are commonly used which have the following analysis:

TABLE 4

	(a) Per cent	(b) Per cent	(c) Per cent
Carbon	0.45—0.55	0.40—0.50	0.65—0.75
Manganese	0.60—0.80	0.80—1.00	0.85—1.05
Sulphur	0.045 max	0.040 max	0.035 max
Phosphorus	0.045 max	0.040 max	0.035 max
Silicon	1.80—2.10	.....	0.30 max
Chromium	.....	1.05—1.20	0.30—0.45
Vanadium	.....	0.15 min.	.....

These steels all give good results. Steel (c) is generally conceded to be the best of these three, but it is more delicate and consequently more difficult to handle than the other two. The hardness of the spring leaves should be as close to 400 Brinnell as is commercially possible to maintain.

(11)—A magnet steel. The following analysis is common for this purpose:

	Per cent.
Carbon	0.80—0.90
Manganese	0.30—0.50
Silicon	0.25—0.40
Chromium	1.90—2.10
Tungsten	0.75—1.00

(12)—A valve steel. Strength, resistance to wear and resistance to scaling at elevated temperatures characterizes a good valve steel. Most of the lower priced cars have valves made from a cast iron head cast or welded onto a machine steel stem. These valves resist scaling at high heats, quite satisfactorily but warp and pit easily. If better materials are required one of the steels shown in Table 5 should prove satisfactory.

The principal merit of steel (a) is in its relative cheapness. It is easier to forge and machine than the other steels in this group and has the lowest first cost. It does not resist scaling well but will not warp as easily as the cast iron head valve.

Steel (b) costs a little more than steel (a) but is a little stronger at high temperatures and so resists warping better.

Steel (c) is the strongest steel of the group at high temperatures, 1,200 to 1,700 degrees Fahr. and for this reason has the highest resistance to warping.

Steel (d) is not as strong at high heats as (c) but resists scaling much better. For this reason (d) under most conditions is better than (c).

Steel (e) resists scaling a little better than (d) but is otherwise about the same.

Steel (f) resists scaling as well as (d) and is nearly as strong as (c) at high temperatures. It is about the best valve steel we have today which has been used on a production scale.

These twelve steels cover every need of the automobile engineer in designing a motor car. It has been necessary to be extremely brief in discussing each of these steels in order to cover them all. If a manufacturer makes every part of his automobile at his own plant, he will require a minimum of twelve steels, and if he uses cast iron head valves, he can cut down to 11. Under present conditions, this is the minimum number of steels from which an automobile can be built on a production scale. No manufacturer makes all parts for his automobile at his own plant, yet it is not at all uncommon to find 20 or more different steels in his stock. While it may not be possible for him to get down to a minimum of twelve steels, he should be able to get along with much less than 20. In these times of retrenchment and economy, it might be well for the manufacturer to consider the opportunity of large saving by reducing the number of steels in his stock.

Aeroplanes are now maintained by the province of Quebec for the protection of forests from fire.

TABLE 5

	(a) Per cent	(b) Per cent	(c) Per cent	(d) Per cent	(e) Per cent	(f) Per cent
Carbon	0.25—0.35	0.50—0.70	0.50—0.70	0.20—0.40 or 0.40—0.50	0.40—0.50	1.20—1.50
Manganese	0.50—0.80	0.30 max	0.30 max	0.050 max	0.30 max	0.20—0.30
Sulphur	0.045 max	0.035 max	0.035 max	0.035 max	0.030 max	0.035 max
Phosphorus	0.040	0.035 max	0.035 max	0.035 max	0.030 max	0.035 max
Silicon	.....	.....	.....	.....	3.50—4.50	0.40—0.60
Chromium	.....	0.50—1.00	3.00—4.00	11.50—14.00	8.00—10.00	11.50—13.00
Nickel	3.25—3.75	.....	.....	3.00 max	.....	0.40—0.60
Tungsten	.....	1.50—2.00	13.00—15.00	.....	.....	.....
Cobalt	.....	.....	.....	.....	.....	3.00—3.50



MARKET DEVELOPMENTS



Several Reductions in Price are Announced

Wire Products Prices Have Dropped—This Follows Tubular Goods—Price Cutting the Cause of Downward Trend—Sheets and Tin Plate Remain Firm—Local Steel Market Good—Other Markets Very Quiet

THERE is a very conflicting story to tell this week, as some markets show entirely different conditions. For example:— Pittsburgh reports several reductions in the price of wire products, this being the result of frequent, if not general price cutting by independent wire mills. Whether the new prices will be low enough remains to be seen. If cutting continues, the steel corporation, who announced the new prices, will, no doubt, lower them still further, until no further price cutting can take place.

Bars, shapes and plates are quotable at 1.50c to 1.60c, but 1.50 is the most common. Sheets stay firm, the price being 3.00c for black and 4.00c for galvanized. Tin plate remains at 4.75c, although some independents are shading this price 10 and 15 cents on particularly desirable orders. Whether steel prices are thoroughly liquidated remains an open question.

The steel market in Toronto has surprised even dealers themselves. Instead of December being a very poor month, it has developed into a better month than November. No one seems able to explain why this has occurred, but the orders on the books tell the story. The business secured is general, and not on any one line.

Montreal reports a very quiet market in all lines. Toronto, with the exception of the steel market, is also very quiet, and no improvement of note is looked for this year, in fact not for some time yet. Tin prices in Montreal have tapered off slightly, but nothing to speak of. Until a steady demand occurs, such small changes will not mean much.

No one cares to predict what 1922 will usher in, but the consensus of opinion seems to be that nothing of importance will occur on the steel market until March or April.

NEW PRICES ANNOUNCED ON WIRE PRODUCTS—PRICE CUTTING THE CAUSE

PITTSBURGH, December 28th.—As a result of frequent if not general price cutting by independent wire mills, the American Steel and Wire Company (Steel Corporation) last Wednesday, December 21, began quoting new prices on wire products, as follows: Plain wire, 2.25c.; galvanized wire, 2.75c.; wire nails, $2.50; cement coated nails, $2.15; painted barb wire, 2,65; galvanized barb wire, 3.15c.; polished staples, 2.65c. Independents are of course forced to meet these prices, while it is a question whether they will cut them. They will probably find them low enough, but if cutting continues the Steel Corporation will no doubt continue reducing its prices, according to its general policy in all lines, until it discovers a level that will not be cut.

No precise statement can be made as to how much reduction these new prices represent, because there was no clearly defined market level. They are no lower than some prices that have lately been made in active competition, while they are $7 a ton on plain wire and $8 a ton on other products below the prices that were nominally regarded as the market in October. There was an "advance" September 12, $2 on plain wire and $3 on nails and barb wire, and the advance seemed to hold for a time, while later prices slipped off. The new prices are exactly $5 a ton below the prices ruling before the September 12 advance, and since the early part of July.

In the previous week the Steel Corporation had reduced tubular goods in somewhat similar manner. These two lines, wire products and tubular goods, are the only ones that have shown any price change of consequence for several weeks. Bars, shapes and plates remain quotable at 1.50c. to 1.60c., with the difference that 1.50c. is now rather common even on moderate sized orders, while a couple of months ago the price was made only on very desirable orders. Probably 1.60c. is sometimes obtained, but hardly on business of any importance. There is some doubt as to whether 1.50c. would be shaded even on a very desirable order. Perhaps 1.50c. may be considered the bottom of the market, but it is improbable that this will be the case indefinitely. That is, the price is quite likely to be lower before it is higher. The market is now so steady that buyers have no incentive to wait for lower prices, as if they need material they would lose more by deferring operations than they would make up by a concession in prices. Should an active buying market develop competition would probably force prices down a trifle. As the market now stands there is little incentive to cut prices farther.

Sheets are phenomenally firm at 3.00c. for black and 4.00c. for galvanized. Buyers have been quite unable to budge any of the mills from these figures and the market is in a striking contrast to the market that obtained some time ago, when there was no regular price at all. These prices are $5 a ton higher than those ruling late in August and early in September, when a good bit of business for delivery to the end of the year was booked, while the cost of production is a trifle lower than in the latter part of August. It is claimed, however, that mills were losing money then.

Tin plate is quite steady at the regular price of $4.75, but it seems some independents are occasionally shading the price 10 or 15 cents a box, to secure particularly desirable orders.

There is room for an almost unlimited amount of discussion on the subject of whether or not steel prices are thoroughly "liquidated" as well as on the subject of whether or not prices are below the cost of production. Merely to make one comparison, the Bureau of Labor index number of commodities at wholesale, taking 1913 average prices as 100, stands at 149 for November, having fluctuated only between 152 and 148 since last May, although the individual groups of commodities making up the

general average have had fluctuations of considerable magnitude. On the same basis of computation, finished steel products would now stand at 126, and thus they appear to be much more thoroughly liquidated than commodities in general. Farm products, however, stood in November at 114, or still lower, while building materials stood at 197 and housefurnishing goods at 218.

On this basis steel products ought to advance, or several groups of commodities should come down. There is room for attacking this argument, however, on the basis that 1913 steel prices were fairly profitable, and were 21 per cent. higher than at the end of 1914, when there had been quite a decline. Steel prices now, while 26 per cent. above the 1913 average are 52 per cent. above the 1914 low point. Then, as to costs, there is room for much argument, because the cost of production varies according to the rate of operation. A mill running at 30 or 40 per cent. might lose money at present prices and might have very comfortable profits if running at 90 per cent.

Prospects are, as indicated in last report, that steel ingot production in the first eight months of next year will not pass below a rate of 20,000,000 gross tons a year or above a rate of 35,000,000 gross tons. This means one thing to the producer and another thing to the consumer, because steel capacity has so greatly increased, being one-half greater than in 1914 and double the capacity in 1910. A 20,000,000 ton rate would represent, on a conservative basis, a rather fair rate of steel consumption. It would mean a great deal of machinery, agricultural implement and automobile building, not a little consumption in dwelling house construction and would also cover a moderate amount of upkeep of the railroads, though no expansion.

On the other hand, even a 35,000,000 ton rate would be low for producers, according to precedents, for it would only be about two-thirds of capacity, and in the past steel prices have never advanced unless mills were running at about 85 per cent. The average rate in the past three months has been about 23,000,000 tons, but there is likely to be a dip for a time, owing to some mills closing for a week or two.

Pig iron continues very dull, with the market quotable at $20 for Bessemer, $19 for basic and $19.50 for foundry, f. o. b. valley furnaces, freight to Pittsburg being $1.96. Old contracts, some of them quite old, have now been pretty thoroughly worked out, while consumers have reduced their stocks to almost nothing. In January there will probably be a buying movement, in a conservative manner, and the consumption may force prices down a trifle, but prices cannot go down much with present freight rates on ore, coke and limestone, while there is no reduction probable even for many months that would permit such a decline.

Connellsville coke for spot shipment continues weak, with quotations at about $2.90 to $3.00 for furnace and $3.75 to $4.50 for foundry. Two contracts for furnace coke for first quarter have been made, at $3.25 and $3.40 respectively. Some coke could be had at less than $3.25 for the quarter, but not the best grade.

POINTS IN WEEK'S MARKETING NOTES

Several new prices on wire products have been announced. This move is the result of frequent if not general price cutting by independent wire mills. The American Steel & Wire Co. have issued these latest prices, and it is believed they will be low enough to prevent further cutting. If not it is likely they will drop until a level which cannot be cut is reached.

Sheets stay firm, being priced at 3.00c. for black, and 4.00c. for galvanized. Present prices are $5 a ton higher than those existent late in September. Tin plate is also steady at $4.75, although some independents are said to be shading the price 10 or 15 cents to secure desirable orders.

Prospects are that steel ingot production for the first eight months of 1922 will not be lower than 20,000,000 gross tons a year, nor higher than 35,000,000. A 20,000,000 ton rate would represent a fairly good figure, and would mean considerable machinery, agricultural implement and automobile building, and would also cover a moderate amount of upkeep for railroads but not for expansion. On the other hand a 35,000,000 ton rate would be low for the producers. Details of this are given in the Pittsburgh letter.

Montreal says that the present steel quotations are, in some cases, below actual cost of production. Pig iron is very quiet. It is well known that if any good volume of business develops the price will have to go up, unless operating costs are reduced in the meantime. Few manufacturers care to risk an opinion on the events for the coming year.

Toronto steel market is the only bright spot in the local market. Business in December is greater than in November in spite of the fact that December is usually a very dull month. The other markets, however, are very quiet.

STEEL MARKET ONLY BRIGHT FEATURE

TORONTO, December 28th.—"People have been buying too many rocking horses, electric trains and so on, to think of the machine tool market." Thus, in a few words, one dealer sums up the situation. The Christmas season just passed has been good for the retailer handling suitable lines for gift purposes, but so far as machine tools, steel, or scrap iron are concerned, there has been very little moving. This might be as good a time as any to suggest that in future, various dealers make it a point to find out what the different manufacturers require, then coax them into giving each other machine tools, or perhaps a ton or so of scrap as a Christmas present. However as the idea is the main thing, this supplies the idea, and it is now up to dealers to work out the details.

Seriously, the market generally is very quiet. Not that there is absolutely no business moving, for such a statement would be incorrect. Strange to relate the only activity of note, is from a most unexpected quarter, the steel market. Instead of December being a poor month, as it generally is, we find that the sales this month exceed those of November. Dealers themselves cannot explain the unlooked business. The fact remains it is there on their books, and they are satisfied to let it go at that. Nothing really featured, the demand being general in all lines.

We would like to report a similar story of the machine tool market, but in this case, there is nothing moving. Manufacturers are sitting tight, refusing to spend any money until they are satisfied the turn in the trade has arrived. A similar state of affairs exists on the small tool market. The metal market is quiet, although prices remain fairly firm. No improvement is looked for this year, so that next week's letter is bound to be very much a repetition of the present one. In fact it will be March or April before anything startling will happen on the steel market.

The use of acetylene as a motor fuel is being developed in Switzerland. It has not proved to be as satisfactory as gasoline, it is said. The finding of Keel, a Swiss authority on acetylene and its use, is that 1 kg of acetylene gave as much energy as 2 kg. or 2.5 kg. of benzol, though the heats of combustion are only as 6.5. Explanations given are that there is an excess of air in the benzol fuel mixture while acetylene can be burned with its theoretical air allowance. In tests the combustion of acetylene proved to be complete while that of benzol was shown to be incomplete. Reporting on the variation of the acetylene percentage in the air mixture, Keel stated that on account of high pressures and temperatures produced in the cylinder, the advisable limits extended from 1.5 per cent. to 7.5 per cent. of acetylene. Haber, another authority, sets these limits as 3% and 5%.

THE VARIOUS MARKETS ARE RESTING APRIL FIRST QUOTED AS TURNING POINT

MONTREAL.—With the closing days of the year, purchasing in the lines of iron and steel has dropped to practically the zero point. Throughout all lines no price changes have been reported except from isolated points where more or less special conditions exist.

Looking backward, the year has not been one of good business. Yet after all "good" and "bad" are terms of abstract rather than concrete meaning, and really are relative in value. At first glance it is only natural to compare the volume of business of 1921 with the years that immediately preceded it. Thus, these snap conclusions are only productive of more or less alarming conclusions. We must go deeper into the problem. Then we find that war conditions produced in four years growth and expansion in our metal working industries, that under normal conditions would have taken from ten to fifteen years to attain. The head of one prominent machine tool industry in Canada is credited with the statement that ten times more machine tools were built per year, during 1916, 1917 and 1918 than were built in any one year previous to that time. This is really more or less true of most other industries. These statements largely explain why there is no demand for machine tools, and why there is so much idle equipment throughout the country. The practical elimination of the shipbuilding industry in Canada threw a large quantity of machine tools, raw material, supplies, and labor on the market. The shell industry has been largely absorbed in all its phases by the general manufacturing industries engaged in producing goods whose uses are of a more peace-like nature. Export trade has fallen off to a very low level, owing to general re-adjustment conditions existing in practically all overseas lands.

Yet, withal, the consumption of steel and the products of the iron and steel industries, is not far behind the figures shown in the records of pre-war years. Thus in making our comparisons it is far more comforting to go back to these years to get our standard that we choose to call by that very elusive expression "normal conditions."

Throughout the whole Dominion our industries are built up very largely on a sound basis. Although many do not appreciate the statement, and are bewailing the fact that bad times have fallen upon us, it is still true that conditions in Canada are better than those existing in any of the belligerent countries, with the possible exception of Germany, which country has had several advantages, chief of which is that of her deflated currency. Yet when one analyses all conditions that exist in that country, her lot is not rosy and few of us would care to change places with her.

Our steel mills have a reasonable amount of business on their books which should carry them through to February or longer, and then it is always reasonable to expect that the railways and industrial concerns will have come into the market by that time for their 1922 requirements. Up to the present the various mills are running along at about that point which enables them to break even. Structural steel demands are low, as are the demands for merchant bars. Plates, and sheets in particular, have been enjoying a satisfactory business. Machine tool sales are very scattered while small tools and supplies are in fair demand.

Present Quotations

The present steel quotations are below actual cost of production in many cases, and are down below the average prices that prevailed over the period between 1904 and 1914. This, in spite of the increased cost of production. Pig iron is very quiet. Some steel mills in the U. S., that produce pig iron as a side line, have been cutting prices down to production costs, or lower, in the past few months in order to produce enough business to keep their organizations together. This, of course, forced down the price locally. It is well known that if any volume of business develops the price will have to go up, unless operating costs are meanwhile reduced. Last week it was decided that present prices would prevail until after the New Year.

Few manufacturers care to risk an opinion on the trend of events for the coming year. The general consensus of opinion is that no special impetus to business will be felt on January 3rd. The "dead-wood" has been worked out of most organizations and conditions are on a "solid-rock" foundation. "The corner has been turned" and conditions will gradually improve if honest efforts are put into the work of all. It will be a long strong pull and to attain success everyone must pull together. Many matters will be considered here and in the States during the coming winter months, the settlement of which will have its influence on business in all lines. Perhaps the most important of these matters is the readjustment of freight rates in the U. S. A. This matter will be considered in March. It is felt that a general all-around reduction in freight rates will do much to encourage business. Such an improvement will have its influence on Canadian conditions very soon after the improvement to the South. Some authorities in the world of finance go as far as to state that April 1st will be the date when we can look forward to much better things.

The non-ferrous metals continue inactive at this season. Tin, which was quoted at 39 cents last week, has weakened slightly, and now 38½ cents is asked. Other than this slight change no quotations have been altered.

The future lies largely with ourselves. Opportunities will not likely occur, rather will they have to be created. The future is bright for all those who wish to consider it bright and are ready to go forward and work, to prove to themselves and the world the correctness of their beliefs. Old fundamental conditions still prevail, and the degree of our success individually and collectively will be in the same measure as we apply the old and proven methods.

MANY IMPORTANT FACTORS MUST BE CONSIDERED

(Cont. From Page 163)

unchanged through the war and the period that intervened. Where in the United States commercial loans were up to 6, 7, 8, 9, and 10 per cent. the Canadian banks continued to provide accommodation for their Canadian clients at the old rate. In the United States the rate fluctuated; a borrower might be called on to increase his rate at any time; he did not know what his money would cost for a year's advance or even six months; in Canada the uniform rate held and in this the banks stood almost alone.

The principle of Canadian banking, under the extensive branch bank system, is to maintain an even commercial rate to stabilize industry and commerce. Changes in the business situation are not indicated by shifting bank funds according to supply and demand as reflected by what borrowers are willing to pay but by changing classes of investments. This fact was perhaps responsible for the fact that there was not as violent a post-war adjustment in Canadian business as was the case in the United States. Commercial credit during the period of inflation was on a much higher rate in the United States than in Canada which was an additional factor in raising production and marketing costs.

Messrs. Jones & Glassco of Montreal, have recently completed a contract for the entire conveying system of the National Breweries, Ltd., of Montreal. Owing to local conditions, and certain special requirements , a departure from standard equipment and attachments was necessitated, which makes the installation very interesting. Exhaustive and thorough tests of the equipment have been made, and the whole installation has been accepted as satisfactory. The equipment is capable of handling more than the capacity of the plant, this being slightly in excess of twelve thousand dozen bottles per day. The contract amounted to somewhere about $50,000.

In Westphalia a hand spraying device consisting of a hopper shaped bucket filled with stone dust and carried on the shoulders is used to spray mine roofs and sides otherwise inaccessible. Power is furnished by a trailing connection to a compressed air pipe. The bucket has a long spout to direct the spray. Dust is sucked from the bucket by an injector and delivered with great force.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shaues, Pitssburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 75	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	17 00
Tin	38 50	38 50
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 25
Aluminum	27 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	Net list
Carriage bolts, ⅜" and less	15
Coach and lag screws	—20
Stove bolts	55
Wrought washers	—25
Elevator bolts	Net
Machine bolts, 7-16 and over	—5
Machine bolts, ⅜-in. and less	—30
Blank bolts	Net
Bolt ends	—5
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	+25
Machine screws, fl. and rd. hd., brass	Net
Machine screws, o. and fil. hd., brass	Net
Nuts, square, blank	+25 add $2 00
Nuts, square, tapped	add 2 25
Nuts, hex., blank	add 2 25
Nuts, hex., tapped	add 2 75
Copper rivets and burrs, list less	27½
Burrs only, list plus	10
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 25
Cut nails, base	4 85
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	18 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	.....
Queen's Head, 28 B. W. G.	7 75	.....
Flerur-de-Lis, 28 B.W.G.	7 25	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 25
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 75
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	4 00

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ⅛ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17
Peerless	.22
XX Grand	.16
Superior	.21½
X L C R	.15
Atlas	.19
X Empire	.14
Ideal	.18
X Press	.13

Colored

Lion	.12½
Standard	.11
No. 1	.14
Popular	.10
Keen	9
Fancy	.14

Wool Packing

Arrow	.30
Axle	.25
Anvil	.20

Washed Wipers

Select White	20
Mixed colored	.14
Dark colored	.13

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



INDUSTRIAL NEWS

The Montreal Bolt and Forging Co., Montreal, Que., have been incorporated with $1,000,000 capital.

The Moncton Tramway Gas and Electric Co., Moncton, N. B., has awarded a general contract for construction of a power plant to cost $35,000.

The Bell Piano and Organ Co., Guelph, Ont., is considering the installation of two new boilers to replace the three at present in use.

The Universal Wrench Co., Windsor, Ont., has been incorporated with $250,000 capital to negotiate in the machine tool business.

The New Era Machine and Tool Co., Toronto, Ont., has been incorporated with $50,000 capital to manufacture machine tools and machinery.

The Commercial Cable Co., plans an extension to its wharf at Halifax, N. S. A description of the site and plans have been sent to the Department of Public Works at Ottawa.

The MacKenzie Basin Fisheries, Ltd., Calgary, Alta., has been incorporated under the Dominion Companies Act, with a capital of $200,000 to carry on a general fishing and fur business to operate ships for transportation of freight and passengers.

The Dominion Steel Corporation, Sydney, Nova Scotia, has specifications ready for a large machine shop, to be erected in Sydney. The company has in view the centralization of all machine work and repairs for its railroads, collieries and steel plants. It is stated that construction will start in the near future.

A company in which Mr. R. Patterson, 770 3rd Ave., East, Owen Sound, Ont., is interested, proposes to build a four unit cement-making plant there to have the capacity of 4,000 barrels per day. The Canadian Central Electric Company, Peterborough, Ont., has awarded a contract for a new power house.

Guelph, Ontario, is preparing to purchase equipment for the waterworks plant in connection with the decision to supplement the present steam equipment with that of electrically-driven centrifugal pumps. The city will purchase one imperial three million gallon electrically-driven centrifugal pump and one three million gallon electrically driven Booster pump as an auxiliary. Two three million gallon gasoline or Diesel driven units are to be bought.

The Northern Rubber Co., Metcalfe Street, Guelph, Ontario, will erect a warehouse at the cost of $11,000.

The Oshawa Sales and Service, Ltd., has been incorporated with a capital of $100,000 to manufacture trucks, tractors, machinery and implements, etc.

The Ontario Machinery and Supply Co., Hamilton, Ontario, has been incorporated with a capital of $50,000, to manufacture and deal in every kind of machinery.

The contract for an addition to the pumping and distilling for the water works department for the city of Montreal, Que., has been placed with the Dominion Engineering works.

The electrical contract for alterations to office buildings costing $160,000 for the Toronto Hydro Electric and Toronto Transportation Commission is awarded to Canada Electric Co., Toronto.

The Lawrence Park Garage, Ltd., Toronto, Ont., has been incorporated with a capital of $100,000 to carry on the business of a general garage including the purchase and sale of automobiles and accessories.

The general contract for the construction of car-cleaning shops costing $50,000 for the Canadian Pacific Railway, at Glen Yards has been awarded to G. G. Loomis, 200 McGill Street, Montreal.

The Birmingham Motors have leased their building on Monaghan Road., Peterborough, Ontario, with an option to purchase, where it proposes to install machinery, and carry on manufacturing operations. Jamestown, N. Y., interests are behind the new enterprise.

The International Ferry, Ltd., Sarnia, Ont., has been incorporated under the Dominion Companies Act with an authorized capital of $200,000 to operate a ferry service for automobiles, passengers and freight of all kinds between Sarnia, Ont., and Port Huron, Mich., and to carry on a general navigation and steamship business.

The shops of the Canadian National Railways at Moncton, New Brunswick, were closed on December 20th and will remain closed until January 2nd giving the employees a Christmas vacation. During the interval more or less expensive repairs and over-hauling of the shops will be attended to. It has been the custom to close the shop for certain periods each year during the Christmas Season and the closing this year is only following a precedent established for some time past.

The Alberta Foundry and Machine Co., Calgary, Alta., has recently been incorporated with a capital of $1,000,000.

Figures secured from the Department of Commerce, Ottawa, show that Canada's cost of living for twenty-nine staple articles fell from $11.48 to $11.08 during November.

Contracts for heating and sprinklers for a manufacturing building costing $75,000, for the Goldstein Mfg. Co., 180 John Street, Toronto, is awarded to W. J. McGuire, Limited, Toronto.

Far more improvement is shown this year over last year at Brantford, Ontario. During the past year local improvement work carried on by the Board of Works, totalled $208,953, as compared with $80,000 the previous year.

The Buffalo Specialty Co., 601 Northland Ave., Buffalo, N. Y., plan to construct a factory at Bridgeburg, Ont., for the manufacture of liquid veneer. Estimated cost $40,000. The Northern Textiles Limited, Chesley, Ont., plan to remodel their woollen mill.

The Continental Electric Co., 505 King St., East, Toronto, Ont., recently incorporated to manufacture suction cleaners, etc., has commenced operation. It is the intention of the company to extend the operating capacity in the early future, installing additional machinery.

Fredericton, N. B., reports that the Chestnut Canoe Co. has received an offer from Alliston, Ont., to locate its factory in that town, for the re-establishment of the factory which was almost entirely wiped out by fire some days ago will not be definitely decided for some months.

Leslie & Harding, Georgetown, Ont., are in the market for machinery and equipment for making skates. The Woodstock Powdered Milk Company, Woodstock, Ontario, are in the market for special equipment for milk powder manufacture, including evaporators, separators, etc.

Many Canadian manufacturers will exhibit their wares at the British Empire Exhibition to be held in 1923 at Wembly Park, in the North of London, England. This is the event in which the Prince of Wales is taking a personal interest. The President of a well-known company making a steel product stated that he would probably take space not only at this Empire Exhibition but also at the Industries Fair, which will be held in 1923, about six weeks prior to the big Empire event.

Mr. Normandin, 15 3rd Avenue, Shawinigan Falls, Que., is constructing a foundry at the cost of $5,000.

It is probable that a new bridge will be erected in London, Ont., to open Richmond St. through to South London. The cost is placed at around $140,000.

A greatly improved industrial condition is reported from Tillsonburg. Two local firms there are reported to be running with full staffs and full time while others are speeding up.

One new eight roomed school and two four roomed additions to present buildings are planned by the authorities of Fort William, according to the Times Journal. An approximate figure of cost has been placed at $175,000.

The Canadian Government early next spring intends to start the construction of a modern life saving station on the Main Duck Islands in Lake Ontario. The need for the station has long been felt on account of wrecks. The station will be one of the most modern in Canada.

As a result of the completion of the Chippawa canal sufficiently to let water into it, the Hydro Electric Commission will make an effort to salvage about $10,000,000 worth of equipment. The commission will have for sale concrete plants, electric motors, etc. An official opening of the canal took place the week of December 26th.

London, Ont., spent $937,202.14 in 1921 for walks, curbs, gutters, pavements and sewers according to a report made by the City Engineer, Mr. Brazier. Eight miles of asphalt pavement were laid at a cost of $454.931. All work has been suspended for the cold period except the construction of sewers which is proceeding to furnish work for the unemployed.

The Tanning Industry in Canada has passed through a trying year, especially in the opening months, but has improved steadily however and the outlook is regarded as hopeful. At the present time a fair but limited volume of trade is being done by most tanners, and business, it is felt, is gradually getting back to normal and unless further trade depression takes place—which seems unlikely—the industry in 1922 should be one for running fairly full capacity.

The condition of the paper mills business has improved considerably in the last several weeks. Four of the largest mills in Canada have a production record of 100 per cent. or better in November. The slackening in demand that was anticipated did not materialize. Statistics show that the shipments of Canadian mills have exceeded production. In expressing an opinion of the Paper Industry outlook, several executives have indicated that they expect an improvement in the market for their products during the next year. It is expected that there will be keen competition for export business and high priced pulpwood has not yet been entirely worked off.

The Toronto Board of Control has been calling for tenders for sand dryers for an asphalt plant.

Engraving houses in Toronto are reported to be receiving orders for catalogues from firms which have not been advertising for a long period. This is taken as an evidence that business concerns are getting ready for busier and better times.

From Hamilton, Ont. come reports of improved industrial conditions. Several of the key manufacturing concerns of that city are gradually becoming busier and the acuteness of unemployment has been removed. Seven hundred men have been taken on by various plants.

A business boom without precedent will follow the disarmament conference at Washington, according to the views of Mr. Marquis Regan speaking before the Toronto Advertising club recently. Mr. Regan is of the advertising firm of W. H. Rankin, New York and Chicago.

Negotiations at Acton, Ont., have been completed with Amos Mason of that city, turning over the old power house building and adjoining land for the establishment of a wooden mill. The new proprietor expects to have machinery installed and ready for operation within about two months. It is intented to manufacture knitted goods for children.

Oshawa is to have a new industry. The Ontario Potteries Co., which started in a small way in Bowmanville a few months ago, has decided to locate in this town. Representatives of the company are at present endeavoring to secure either a site for a small building or else an empty building in which temporary kilns may be constructed. The company intend to manufacture tableware, a clay found in Bowmanville to be used largely for this purpose. The company is capitalized at $300,000 and is expected to commence operations in a very active way shortly after the new year.

Representatives of 17 United States industries have recently visited Toronto to enquire into the possibilities of establishing branches in Canada and creating trade connections. In this regard it is significant that Mr. E. L. Cousins, in the report of the Department of Industries made to the Board of Control, says: "There is no doubt that good times are just around the corner."

A good idea for industrial promotion in a town was explained by Mr. A. F. Fifield, manufacturer of St. Catharines, who paid a recent visit to Toronto. He said that during the coming summer every manufacturer in that city will make a visit to all the other plants in order that each may learn what his colleagues make. Every commercial traveler in the future will know when he leaves St. Catharines what is turned out there. The manufacturers will exchange catalogues and their travelers will lunch together so that all may become acquainted with one another's products.

The London & Western Trusts Co. will provide, it is stated, for a large part of the cost of a new office building.

Deseronto finds itself getting busier. According to the Kingston Standard the Thompson Powder Company has resumed operations. The Wood Products Company also expects to return to its usual activity at once.

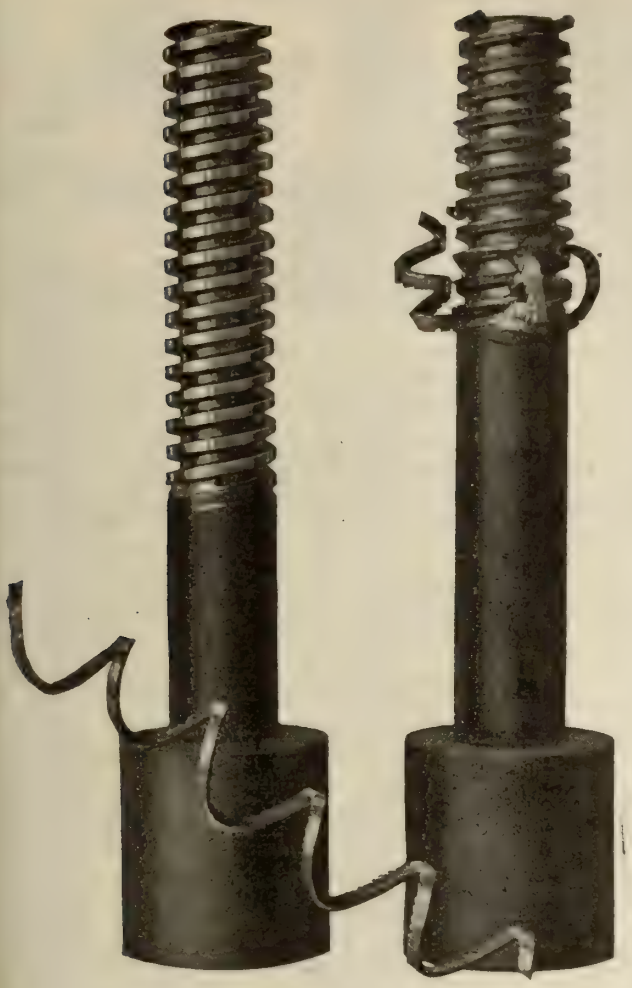
The Temiskaming & Northern Railway Commission is calling for tenders for the construction of approximately seventy miles of road, extending from Cochrane to near New Post. The tenders close at noon on January 9th next.

During this winter the Canadian Welding Society will hold regular meetings to discuss matters of interests to the members. The first meeting recently was addressed by R. E. Smythies, vice-president of the Lincoln Electric Company who dealt with late developments in electric welding, with special reference to the welding of panstocks of the power house of the Chippewa canal project.

Toronto during the closing week in December, has been the mecca of scientists from the four corners of the continent. More than a thousand men have been meeting in annual convention as the American Association for the Advancement of Science, an organization which through its affiliated units has a membership of nearly 12,000. Among the outstanding men is Dr. Frederick C. Cottrell, Washington who discovered the valuable process of avoiding smelter waste. He distinguished himself by his scientific researches relating to the electrical precipitation of fume and fine particles suspended in the gases o fsmelter, blast furnace or cement flues and finally evolved what is known as the Cottrell process.

According to information coming through to the British Trade Commissioner in Toronto, the general industrial condition in Britain is slowly but steadily improving. Speaking broadly there was a marked betterment during October and the early part of November. That there are many hills yet to climb is obvious, but reports indicate a decided spirit of optimism.

A glimpse at the industrial developments of Western Canada reveals that British Columbia has enjoyed the lead in capital investment. According to a preliminary survey of the manufacturing affairs of the four western provinces, prepared by the Dominion Bureau of Statistics, there were, as at the close of 1919, some 6,599 plants and factories in operation. The total capital invested amounted to $482,498,201. The number of employees on salary was 13,084 and those on wages 86,410. The amount paid out in wages was $97,392,944. The cost of materials used in construction amounted to $283,179,527 and the products were valued at $550,672,135. British Columbia stood first in investment with Alberta, Saskatchewan and Manitoba in sequence.



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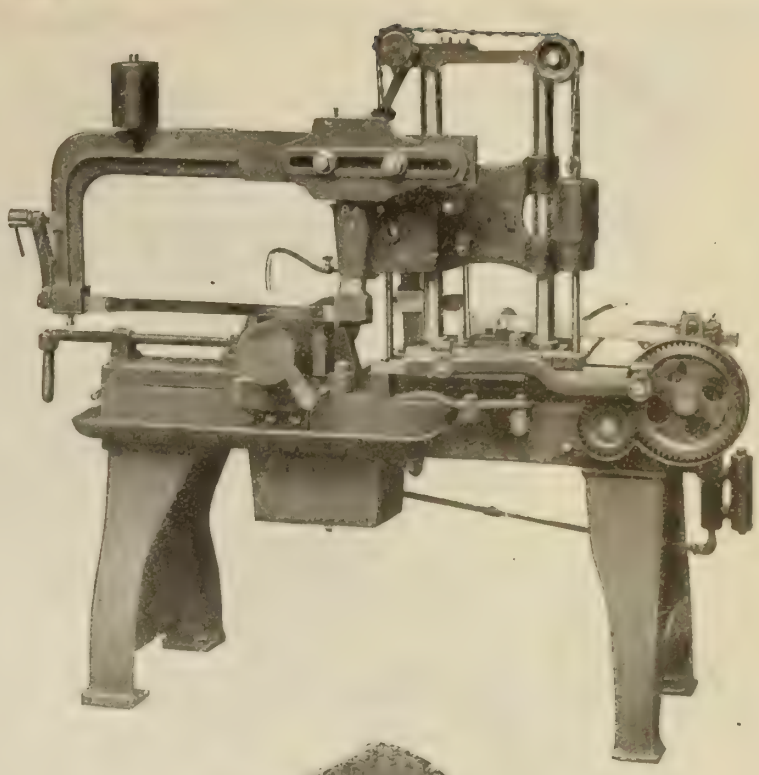
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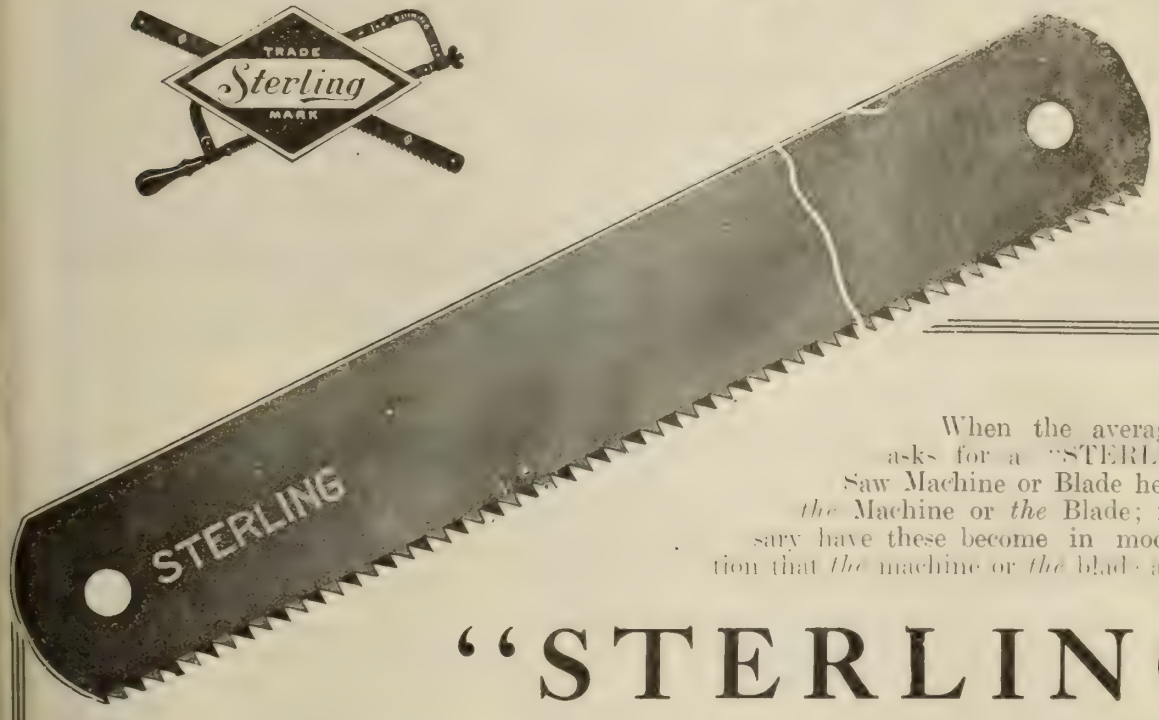
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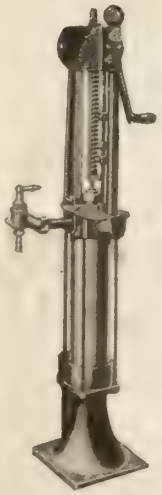
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Write for Illustrated Booklet C-13

The gradual return to 100% production and the change from a seller's to a buyer's market demands that manufacturers reduce their overhead to a minimum.

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Bowser Equipment will save you time and labor by giving you an easily available supply, no matter where the gasoline is needed. Bowser Pumps guarantee to manufacturers clean, dry gasoline and afford an accurate check on all disbursements. Bowser accuracy eliminates spillage in transfer and the perfected construction makes evaporation impossible.

There is a Bowser Piston-Type Measuring Pump to meet your every requirement.

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For

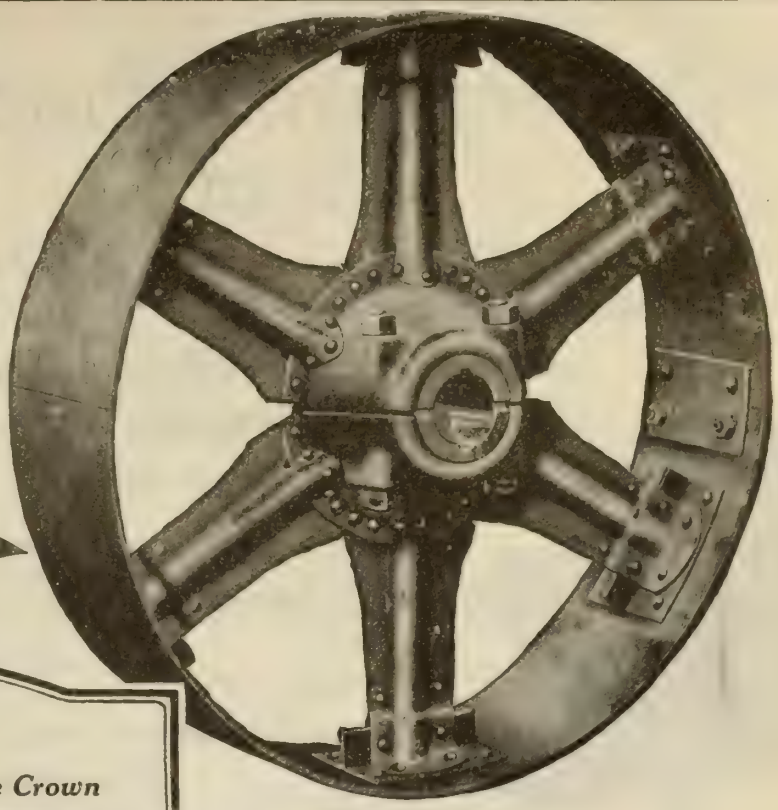
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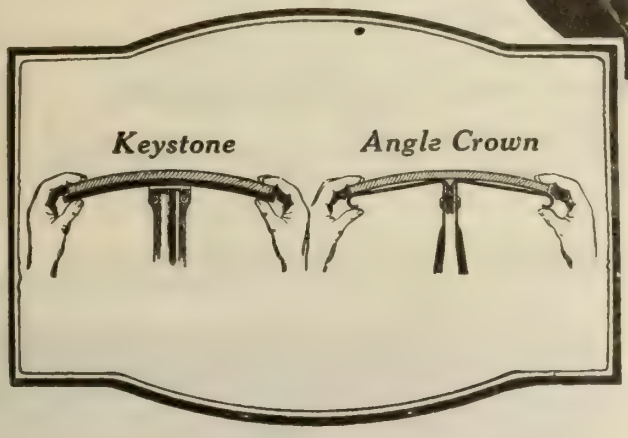
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Steel Split Pulley
made by
DODGE





EXAMINE the small sketch closely. It shows you a big reason why Keystone Steel Split Pulleys reduce bearing friction, lessen power losses, and cut power costs.

Note the way the belt hugs the face of the Keystone oval crown, giving perfect contact over the entire face of the pulley. This means that they can be operated under very low belt tension.

The beadless, accurately turned rim assures perfect balance and true running under high speeds and variable loads.

Dodge-Keystone products stand for quality, satisfaction and long service the world over. Made in Dodge shops—the most modern and completely equipped of their kind—where forty years' experience in the production of everything for the mechanical transmission of power is built into every item of the complete line.



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Your Dodge-Keystone dealer maintains a complete stock and can handle your orders on an immediate delivery basis.

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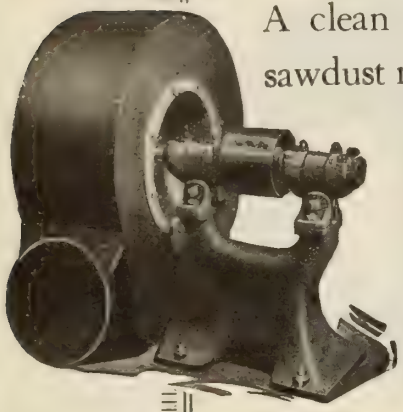
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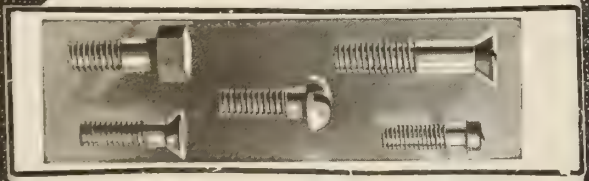
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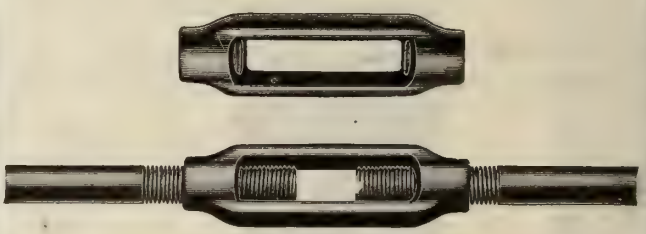
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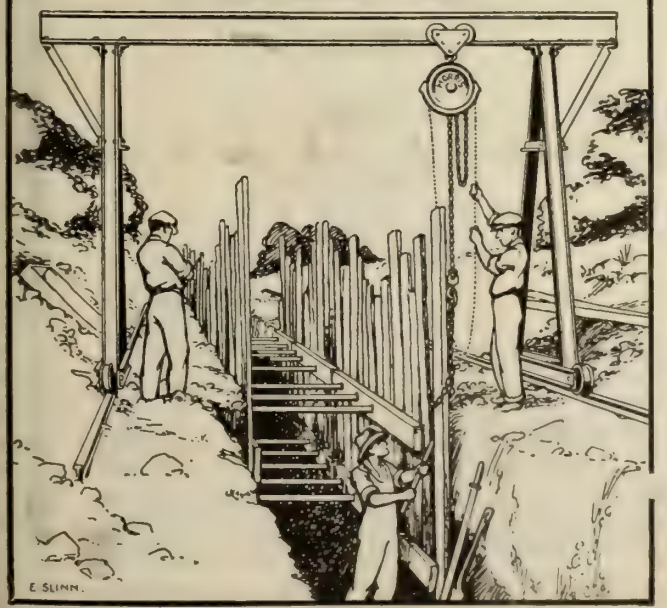
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Engines (slide and piston valve)
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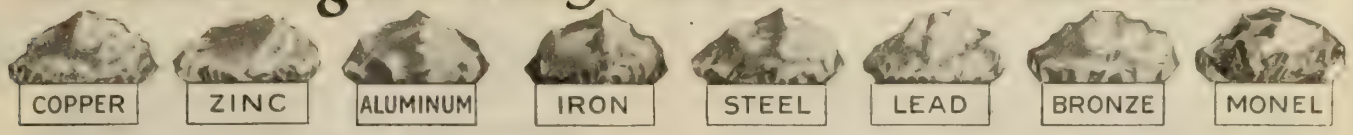
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Acids destroy

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Monel alone stands up against the many destructive forces that quickly break down the resistance of most commercial service metals. Because it is strong as steel, more corrosion resisting than copper, more wear-resisting than bronze, an increasing number of manufacturers are using **MONEL** metal for products for the most exacting and difficult industrial service, as well as for the most common domestic uses.

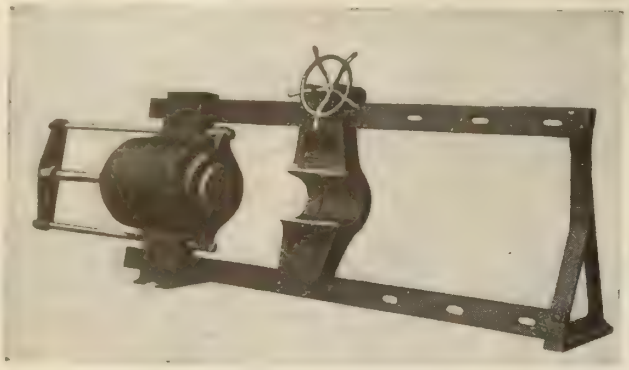
The name Monel identifies the natural nickel alloy—67% nickel, 28% copper and 5% other metals—produced by The International Nickle Company.

THE INTERNATIONAL NICKLE COMPANY OF CANADA, LIMITED

Harbor Commission Building. Toronto, Ont.

INCo Monel metal

THE INTERNATIONAL NICKEL COMPANY



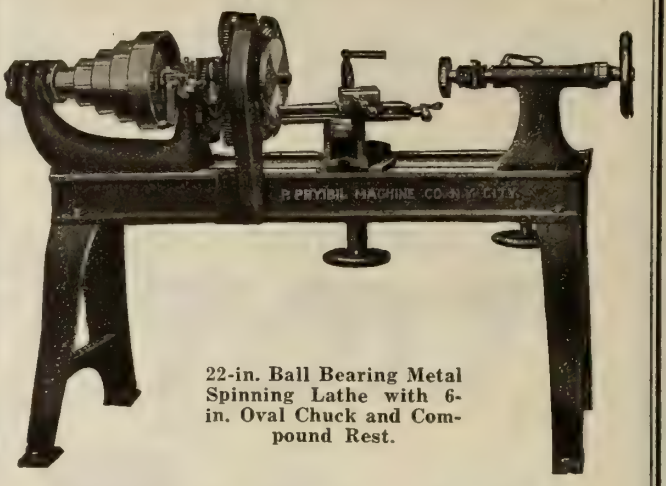
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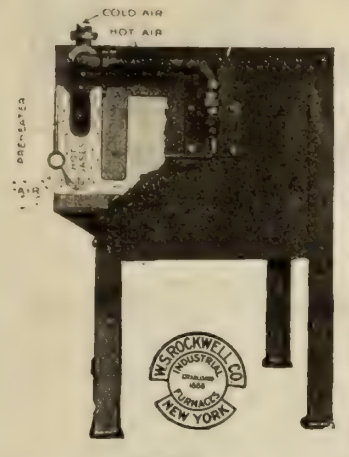
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IDLE MEN IN FORGE SHOPS



(Patented)
Section showing deflection of hot gases, with induced air toward the furnace for protection of the operator and the preheating of air for combustion.

When men are idle, expensive equipment and buildings are also idle.

In past summers, the unbearable heat that caused prolonged shutdowns in many forge shops was **often due to faulty forges or improper application and utilization of the heat.**

To relieve these conditions, progressive forge shops are installing Rockwell Economizer Forges.

These forges enable the men to **work steadily and in comparative comfort.** They also afford other advantages in the way of **decreased operating cost, better quality of product,** and **decreased floor space.**

Write for Bulletin 239-T, dealing with improved methods of heating and handling material, layout of equipment, and other factors influencing the cost of production.

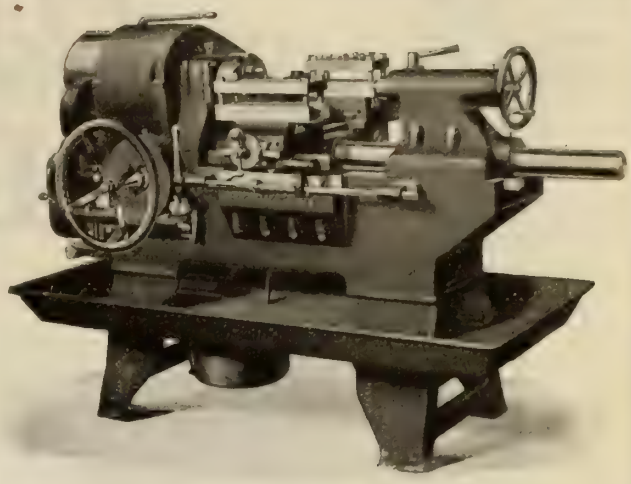
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Increase your production and cut your costs by installing Rockford Automatic Lathes. They are built to stand severest service, have three changes of speed, positive geared feed and automatic stop. The feeds on both front and rear heads are controlled by the same feed lever. All cuts are taken simultaneously by front and rear tools. Will swing work up to 14 inches in diameter and take 18 inches between centers. Write for full particulars.

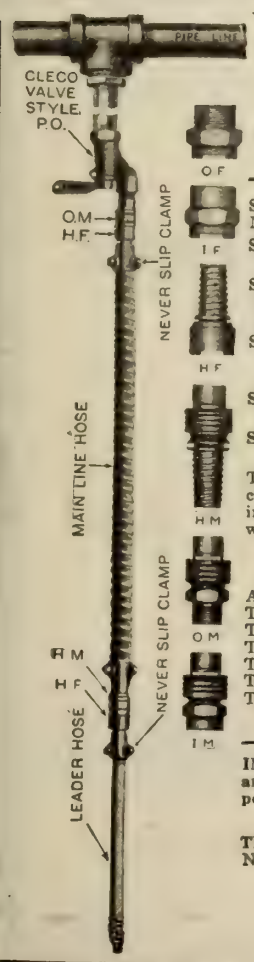
Manufactured by

Rockford Machine Tool Company

Rockford, Ill.

Cleco Pressure-Seated Air Valves

Bowes Air Hose Couplings—Cleco Never Slip Hose Clamps — Cleco Grooved Hose Nipples and Hose Clamp Tool



STYLE O.F. is an Outside Thread Female Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.F. is an Inside Thread Female Pipe End. Made in sizes ¼-inch to 1½-inch.

STYLE H.F. is a Female Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼-inch to 1½-inch.

STYLE H.M. is a Male Hose End with spiral shank to insert into the hose and has groove for the Never Slip Hose Clamp. Made in sizes ¼ inch to 1½-inch.

STYLE O.M. is an Inside Thread Male Pipe End. Made in sizes ⅜-inch to 1½-inch.

STYLE I.M. is an Inside Thread Male Pipe End. Made in sizes ¼-inch to 1½-inch.

The Male and Female Ends of Bowes Couplings interchange in sizes ¼-inch to ¾-inch. Sizes 1-inch and 1¼-inch interchange. The 1½-inch ends interchange only with themselves.

BOWES COUPLINGS

Are instantly connected or disconnected.
They are absolutely air-tight under all pressures.
They quickly pay for themselves by stopping costly leaks.
They interchange in sizes most commonly used.
They have no loose parts to be mislaid or lost.
They are made of brass and will not rust.
The U-shaped Gasket interchanges in couplings ¼-inch to ¾-inch.

CLECO AIR VALVES.

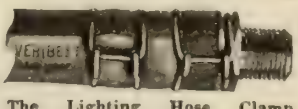

Style R.A.


Style P.O.


Style A.

Style P.O.—Made in sizes ¼ in., ⅜ in., ½ in., ¾ in., 1 in., 1¼ in., 1½ in., 1¾ in., and 2 in. Pipe Outlets. Inlets are one pipe size larger.
Style A—30° Angle Valves, are made in sizes ½ in., and ¾ in.
Style R.A.—Right Angle Valve, made in sizes ¼ in., ⅜ in., ½ in., and ¾ in.

CLECO GROOVED HOSE NIPPLES



Grooved Nipples when attached to the Hose with Wire Clamps as illustrated cannot "blow out." Wire clamp tool shown below applies the wires to hose.

The Lighting Hose Clamp Tool illustrated applies wire clamps at a cost of 1½ cents each.

In stock: Riveting and Chipping Hammers, Air Drills, Emery Grinders, Sand Rammers, etc.



Use Annealed Wire No. 14

IMPORTANT:—The Small Leaks in your "AIR LINE" mean serious loss in DOLLARS. Have you any idea of the amount of "Air" wasted in small leaks at your connections? Air Leakage through 1-16 in. opening equals 5.32 cu. ft. per minute at 80 lbs. It will pay you to install Bowes Couplings and Cleco Valves, which will stop costly leaks.

Bulletins Nos. 46, 48 and 51, mailed on request.

THE MODEL HOSE LINE illustrated shows correct styles of couplings and valve to use and proper way to attach the Cleco Never Slip Hose Clamps to Bowes Couplings. No "blow-offs" can occur when "Cleco" Clamps are used.

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

84 Chestnut St., TORONTO, ONT. 337 Craig St. W., MONTREAL, QUE.

The Kind of Wiping Cloth *You* Would Order!!

CLEAN!

All Dust Removed - Sterilized at 240 Degrees

IF YOU had to use a Wiping Cloth, you would make sure first of all, that it was **clean**. You would not want to endanger your own health with a rag of doubtful origin. Why then ask your employees to use Wiping Cloths that are a positive menace to health?

As Pure as the Most Carefully Laundered Linen

SUNCLO Wiping Cloths are first boiled with an extra strong solution of soda. They are then washed with soap, and after several rinsings in fresh water, they are dried and sterilized at the extreme temperature of 240 degrees. So clean are they that they can be used in the home without the slightest hesitation.

Cleanliness is not the only feature. The rags are cut to usable sizes; buttons, hooks, etcetera, are carefully removed, and the finished Wiping Cloths—soft, free from anything likely to scratch or mar the finest surface,—are packed in neat and compact bales.

Be sure in your next order for Wiping Cloths you specify—SUNCLO—The Wiping Cloth of Merit.

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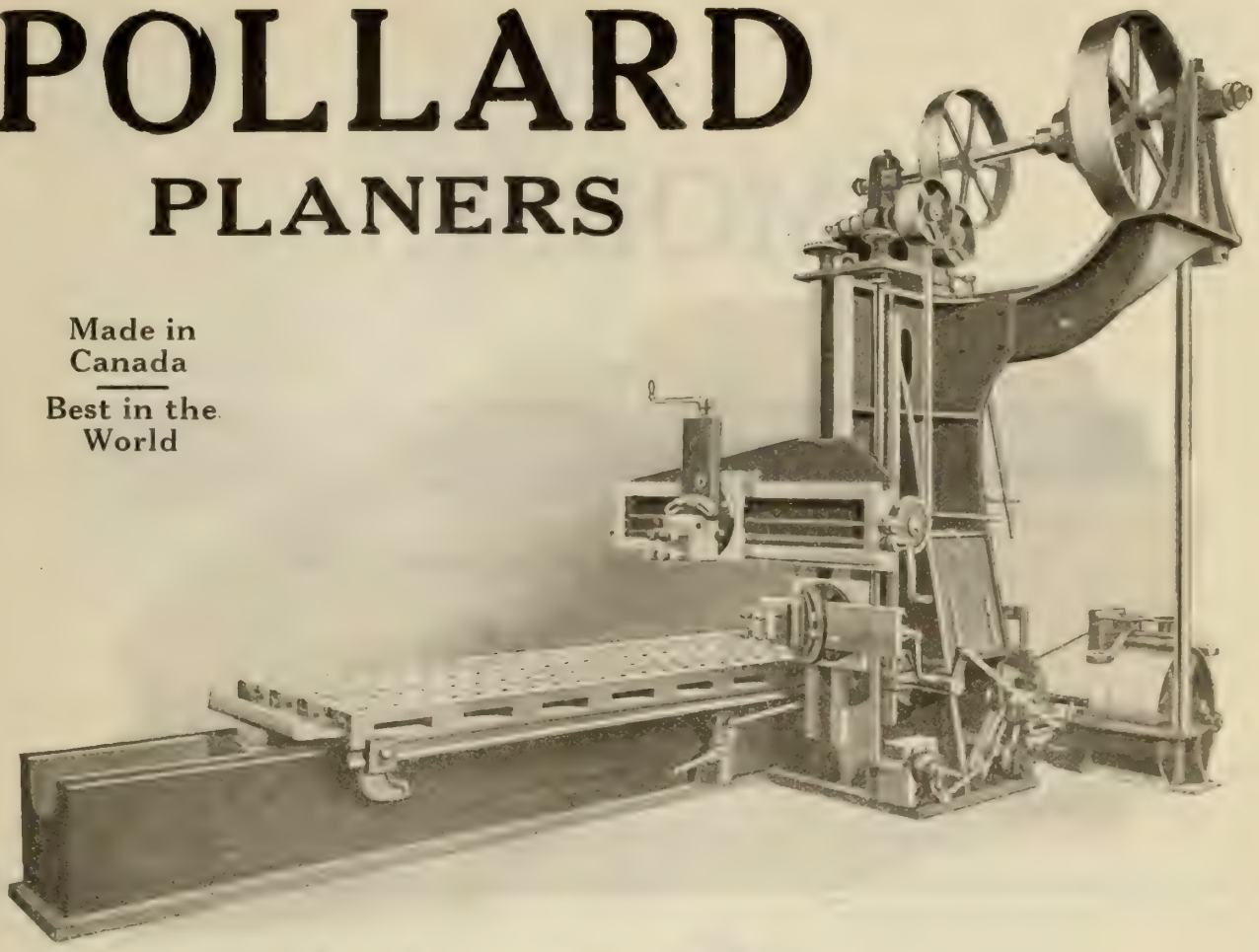
PHONE ADEL. 3197, ADEL. 4636

Revised price lists of SUNCLO Wiping Cloths, giving grades and prices, will be mailed at your request.

POLLARD
PLANERS

Made in Canada

Best in the World



—Save Workmen's Wages

Advantages—The advantage of the openside planer is, of course, "the open side," the absence of a limiting distance between two posts. Long pieces can be cross planed to advantage. Work wider than the table can be planed on such a machine, where a two post machine of perhaps twice the size and initial cost would otherwise be required.

For regular production work the openside is equal in every way to the two post design of machine.

It has advantages. It has no disadvantages.

SPIRAL GEAR DRIVEN

Belt troubles eliminated. Smooth running at high speeds. Long life and minimum power.

ATTACHED COUNTERSHAFT

All shafting independent of building. Belted direct from motor or line shaft.

SIDE HEAD DESIGN

Power raise and lower is an original feature, insuring increased speed and additional comfort to operator.

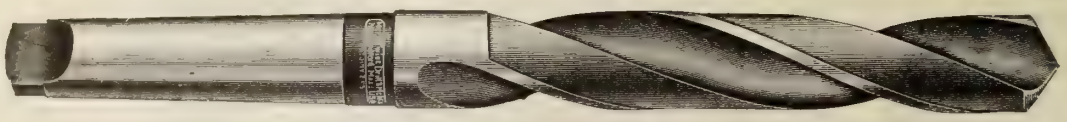
SIZES

42 in. wide. 48 in. high, lengths 12 ft. 0 in. and 14 ft. 0 in.

Pollard Manufacturing Co., Ltd.

Niagara Falls, Ont.

"MORSE"



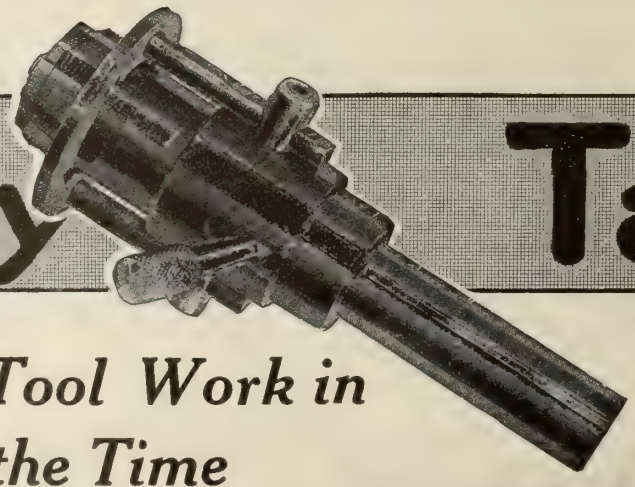
This name on a tool inspires

Confidence

Morse Twist Drill and Mch. Co.

New Bedford, Mass., U. S. A.

Murchey Taps



Get Out Your Tool Work in One-half the Time

Doesn't this sound interesting to you? Doesn't it sound convincing enough to specify Murchey Collapsing Taps in your next order? You'll find by actual experience that every word of it is true. Murchey Taps and Dies will actually boost your production fifty per cent. and do better work than ordinary tools.

Collapsible Construction

The Collapsible and adjusting features of Murchey Taps enable convenience and quick-acting operation. Built for speed, they maintain their rigidity under the heaviest strains.

Murchey Tools have proved their money-saving qualities to others. Let them do the same for you. A sample Murchey Tap and Die will be sent on approval by writing us.

The Coats Machine Tool Co., Ltd., Caxton House, Westminster, London, S.W., England
Fenwick Freres & Co., 16 Rue Fenelon, Paris, France.

Murchey Machine & Tool Co., 75 Porter Street, Detroit, Mich.



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FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

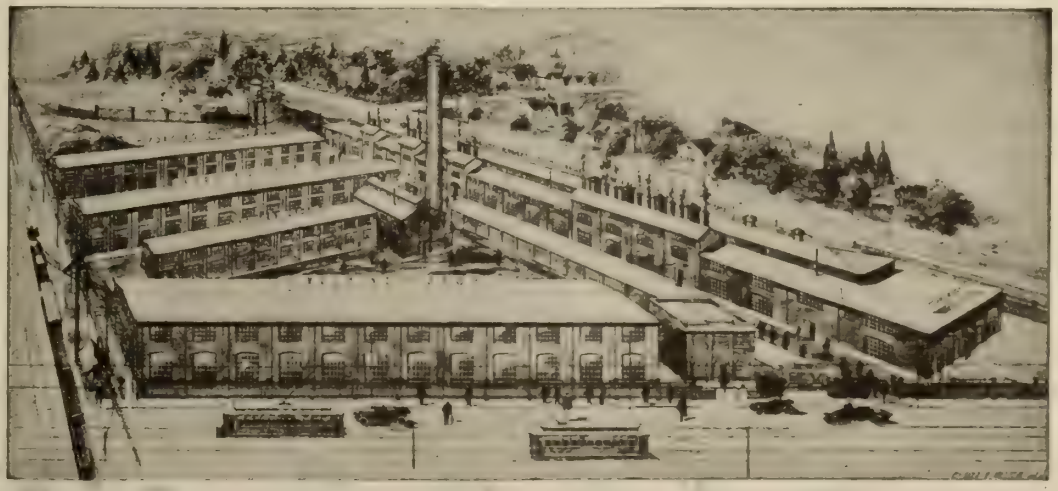
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Foundries, Limited *Hull, Quebec*

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Machine-Moulded Gears

"H I S C O" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

What an eminent authority says on costs:

The correct basis of distribution of rent, insurance, taxes, repairs and depreciation is **time.** It is clear, also, that such expenses as power, light and heat when applied to actual productive operations are logically distributed on a **time** basis through a machine rate.

DEXTER E. KIMBALL, M. E.

Professor of Machine Design and Construction, Cornell University.

Your Chief Cost is TIME and Your Chief Loss is TIME

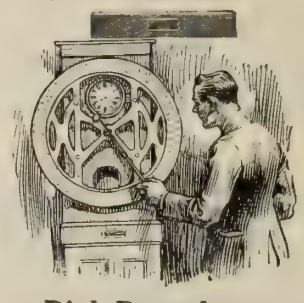
WHEN you thing of costs—as all business is doing today—think of Time, which chiefly governs those costs. Time is at once the most expensive and the most elusive factor in a business. It should receive first attention when increased efficiency and economy are sought.



Job Recorder



Card Recorder



Dial Recorder

International Time Recorders

keep time mechanically: encourage punctuality and full-time production; stop time leaks and provide full and accurate data for correct payrolls, greatly reduced clerical work and expense.

International Job Time Recorders complete the protective policy by showing the exact distribution of time in each working day, job by job. They supply necessary cost-keeping records, improve superintendence, link each day's working hours with the actual results accomplished and give every minute its true production value.

Internationals are made in 260 models, either electrically-operated or spring-driven and adapted to all lines of business.

May we show you how YOUR requirements can be filled perfectly?

INTERNATIONAL BUSINESS MACHINES CO., LIMITED

FRANK E. MUTTON, Vice-President and General Manager

Head Office and Factory, ROYCE AND CAMPBELL AVENUES, TORONTO

OFFICES AT VANCOUVER, WINNIPEG, WALKERVILLE, LONDON, HAMILTON, TORONTO, OTTAWA, MONTREAL, QUEBEC, HALIFAX, ST. JOHN, N.B.

Also manufacturers International Dayton Scales and International Electric Tabulators and Sorters.



"At Your Service"

International Time Recorder Service Men Cover Canada

Equip Yourself to "Turn the Corner"

International Time Recorders

Speed up production, trace business wastes, record losses, prove costs and insure the payroll. When you buy an International you have the assurance—not merely the promise—of continued service. Our service does not end with the sale. It begins there. Our Service Stations with their staffs of skilled men are established for your convenience in all the principal cities of Canada. Treat your Recorder as well as you do your delivery truck—have it inspected occasionally.

Our experience is at your disposal in equipping yourself o turn the corner. A card will bring one of our representatives.

International Business Machines Co., Limited

FRANK E. MUTTON, Vice President and General Manager

Head Office and Factory, ROYCE AND CAMPBELL AVENUES, TORONTO

For your convenience we have Service and Sales offices at VANCOUVER, WINNIPEG, WALKERVILLE, LONDON, HAMILTON, TORONTO, OTTAWA, MONTREAL, QUEBEC, HALIFAX, ST. JOHN, NFLD.

Also manufacturers International Dayton Scales and International Electric Tabulators and Sorters.

A MESSAGE FROM I.B.M. CO.

Are You Equipped to "Turn the Corner"?

Are you waiting?
If so, what are you waiting for?
Business is on the move! The head of the procession **has already turned the corner!** Are you going to be a pace-maker or a tail-ender? Use your accelerator! What are you waiting for?

* * * * *

Business is on the move! How do we know? Just a moment—and we'll give you the story in figures. Nothing is more responsive to the quickening and revival of trade than the demand for International Business Machines. Glance at the sales records of the International Time Recorder, the Dayton Scale, the Electric Tabulator, in these you have the real **speedometers** of Business Progress, and here is what the records show:

INTERNATIONAL TIME RECORDERS—Sales within the last two months increase 40 per cent. over those of preceding four months.

DAYTON AUTOMATIC SCALES—Sales to date in 1921 increase 18 per cent. over those of 1920.

INTERNATIONAL ELECTRIC TABULATORS—Sales in 1921 increase 20 per cent. over 1920.

* * * * *

Ponder these figures and you know what employers of labor, and the men in the mercantile field all over Canada, are thinking and doing. The men and the firms that "turn the corner" first are those who reduce overhead and improve their merchandising with the modern, high-class International Business Machines.

* * * * *

What are YOU waiting for?

—INTERNATIONAL BUSINESS MACHINES CO., LIMITED

CUT GEARS

Theoretically Correct

PROMPT SERVICE

ROBERT GARDNER & SON
LIMITED
52 NAZARETH ST., MONTREAL, P. Q.

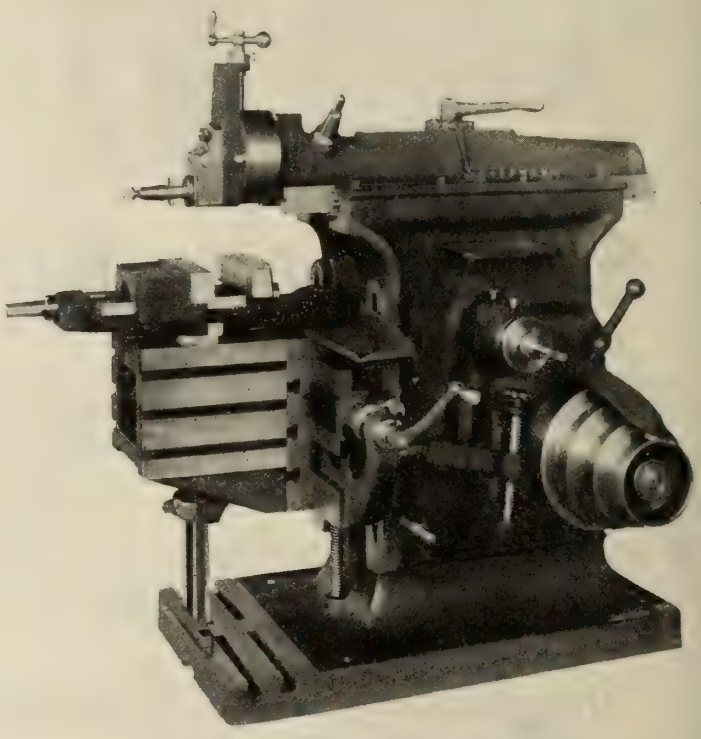
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16" Production Shaper

Designed from years of experience and built to give real lasting service.

The finest material and workmanship are embodied in this machine. You will find it exceedingly accurate and dependable. There are many outstanding features in this machine which you should know about. Ask for further information from any reliable machinery dealer or direct from



D. McKenzie Machinery Co.
Manufacturers
Guelph Ontario Canada

"All Canadian Made"

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

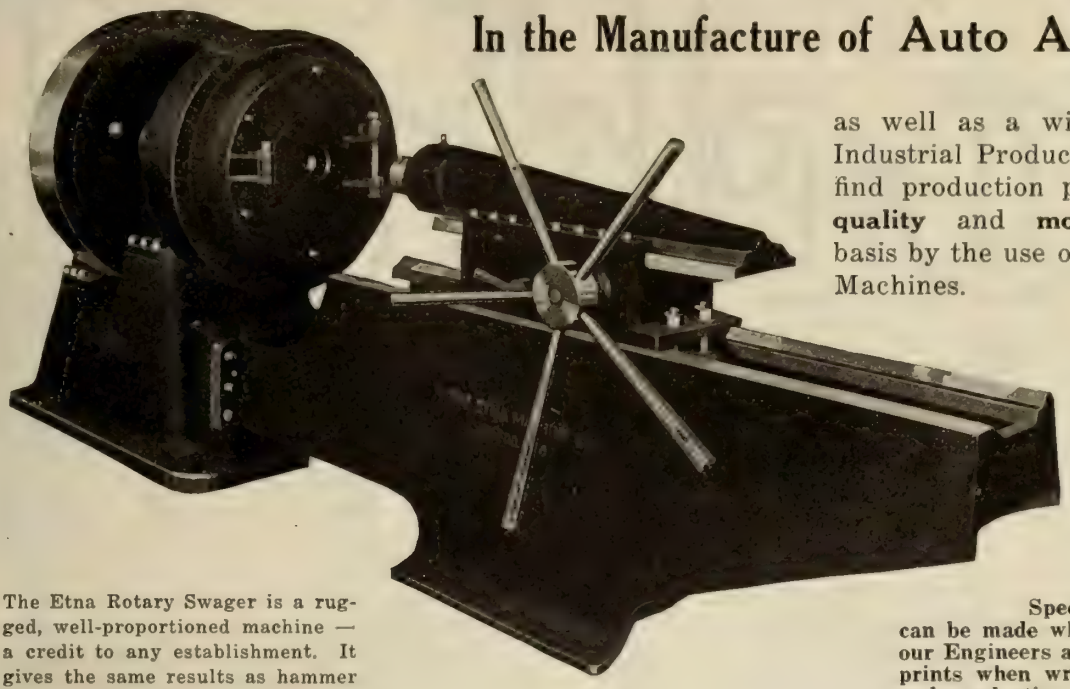
HANNA

M·A HANNA & CO.

Cleveland Toronto Cincinnati
Pittsburgh Buffalo Detroit

ETNA SWAGING MACHINES

In the Manufacture of Auto Accessories



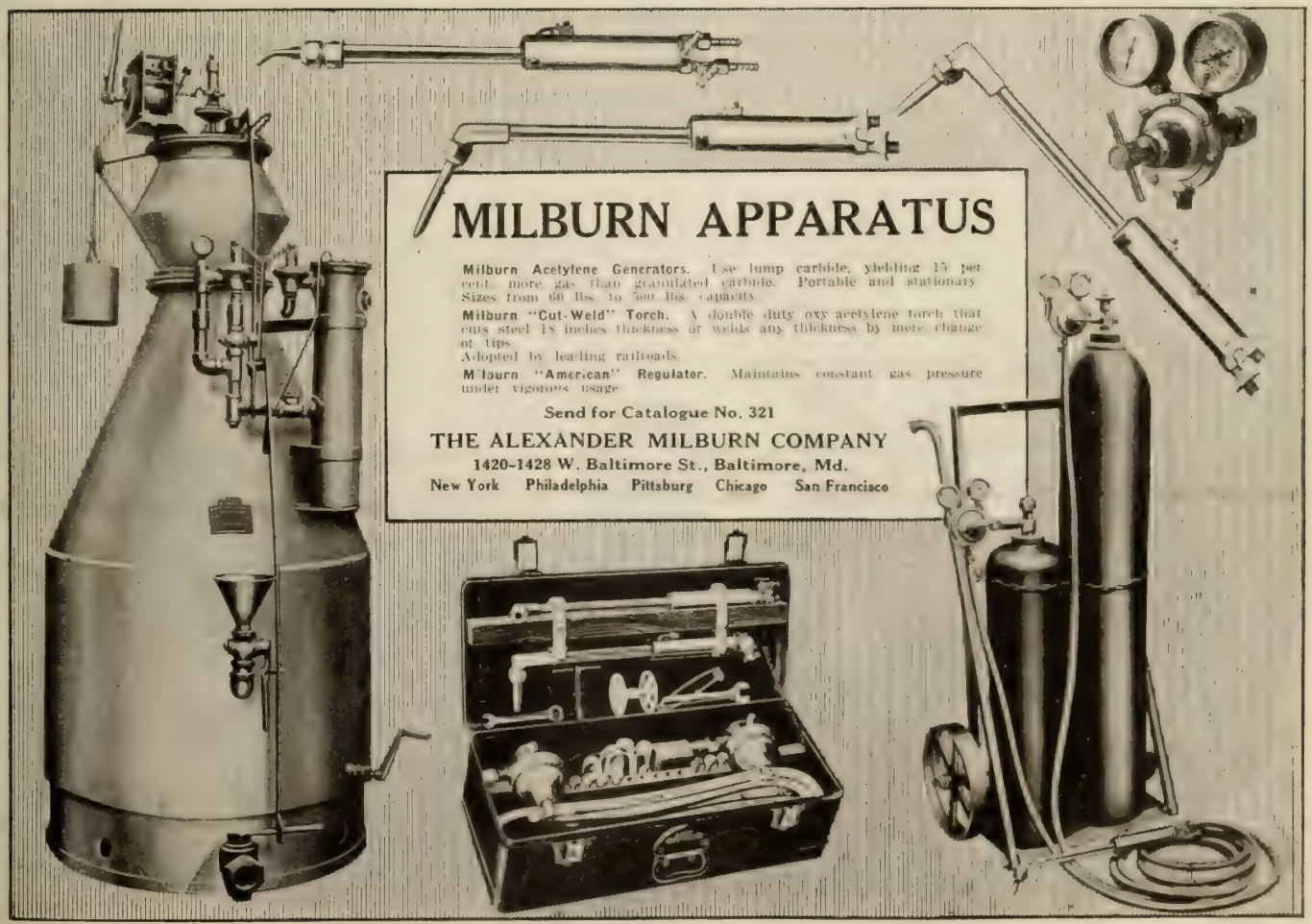
as well as a wide variety of Industrial Products, many firms find production put on a **better quality** and **more economical** basis by the use of Etna Swaging Machines.

Etna Swaging Machines are capable of continuous, unrelenting hard work. They will outlast any other swager made. Built in all sizes from one-half inch diameter to 4-inch diameter.

The Etna Rotary Swager is a rugged, well-proportioned machine — a credit to any establishment. It gives the same results as hammer blows, while eliminating all waste.

Special Etna Swagers can be made where desired. Have our Engineers advise you. Enclose prints when writing for catalogue and production estimates will be furnished.

THE ETNA MACHINE CO., TOLEDO, OHIO



Rockford

Horizontal Boring Machine

For Heavy Duty

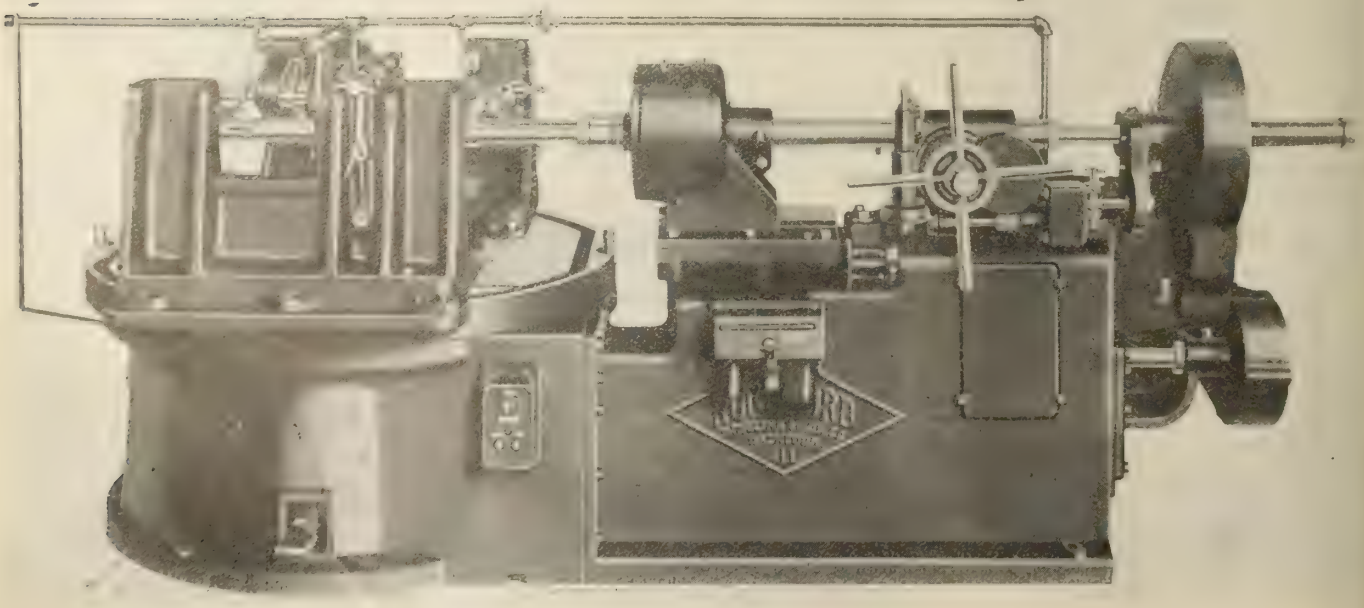
HIS type of Rockford is unexcelled for continuous production. It is of the single end type equipped with two spindle drive head and indexing table, complete with fixtures, cutters and line bars. Its construction insures continuous production of the first quality and continued accuracy. There is no machine which so well meets the requirements of accuracy, production and adaptability as does the Rockford.

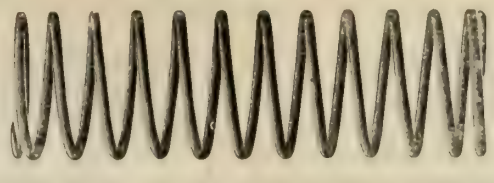
The drive is directly by motor with interchangeable pick-off gears for speed changes. The table may be indexed 180 deg. to bring both fixtures in turn into operating position. One fixture is being loaded while the other is in operation.

Complete equipments are a Rockford specialty. This equipment is the choice of most automotive engineers for solving their boring problems.

Rockford Drilling Machine Co.

Rockford, Illinois, U.S.A.




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Flat material

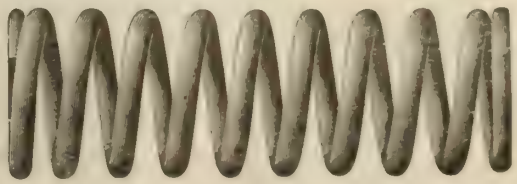
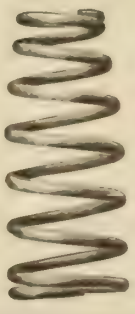


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Constructed on a scientific principle of sliding wedges and compressible cushion, making the packing self-setting.

P.P.P. in the stuffing-boxes of your engines, pumps, compressors, etc., will greatly increase the efficiency of your plant as well as reducing operating expenses. The reasons why are explained in detail in "The Story of Some Friction Tests" mailed free to any Engineer.



EBONITE Sheet Packing

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Orders for P.P.P. and EBONITE during the past month show that many industries have taken on increased activities.

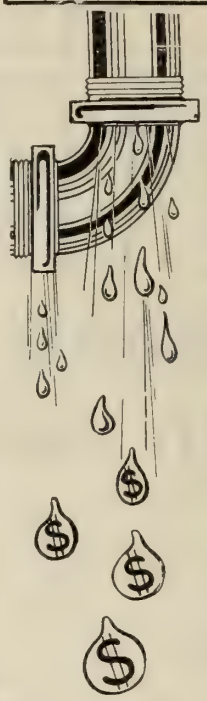
The fact that others are securing the benefits by their use will not help you or your plant.

If you are not using these packings place an order today.

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Mfrs. Mechanical Rubber Goods

General Canadian Agents:
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SMOOTH-ON ELASTIC CEMENT No3



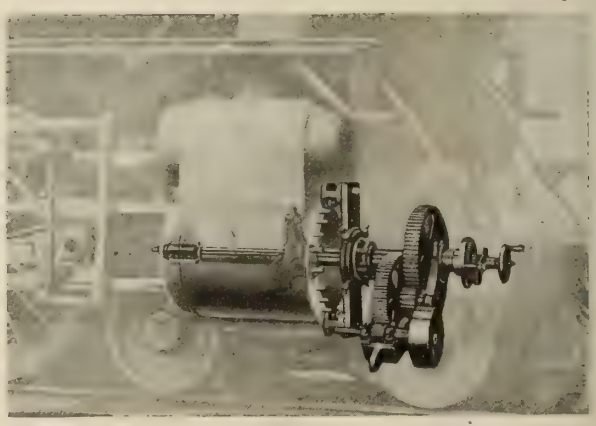
Leaks Run Into Dollars

Stopping leaks in flanges and screw-thread joints is the easiest thing Smooth-On Iron Cement No. 3 does. Cracks in pipes, boilers, cylinders, valves—almost any power plant part—can be repaired easily and quickly.

Send for our new Smooth-On Instruction Book No. 18. It illustrates and describes many repairs actually made with Smooth-On Iron Cement. Most of these repairs being described by the engineers who did the work. Many repairs are unusual, but most of the repairs might be needed in your power plant or boiler room any day.

May we send you a copy of Smooth-On Instruction Book No. 18? It's free, of course.

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JERSEY CITY, N. J., U. S. A.
Canadian Distributors: Canadian Asbestos Co.
Montreal Toronto Canada



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UNDERWOOD'S

Locomotive Boring Bar

has many improvements for doing heavy work and is quickly adjusted to the cylinder with one or both cylinder heads off.

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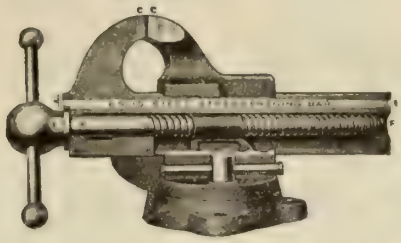
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The result is loss of efficiency, wasted time and effort.

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Best results will be obtained by specifying one of these famous five brands, the standard for over fifty years.

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Made in Canada by:

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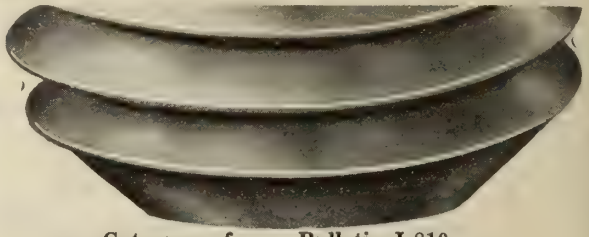
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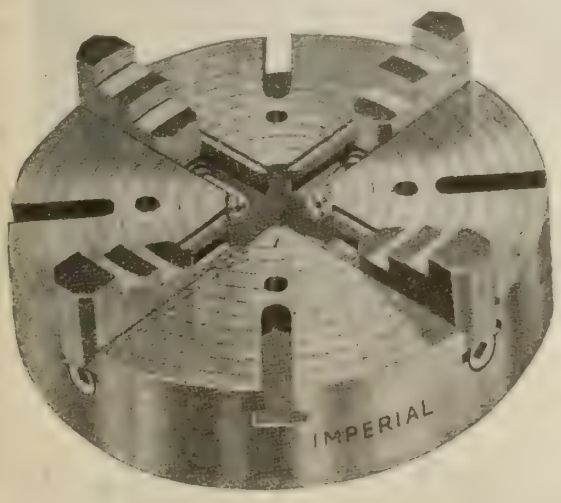
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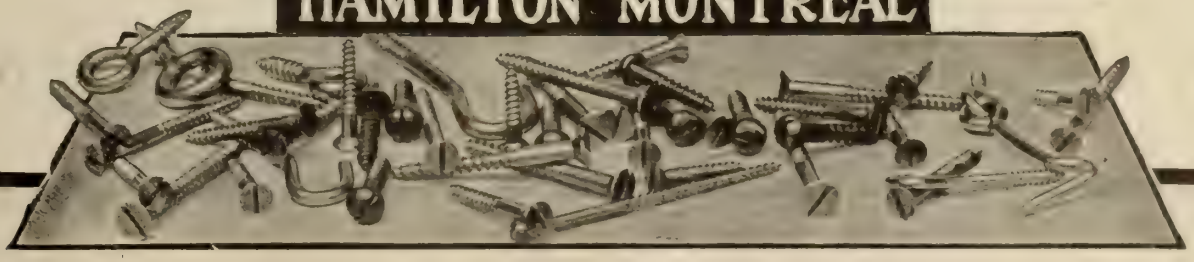
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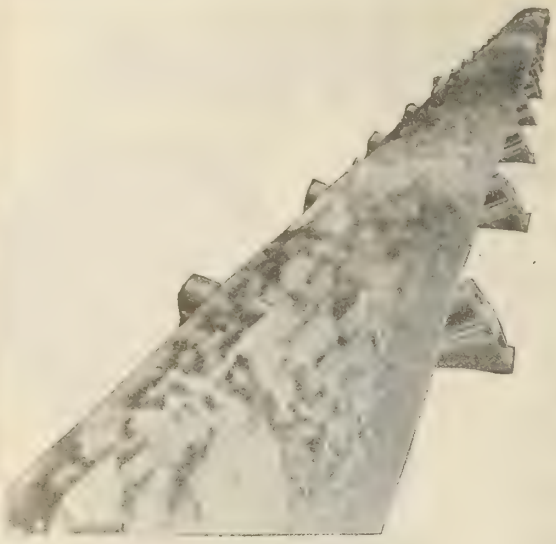
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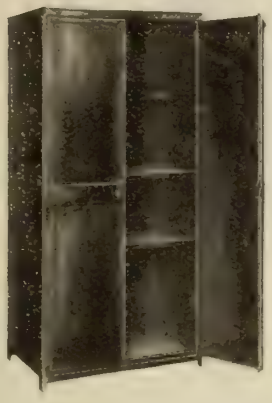
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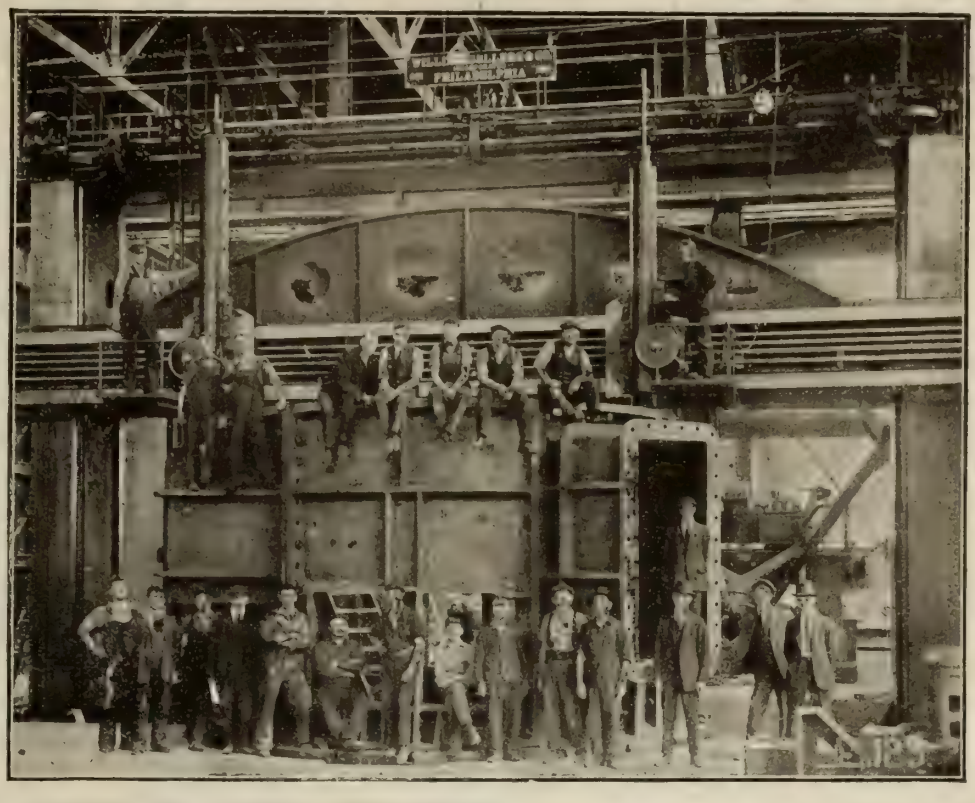
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FLOOR SPACE — SEPARATE ENTRANCE— Suitable for machine shop or light manufacturing, with power, reasonable rental with long lease if desired; also small foundry building, suitable for 4 to 6 moulders; in good manufacturing town; railway centre. Apply Box 789T, Canadian Machinery.

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WANTED AT ONCE — THOROUGHLY COMpetent mechanic of good character and judgment, to take charge of production in a modern plant manufacturing automatic screw machine products. Must be thoroughly conversant with up-to-the-minute methods of producing on automatics and finishing by secondary operations both high-grade and commercial products, with a complete knowledge of tools, and tool designs best adapted to get these results. Must be able to train and handle help, enthusing them by personal leadership and energy so that efficiency can be constantly maintained. To a thorough mechanic who has a capacity for getting things done, this is a real opportunity. In applying state age, nationality, experience, and lowest salary expected as a start. Plant is up-to-the-minute in modern equipment. The Galt Machine Screw Co., Limited, Galt, Ontario, Canada.

FACTORIES FOR SALE TWO DESIRABLE plants; one at Mount Forest, constructed of brick, floorage over 40,000 square feet, formerly operated by Weir Wardrobe Co.; and the other at Guelph, stone florage over 50,000 square feet, formerly operated by Dominion Casket Co. Apply Box 777G, Canadian Machinery.

CANADIAN PATENT ON OPERA CHAIR spring, which automatically raises seat; can be manufactured at low cost and show big profit; now installed in some of best theatres in Toronto; every theatre, from smallest to largest capacity, a likely purchaser; will sell outright or for cash and royalty basis. Box 777T, Canadian Machinery.

LETTERS PATENT

The proprietors of Letters Patent M. R. Matti No. 137772 relating to "Arrangement for changing the moment of fuel injection into the combustion chamber during the run of the motor and for regulating the quantity of fuel" desires to dispose of the patent or to grant license to interested parties at reasonable terms with a view to the adequate working of the patent in Canada.

Enquiries to be addressed to the patentees, Svenska Aktiebolaget Nobel-Diesel, Nynäshamn, Sweden.

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
A8K U8.
THE KATIE FOUNDRY, GALT, ONT.

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WANTED—BY AN ESTABLISHED CONCERN. **Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)**

FOR SALE

FOR SALE — FORTY HORSE-POWER VERtical Boiler 120-lb., steam, Ontario inspection, 129-2" tubes 5' 9" long, 71 of them new. Complete with grates, smoke stack and cast iron base. $500.00 F.O.B. Port Arthur.

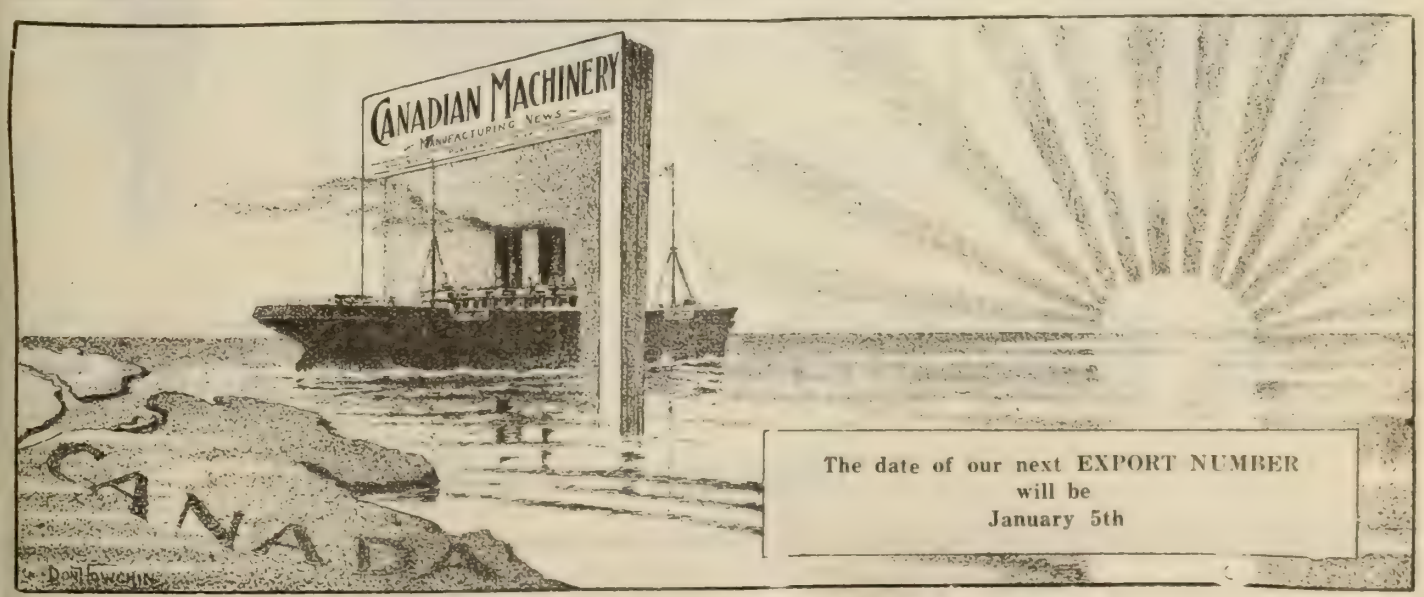
Return Tubular Boiler 72" x 18" for 115-lb. steam, Ontario inspection, 84-3½" tubes, straight seams, triple rivetted butt joint. This boiler with full flush front and doors, arch-plates, soot doors but no grates or fittings, for $900.00 F.O.B. Port Arthur. Port Arthur Boiler Works. (c2m)

SCREW MACHINE "NEW BRITAIN" SIX spindle automatic, 1⅝" bar capacity; condition new; never been used; located in Canada; low price for quick sale. Box No. 789M. Canadian Machinery.

FOR SALE — A NUMBER OF SECOND-HAND machine tools in excellent condition; these may be inspected at our works. Box 787T. Canadian Machinery.

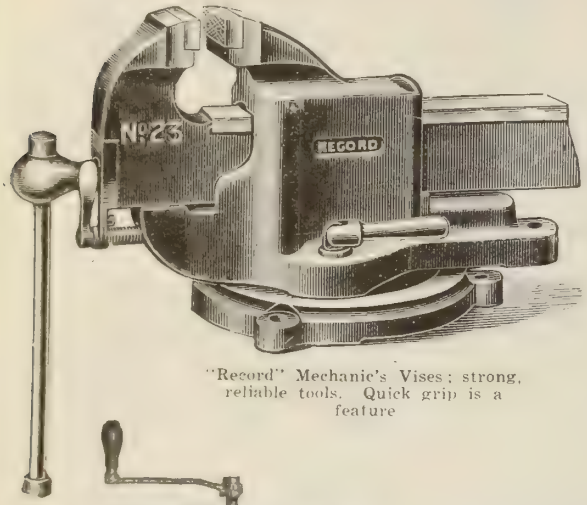
CASTINGS — UNIFORM AND MACHINABLE; repetition contract work; capacity fifteen tons daily; expert metal pattern work; advice or estimates free; also semi-finishing or machine roughing operations. Box 788G, Canadian Machinery.

1 NO. 2 BROWN AND SHARPE MILLING Machine; 1 No. 2½ Le Blond; 1 Le Blond grinder; 28" Barnes drill. Phone Kenwood [illegible] Box 787G, Canadian Machinery.

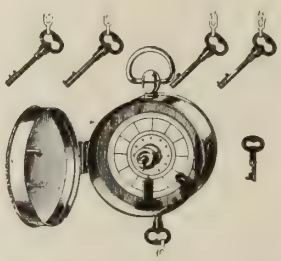


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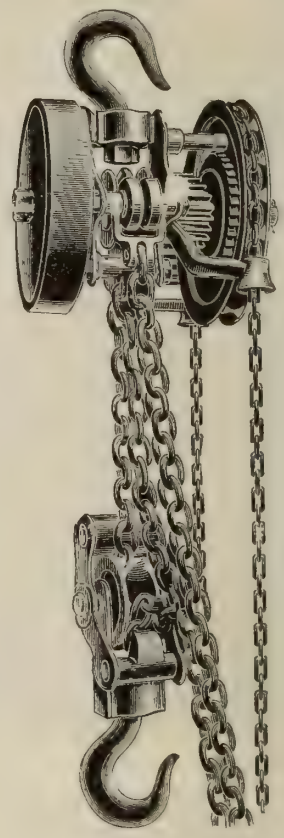
Aikenhead's Offerings of Tools Are Designed for the Man Who Insists on the Best



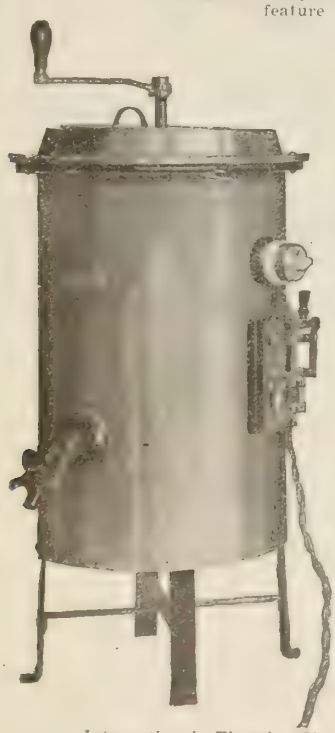
"Record" Mechanic's Vises; strong, reliable tools. Quick grip is a feature



Nightwatchman's Clocks; Fitted with keys for six stations. Accurate and well built devices.



Simplex 2-Speed Hoist. Saves time.



International Electric Glue Heaters. The economy way.

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—Essential to Quality and Quantity Work



Recognized as the world's standard of accurate gauging.

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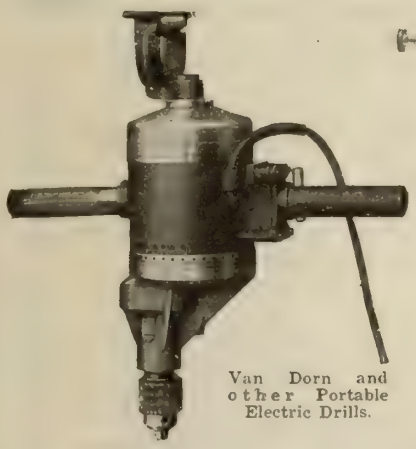


AIKENHEAD'S

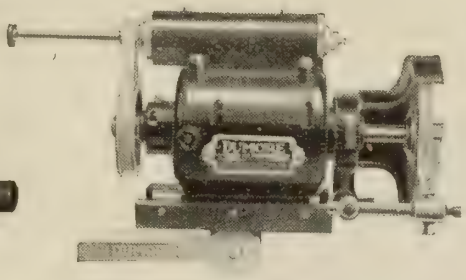
17 Temperance Street

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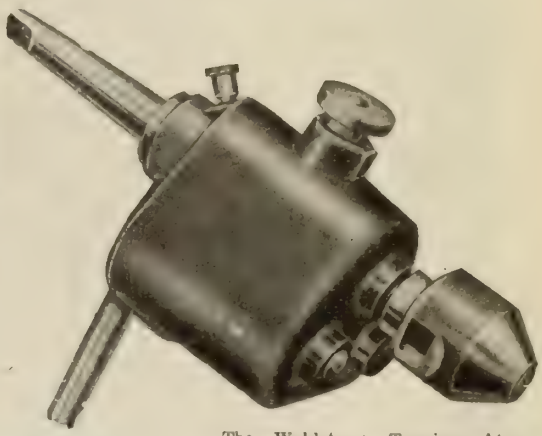
Aikenheads Can Guarantee Complete Satisfaction To Every Purchaser



Van Dorn and other Portable Electric Drills.



Dumore High Speed Electric Grinders: light, powerful and accurate. High speeds.



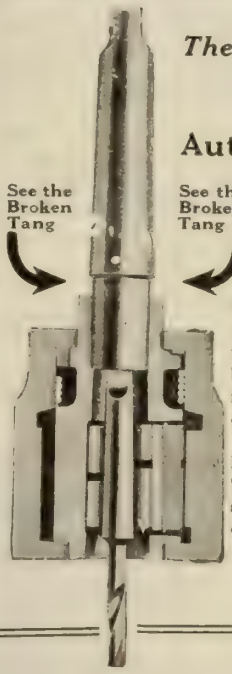
The Wahlstrom Tapping Attachment: prevents tap breakage by keeping the lands free from chips.



Quart size International Glue Heater.

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and state your requirements. We will promptly do the rest.



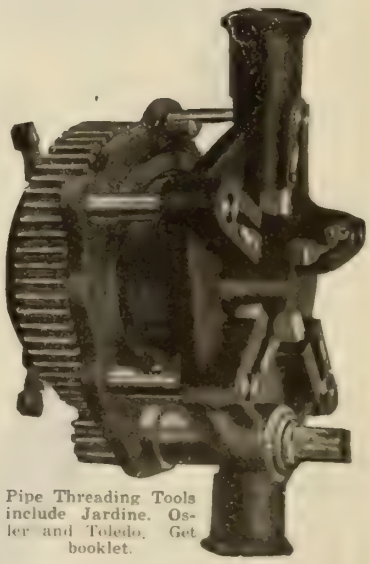
The **Wahlstrom**

Automatic Drill Chuck

—It never slips

Three cylinder jaws operate on cams; the greater the resistance the tighter the grip. For this reason drills with broken tangs can be held firmly. Automatic and instantaneous in action. Reduces cost.

Made to handle No. 1, 2, or 3 Morse Taper Shank tools or all sizes straight shank tools from ¼ to ½ inch. Sent on ten days' trial.



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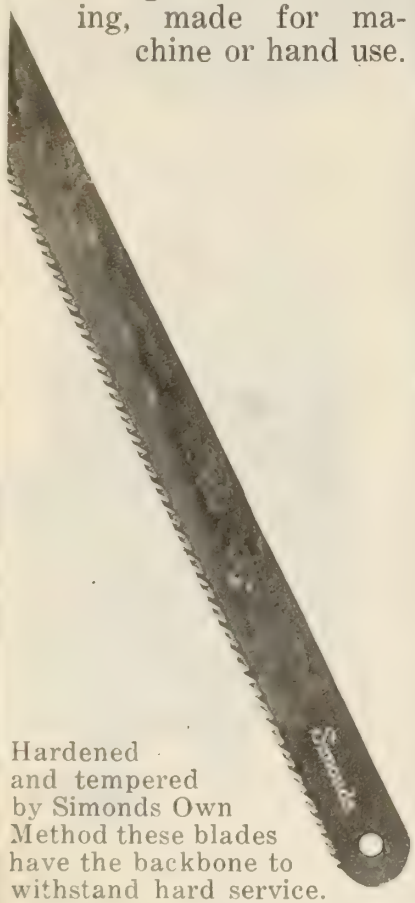
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Toronto, Ontario

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Simonds are the Best Hack Saw Blades on the market. They are fast cutting and non-breaking, made for machine or hand use.



Hardened and tempered by Simonds Own Method these blades have the backbone to withstand hard service. If you require hack saws YOU'LL WANT SIMONDS.

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If your machine shop, or garage, does not include in its equipment a "Rego" welding or cutting torch, why not make it a present of one. It will be appreciated and the time and money it will save you will help to make 1922 a happier one than ever in your business.

Carter Welding Co.,
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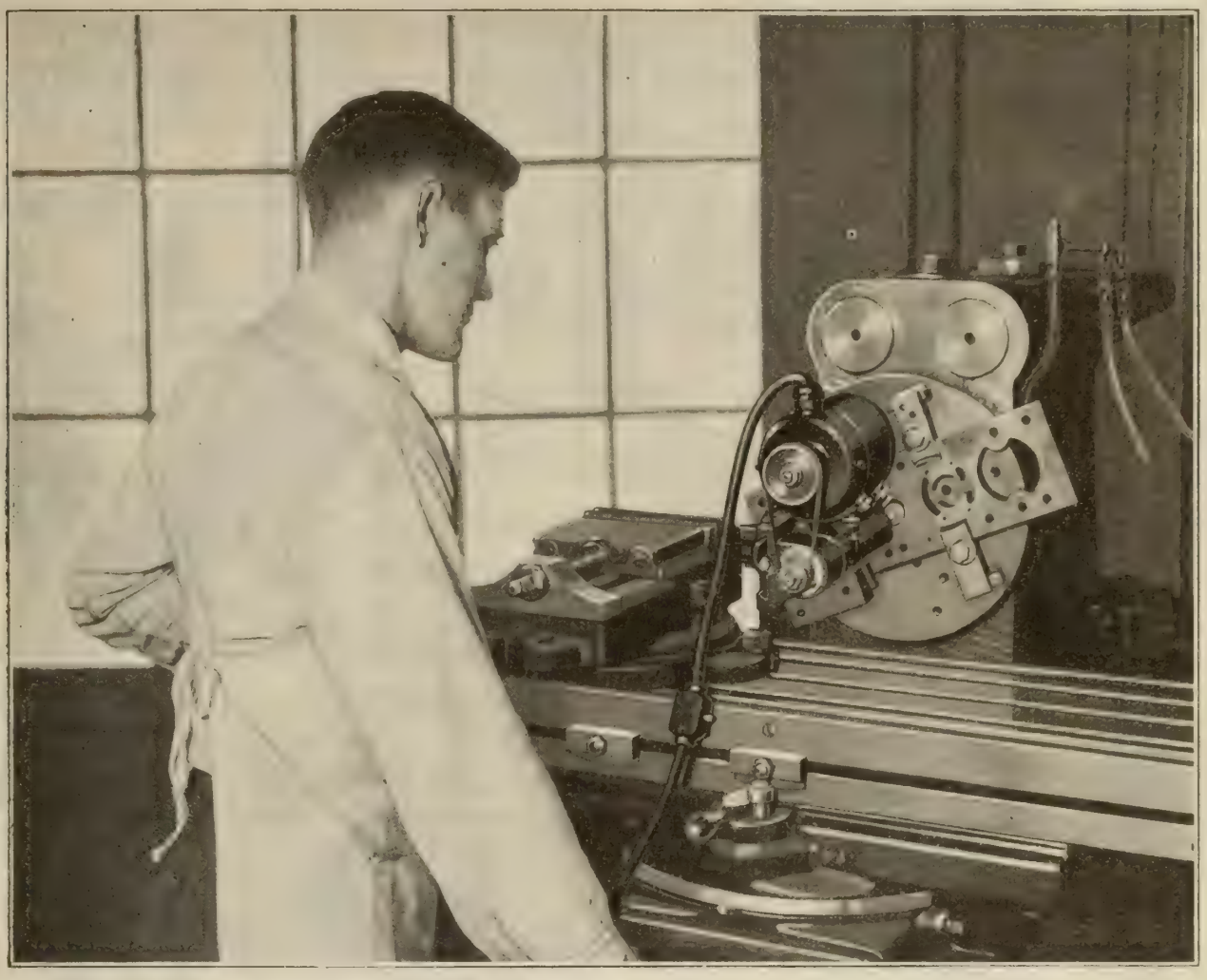
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Many difficult operations are made possible through the perfect running balance—rigidity—correct peripheral speed of wheels—absence of lateral or radial play—and portability of Dumore Grinders.

The illustration above shows the Dumore set up on a milling machine correcting inaccuracies caused in hardening a blanking die. This combination enables you to obtain accurate centers and perfect finish on hardened metal jobs.

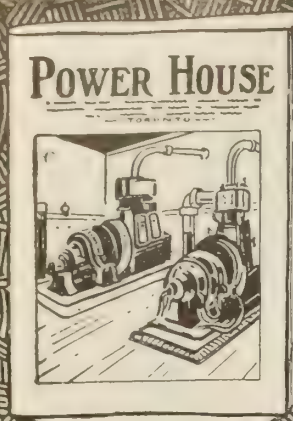
The Dumore can be operated in a vertical position so that the job may be set up on a circular milling attachment.

It can be used anywhere; taking power from the nearest lamp socket.

There is a Dumore for every grinding problem. Ask the man who uses one. Send for our complete catalog and then have your dealer demonstrate the type that meets your particular need.

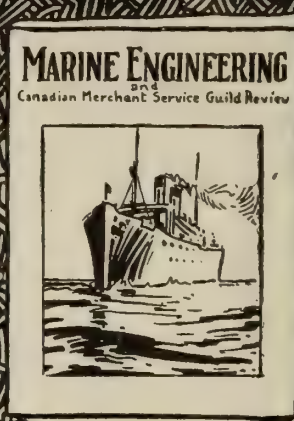
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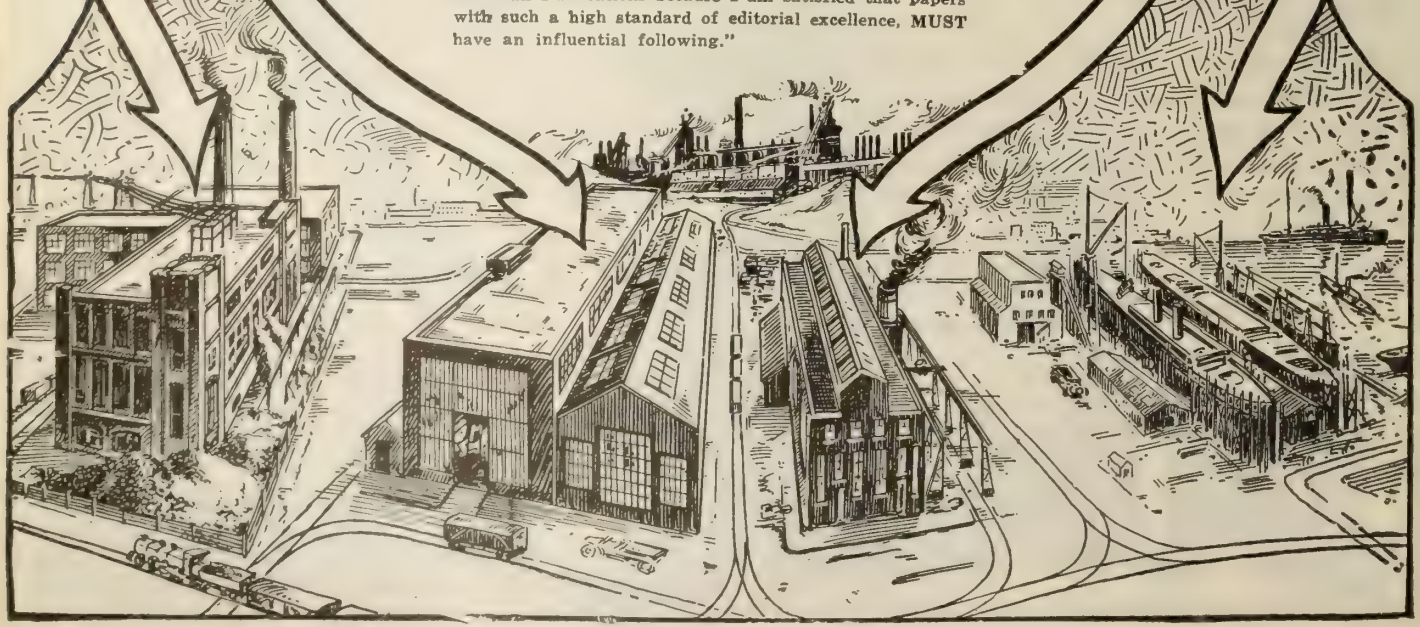
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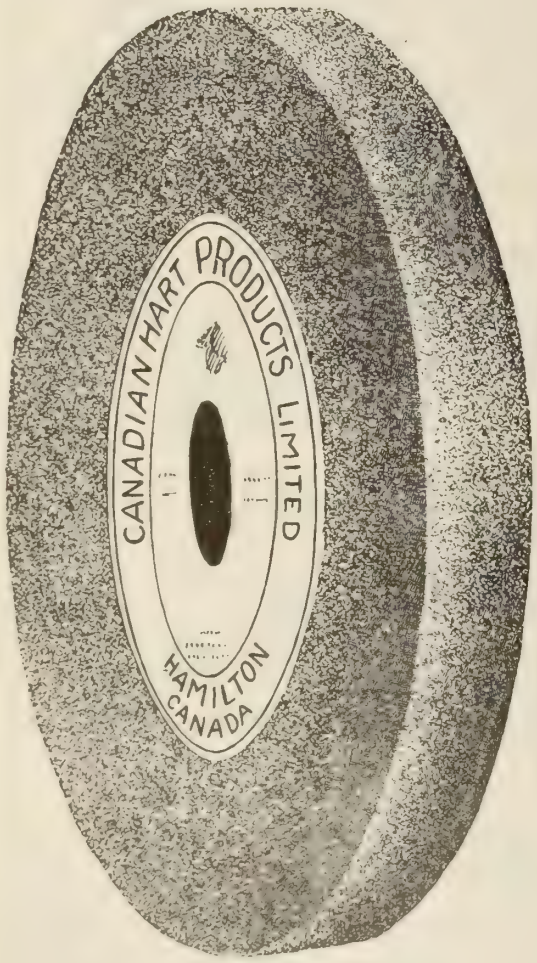
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Hamilton, Canada

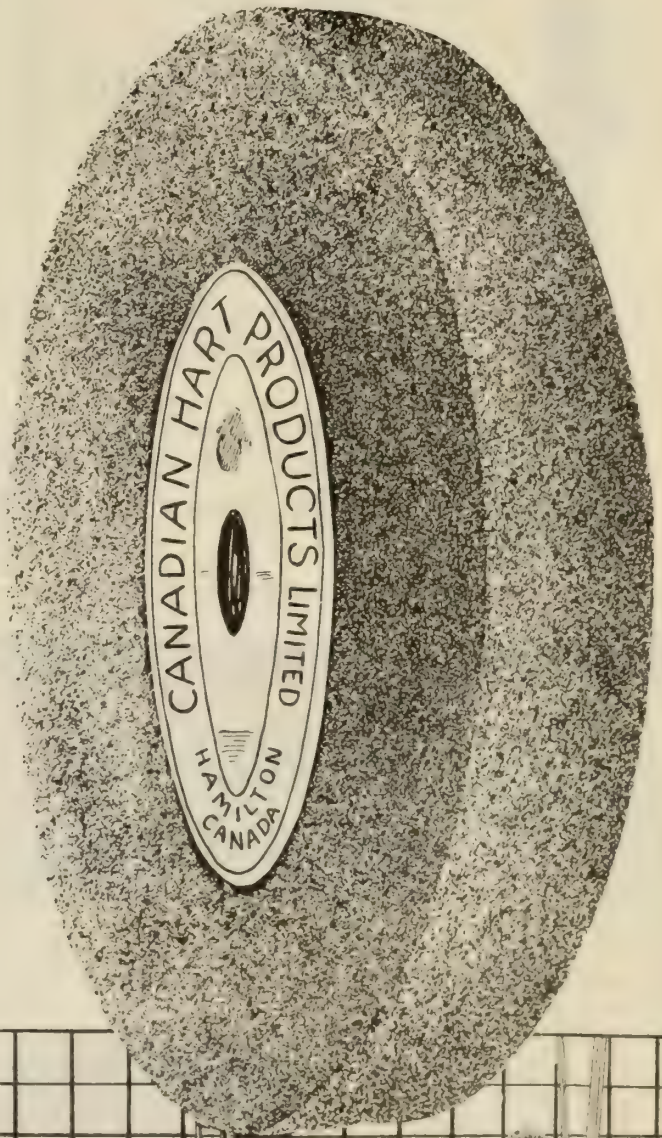
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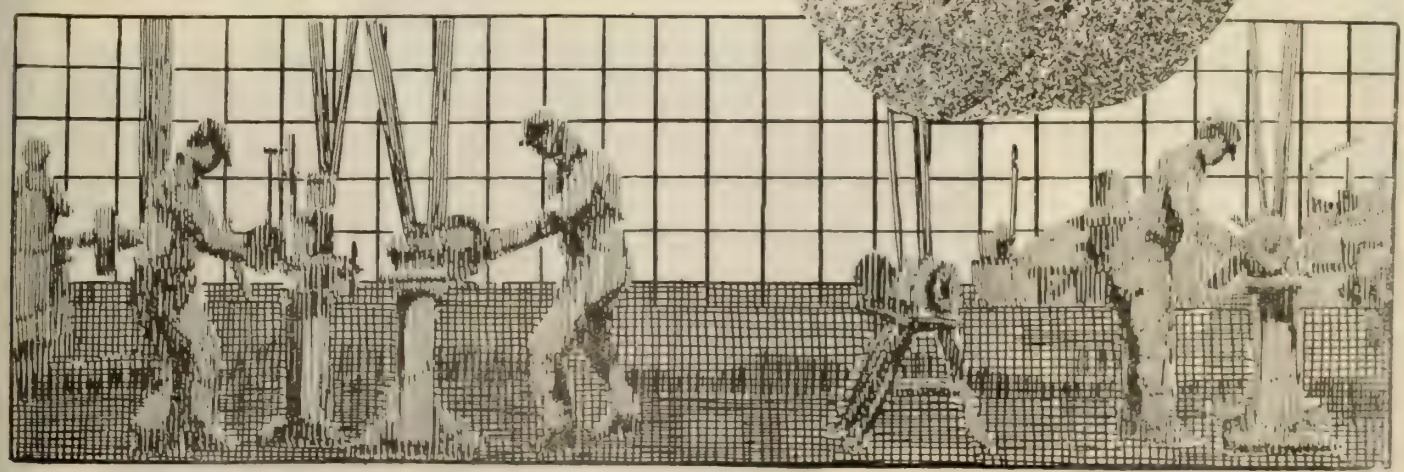
Tell Us The Class Of Work

Then We Will tell You the Wheel to Use

You can secure valuable help by placing your grinding problems in our hands. We assist you to secure the right grain and grade of wheel for every class of work. Use the right wheel and you will save a lot of time, trouble and expense. Tell us the class of work and we will tell you the wheel to use.

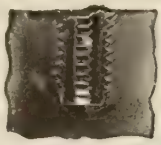






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Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

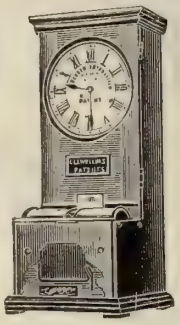
And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

Time Checking Machines, Time Recorders, Watchman's Watches, Recorders for all purposes



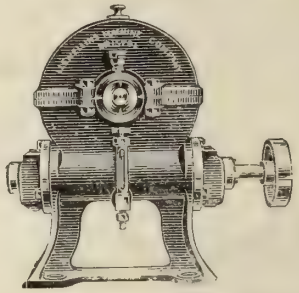
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1—Bertram Lathe, 20″ swing, 10″ bed.

1—Sydney Lathe 18″ swing, 10′ bed.

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1—Whiting Foundry, cyl. 10″ x 52″, iron.

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4—Herbert Morris, 1 ton, 18′ arm.

2—Herbert Morris, 1 ton, 5′ arm.

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Lumsden Building - Toronto

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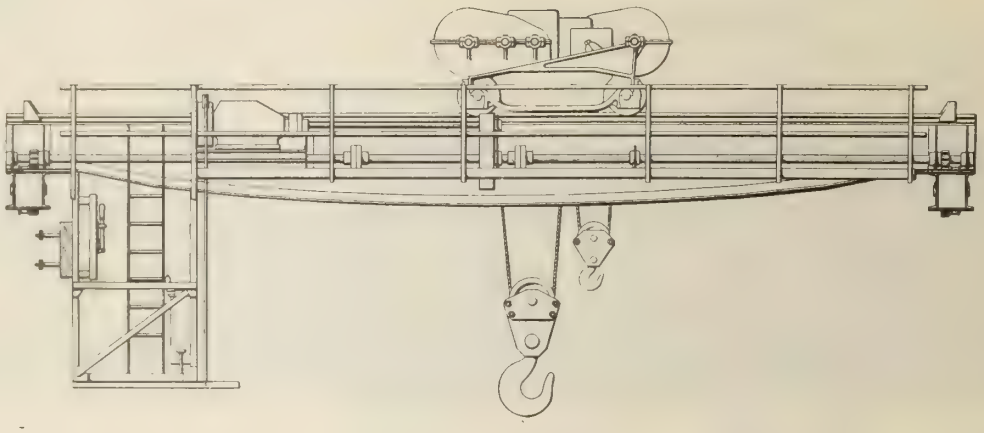
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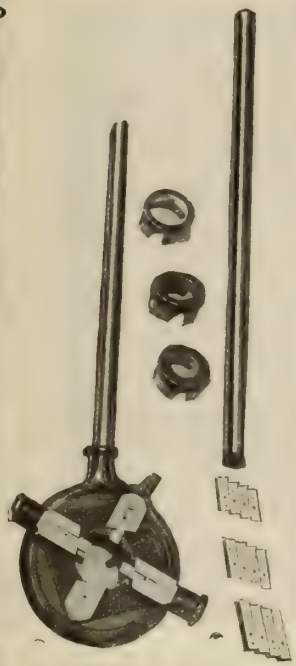
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JARDINE

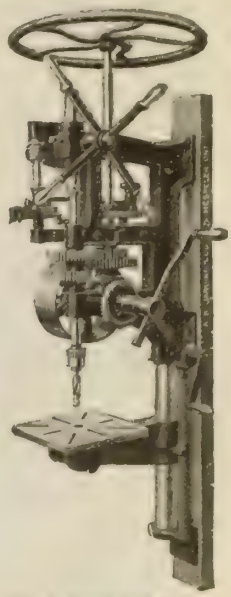
REGISTERED J TRADE MARK

Sole Makers of "Jardine" Pipe-Threading Tools

Machinists' Blacksmiths' Boiler-Makers' and Pipe-Fitters' Tools



No. 1A Toledo Pipe Stock.



No. 6 Hand and Power Drilling Machine

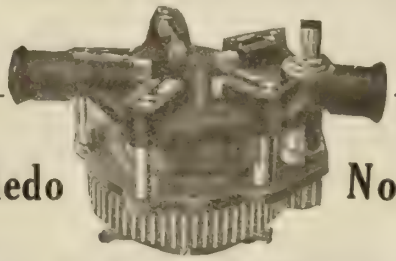
WHEN you purchase these MADE IN CANADA tools you pay no duty, nor exchange rates, and you get tools correct in design, high in quality and efficient in service.

Catalog No. 17 covers our Machinists', Blacksmith's and Boiler-Makers' Tools. Cata'og No. P3 our Pipe Fitters' Tools. Which one shall we send you?



Canadian G ant Power Hammer.

Sole licensees to manufacture and sell Toledo Pipe-Threading Tools in Canada



Toledo No. 2

Geared Adjustable Threading Tool.



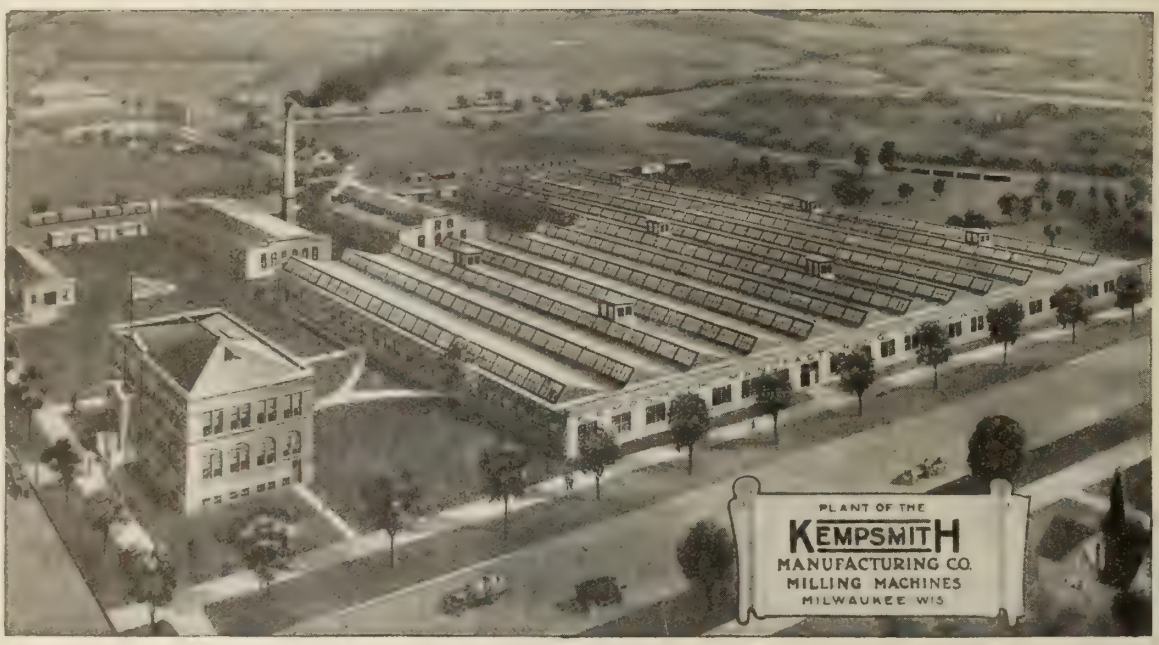
No. 3 Horseshoer's Vise and Bolt Header.

A. B. JARDINE & CO., LIMITED, Hespeler, Ont.

Agents: Winnipeg and West—Stanley Brock, Ltd., Winnipeg, Man. Brockville and East—J. R. Devereux, 358 Beaver Hall Square, Montreal. Belleville and West—W. H. Cunningham & Co., 269 West Richmond St., Toronto, Ont.

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KEMPSMITH



A Tool is Judged by its Makers!

We don't buy machine tools these days without finding out something about the firm that makes them; for a machine tool cannot be efficient unless the parent plant is efficient. Hence it follows logically that the greater plant efficiency means greater tool efficiency. Canadian buyers in investigating our tools will do well to consider the **KEMPSMITH plant.**

The Ideal Plant for Specialized Tool Construction

It is located in a new and rapidly developing section of West Allis, where the ten acres we own give abundant room for expansion. There are four buildings, aggregating 90,000 sq. ft. of floor area; Machine Shop, 250x300 ft., the model shop of its kind; Pattern Shop absolutely fireproof; Power Plant a neat and complete direct connected power unit; three story Office Building. Every detail of system and equipment in the shop is carefully planned for its function in the advantageous construction of this specialized line.

All machines and parts are built in multiple lots, under a complete system of jigs, and templates, and all parts are completely interchangeable at any time. A spacious tool room is centrally located in the shop. There are also separate enclosures for rough stock, finished stock and stores, and for finishing and shipping, so planned that the parts in ordinary course of manufacture shall make an automatic circuit of the shop to the assembling and shipping floors. Recognized experts have planned our lighting systems (natural and artificial) sanitary systems, etc. Consequently the work is done under the best conditions.

THE KEMPSMITH

MILWAUKEE

CANADIAN AGENTS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

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Milling Machines

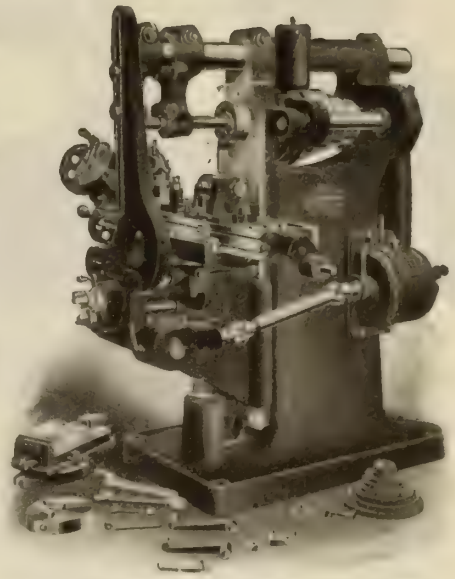
and Attachments

How Durability is Tested

Every machine, whatever size or type, is put to test under cuts and conditions purposely more severe than it will encounter in even the most progressive shops.

Why They Are Guaranteed

So confident are we after this test that every machine carries our definite guarantee. Note the massive proportions of the column, knee, table, etc.; the wide range of feeds; liberal bearings; the excellence of our entire feeding mechanism; the centralized location of operation at front of knee.



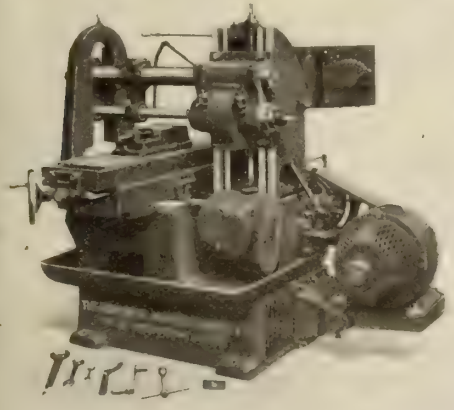
Cone Type Miller: A true reflection of our ideal —highest quality only.

The Three Essential Points

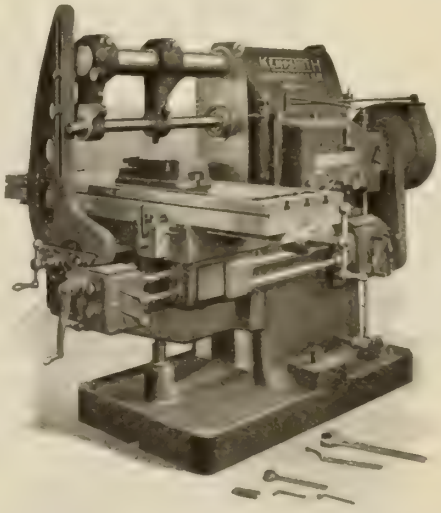
Summing up the foregoing you will see that KEMPSMITH MILLERS represent:

1. A machine design of established excellence.
2. A highly modern factory and equipment with specialized systems.
3. Trained and specialized mechanics under the most favorable conditions and under a system of rigid inspection.

Our line embraces plain and universal milling machines and attachments of all kinds. Write for our latest catalogue.



No. 33 Production Type Miller: For rapid and accurate production.



Maxmiller: A design which is undoubtedly the acme of present milling development.

MANUFACTURING CO.

WISCONSIN, U. S. A.

FOREIGN REPRESENTATIVES:—Barandiaran & Co., 8 Alameda, San Sebastian, Spain; Bevan & Edwards Pty., Ltd., 117-29 King St., Melbourne, Australia; Edgar Bloxham, 12 Rue du Delta, Paris, France; Nielsen & Winther, Blegdamsveg 60, Copenhagen, Denmark; Parke & Lacey Co., Ltd., 60 Clarence St. Sydney, N. S.W., Australia; Selson Engr. Co. 19 Via Botero, Turin, Italy, and 85 Queen Victoria St, London, E.C., England; Spliethoff, Beewukes & Co., Leuvehaven, W.Z., 159 Rotterdam, Holland; American Trading Co., Tokio, Japan, Societe Anonyme Belge Alfred Herbert, 35 Rue de Laekin, Brussels, Belgium; Turner, Hoare & Co., Ltd., Bombay, India.

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Test Your Metals with a SCLEROSCOPE

for Softness, Hardness, Strength



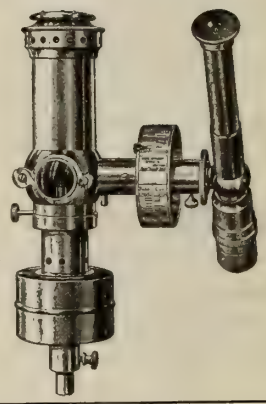
"Profit and loss" is apt to show an appalling debit unless the quality of materials used is assured before working up. The Scleroscope eliminates this long-standing difficulty; for it is a simple matter to establish definite standards for all raw materials and with the help of the Scleroscope any unskilled worker can see to their fulfillment.

Direct reading, can be operated by anyone with great rapidity. Measures softest metals and hardest steels without adjustment.

You would be well advised to send for free booklets explaining fully, both the "Scleroscope" and the "Pyroscope."

The PYROSCOPE

—a simple and reliable device for determining the temperature of metal in process of heat-treatment —durably constructed and requires no skill. Unexcelled for constancy, and it is inexpensive.



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ANNOUNCEMENT

Davis-Bournonville Company

Jersey City, N. J.

Manufacturers of oxy-acetylene welding and cutting apparatus, acetylene generators and welding supplies, have made arrangements by which

The Taylor & Arnold Engineering Company, Limited

will act as dealer in the Provinces of Ontario, Quebec, New Brunswick and Nova Scotia, and in Newfoundland, with sales offices and warehouses at 100 Ann Street, Montreal, and 32-34 Eastern Avenue, Toronto.

All correspondence relative to Davis-Bournonville products in the above-mentioned territory should be directed to the Taylor & Arnold Engineering Co. Ltd., at either of the above sales offices.

Frank Darling & Co., 114 Homer St., Vancouver, B. C. and G. T. Mumford, Galt Building, Winnipeg, will continue to represent the Davis-Bournonville Co. in their respective districts as heretofore.

Davis-Bournonville Company

Jersey City, N. J., U. S. A.

Branches in Principal Cities

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WM. BEARDMORE & CO., LTD., OF SCOTLAND,
are prepared to supply to the trade, through their Canadian Office the following products at manufacturers' prices:

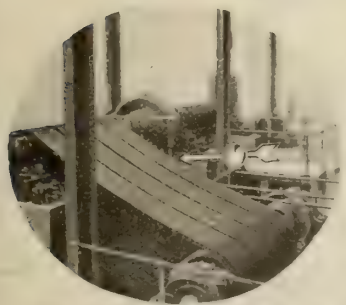
Steel Shafting and Forgings up to all sizes. Tyres and Axles. Lap-welded Furnaces, corrugated or plain. Sheets. Ship and Boiler Plates and Sections. Boilers, Scotch and Locomotive. Centrifugal Pumps, direct connected and belt driven. Semi-rotary Wing Pumps. Lighting and Generating Sets.

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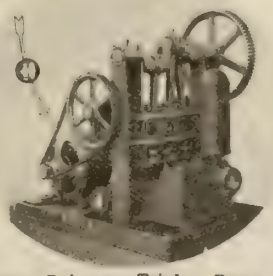
WILLIAM
BEARDMORE
AND COMPANY · LIMITED ·

285 BEAVER HALL HILL
MONTREAL - QUEBEC

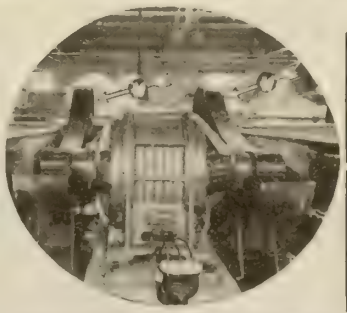
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5000 H.P. Drive, Waterwheel to Generator



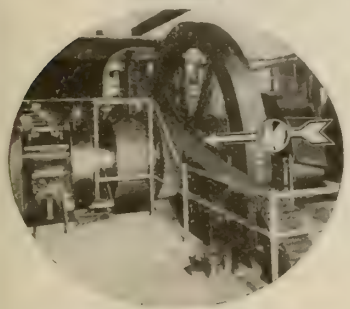
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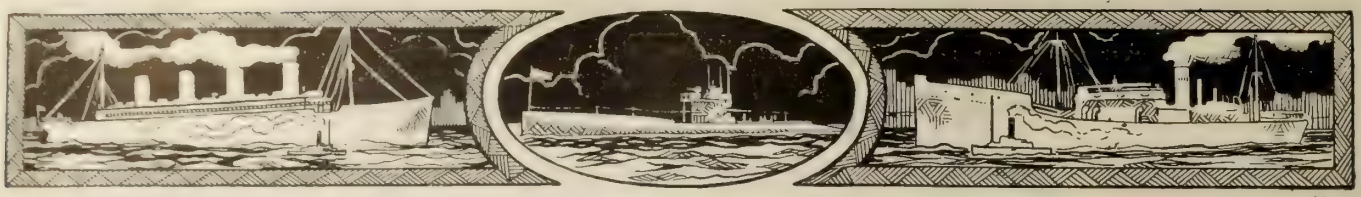
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JONES & GLASSCO, Regd.

MONTREAL : TORONTO

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& Company Limited.

LEEDS, England

Codes: A. I., A. B. C. (5th Edition), Engineering, Everybody's Pocket Code, Marconi International.

CANADIAN AGENTS:

Messrs. Fairbanks-Morse Company, Limited.

***Head Office*—Montreal**

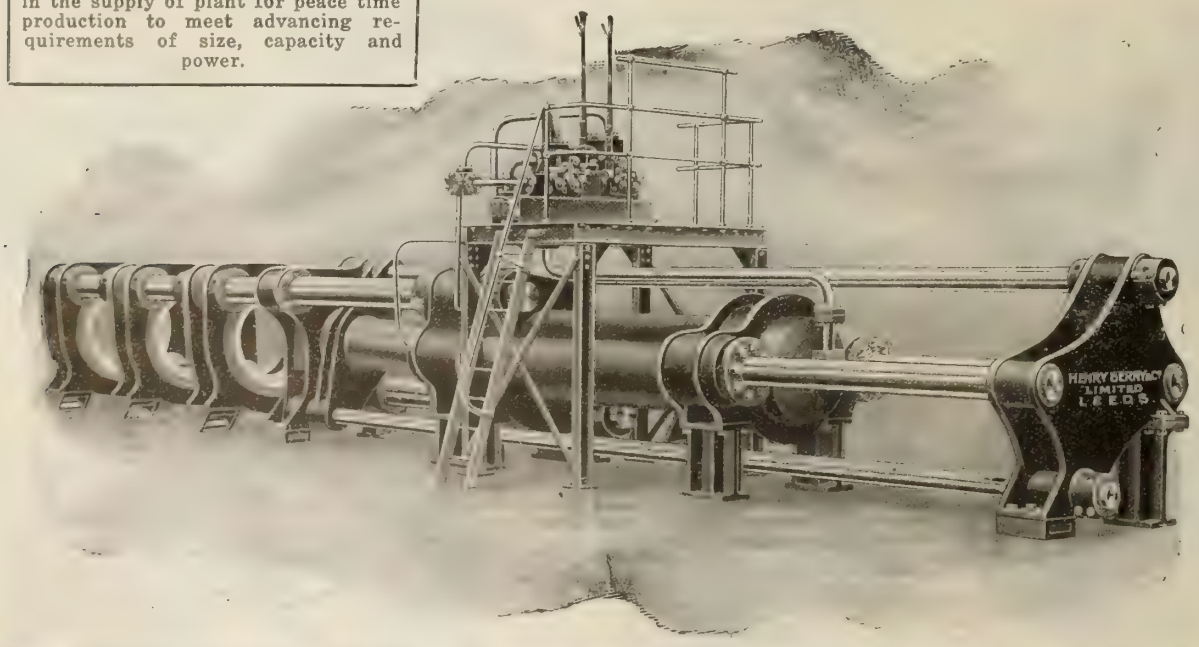
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Concerned for many years with the design and the manufacture of some of the largest types of machinery for the British Government, the Colonies and the Indian Empire, the firm of Henry Berry & Co. possesses some of the most extensive resources in the country for the production of the biggest, most powerful and most practical types of hydraulic machinery for Shipyards and Industrial Enterprises. These include all kinds of Shipyard Tools, Plate and Armour Bending Rolls, Rivetters, and Punching and Shearing Machines, Presses and Cranes.

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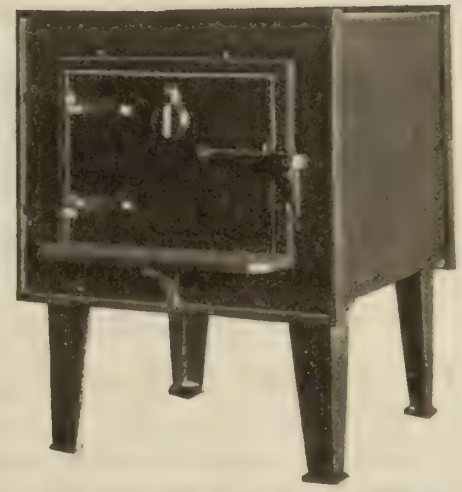
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A Handy

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Electric Furnace

For Tool Room Use



110 and 220 volt sizes $225.00
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MUFFLE — 8″ wide by 5½″ high by 14″ long operating temperatures 300 to 1,900 degrees Fahr.

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Unloading Device
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ELECTRIC Steel Castings of all kinds from 5 pounds to 5,000 pounds.

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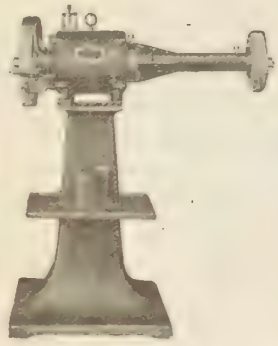
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HIGH SPEED STEEL

Tool Steel for Every Purpose

Twist Drills, Music Wire, Steel Balls

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Portable Electrical
FLOOR GRINDER

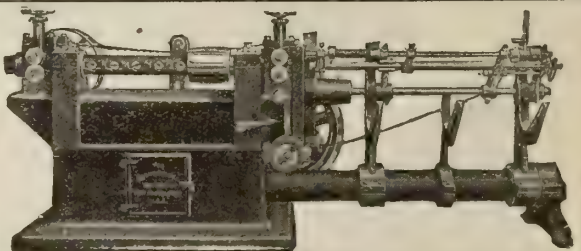
Figured on the basis of length of service, it costs the least.

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Made in 4 sizes: ½, 1, 2 and 3 H.P.

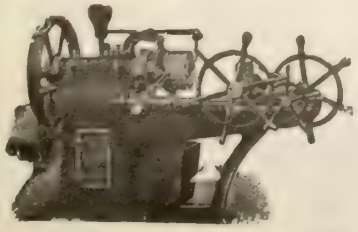
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and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

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Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines etc



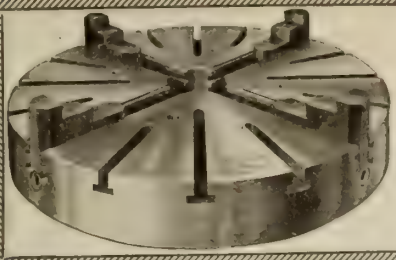
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Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

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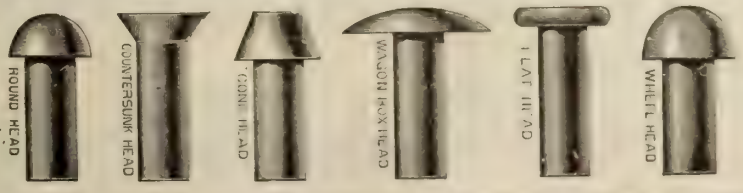
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up to ¼" capacity

3 Types, 4 Sizes 12" to 24" Wheel Capacity for all purposes

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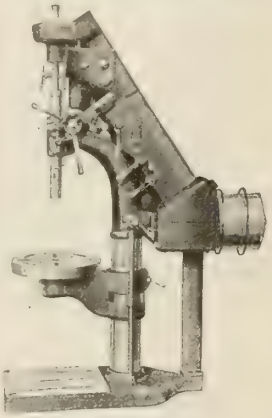
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Modern Tools for Modern Needs

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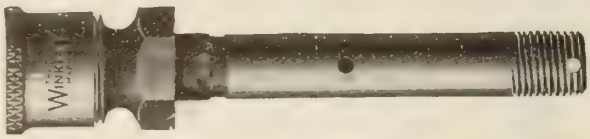
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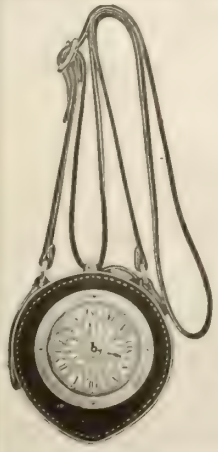
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Heavy duty double truck hoists; all latest improvements in construction.

HORIZONTAL DRILLING and BORING MACHINES
Designed to handle large, bulky pieces with one setting.

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Canadian Agents:
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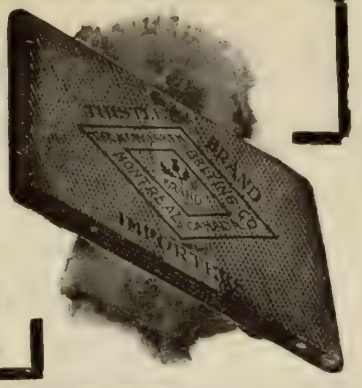
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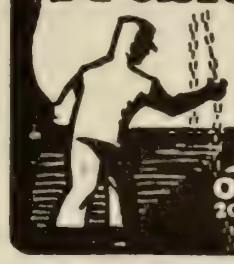
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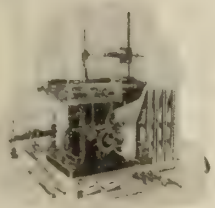


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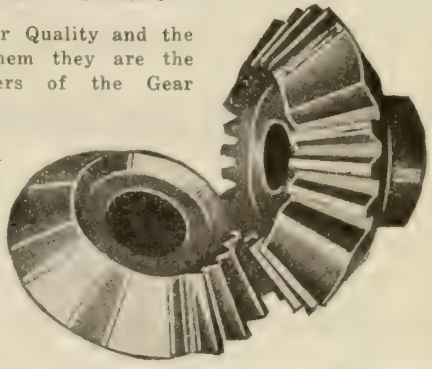
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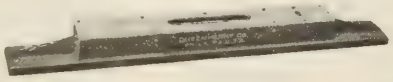
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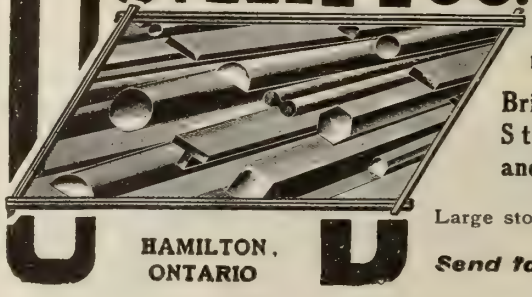
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Stewart & Co., Duncan, Glasgow, Scot.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Attachments, Tapping
William I. Procunier, Chicago, Ill

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.
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Atkins & Co., Inc., E. C., Indianapolis, I.
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Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Dominion Foundries & Steel, Ltd., Hamilton, Ont
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Armstrong Bros. Tool Co., Chicago, Ill.
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Gisholt Machine Co., Madison, Wis.

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Underwood Corp., H. B., Philadelphia.

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Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Dom Foundries & Steel, Hamilton, Ont.
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Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
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Belt Fasteners
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Flexible Steel Lacing Co., Chicago, Ill.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

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McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glasco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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Can. Fairbanks-Morse Co., Ltd., Montreal
Dom. Belting Co., Ltd., Hamilton, Ont.
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Sumner & Co., New York City

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Atkins & Co., Inc. E. C., Indianapolis, I.
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McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.
Sumner & Co., New York City.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal Que
Quaker City Rubber Co., Philadelphia

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.
Skinner Bros. Mfg. Co., Inc., St. Louis, Mo.

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Ernest G. Booker, Aylmer, Ont
Goldie & McCulloch Co., Galt, Ont

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

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Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
London Bolt & Hinge Works, London, Ont
Fittings, Ltd., Oshawa, Ont
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont

Boring and Turning Mills, Vertical
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa

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Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
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McDougall Co., Ltd., R., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont

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Aikenhead Hardware Ltd., Toronto, Ont

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Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis

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Puro Sanitary Drinking Fountain Co., Haydenville, Mass

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Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

Broaching Machines
Bilton Machine Co., Bridgeport, Conn.

Bronze, Phosphor
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Prybil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Bulldozers
Building Materials
Robertson Co., H. H., Cleveland.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Driver-Harris Co., Walkerville, Ont.
Fittings, Ltd., Oshawa, Ont
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Castings, Die Molded
Banfield & Sons Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Grey Iron
Fittings, Ltd., Oshawa, Ont

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio
Hepburn Ltd., John T., Toronto, Ont
Katie Foundry Co., Galt, Ont
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries Montreal Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Fittings, Ltd., Oshawa, Ont

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

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Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom Steel Products Co., Brantford, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom Steel Products Co., Brantford, Ont
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn

Chucks, Tapping
Wells Bros. Co., Greenville, Pa.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks' Watchman's Portable and Stationary
Chicago Watchman's Clock Works, Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cost Keeping Devices
Durant Mfg. Co., Milwaukee, Wis.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Engine
Durant Mfg. Co., Milwaukee, Wis.

Counters, Revolution
Durant Mfg. Co., Milwaukee, Wis.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Durant Mfg. Co., Milwaukee, Wis.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Underwood Corp., H. B., Philadelphia, Pa.

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Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cylinder Reaming Sets
Wetmore Reamer Co., Milwaukee, Wis.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Barnes Drill Co., Rockford, Ill.
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Flour Mill Units.
Pollard Mfg. Co., Niagara Falls, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Lt Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Founders & Machinists
The Vulcan Co., Ltd., London, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S. New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.
The Vulcan Co., Ltd., London, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Ltd Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont
The Alexander Milburn Co., Baltimore, Md.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Blanchard Machine Co., Cambridge, Mass.
Brown & Sharpe Mfg Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Perfect Machine Co., Ltd., Galt, Ont.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont

Grinding Machines, Disc
Ford Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Electric
[illegible] & Co., N. A., Cincinnati, O.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Monarch Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Carlton Machine Tool Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio
Cleveland Pneumatic Tool Co., Toronto Ont
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Portable
Schaum & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Perfect Machine Co., Ltd., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont
Hitch Speed Hammer Co., Rochester.
McKenzie Machinery Co

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Hooven & Sons, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont
Hooven & Sons, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Williams Machinery & Supply Co., A. R., Montreal Que
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
[illegible] Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Flexible Steel
Quaker City Rubber Co., Philadelphia, Pa.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hospital Equipment
Hartz Co., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
William Hamilton Tool Co., Peterborough, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Purke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Rockford Machine Tool Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Machinery Corp., Galt, Ont.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Porter-Cable Machine Co., Syracuse, N.Y.
Roelefson Machine & Tool Co., Toronto,
Rockford Lathe & Drill Co., Rockford, Ill.
Jas. I. Ryerson & Son, Chicago, Ill.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn
Warner & Swasey Co., Cleveland, Ohio.
Queen-Gray Co., Philadelphia, Pa. N.Y.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Machinery, Woodworking
Cowan Co., Ltd., Galt, Ont.

Machinists
Parker Co., Charles, Meriden, Conn.
McKenzie Mach. Co., Guelph, Ont.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Durant Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
F. F. Barber Machinery Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
McKenzie Mach. Co., Guelph, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garvin Machine Co., New York, N.Y.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
Petrie, Ltd., H W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co. Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can Consolidated Rubber Co., Ltd., Montreal, Que.
Quaker City Rubber Co., Philadelphia, Pa.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R I

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co A R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que
Jardine & Co., A. B., Hespeler, Ont
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal
Canada Machinery Corp., Galt, Ont
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg Co., Muskegon, Mich.
Pollard Mfg. Co., Niagara Falls, Ont
Oliver Machinery Co. Grand Rapids, Mich
Rockford Machine Tool Co., Rockford Ill.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John Dundas, Ont.

Plates, Boiler and Shi
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont

Polishing and Buffing Machines
Archibald & Co. Chas P., Montreal Q
Blount Co., J. G., Everett, Mass
Brown & Sharpe Mfg. Co., Providence R I
Ford-Smith Machine Co., Hamilton, Ont
Prentiss Machine Co., New York, N Y

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa
Fisher Motor Co., Ltd., Orillia, Ont

Presses, Arbor
Atlas Press Co., Kalamazoo Mich
Can Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont
Petrie, Ltd., H W Toronto Ont

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot
Brown, Boggs & Co., Ltd., Hamilton, Ont
Terry & Co., John C., Birmingham, Eng

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Niagara Machine Tool Co., Buffalo, N.Y.
Hepburn Ltd., John T., Toronto, Ont.
Rockford Machine Tool Co., Rockford, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R I

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa
Can. Fairbanks-Morse Ltd., Montreal Q.
Canadian SKF Co., Toronto, Ont
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que
William Hamilton Tool Co., Peterborough, Ont.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can
Can Blower & Forge Co., Ltd., Kitchener
Can Fairbanks-Morse Ltd Montreal Q
Hepburn Ltd., John T., Toronto, Ont

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence R I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Starrett Co., L. S., Athol, Mass

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Excelsior Tool & Machine Co., East St. Louis, Ill
Petrie, Ltd., H W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn
Taylor Instrument Co., Toronto, Ont
Hiram Walker & Sons Metal Products Co., Walkerville, Ont

Racks, Cut
Ford Smith Machine Co Hamilton, Ont
Hamilton Gear & Machine Co., Toronto Ont

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont
Wetmore Reamer Co., Milwaukee, Wis.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Machine Expanding
Wetmore Reamer Co., Milwaukee, Wis

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Detroit Twist Drill Co., Walkerville, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Can Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O
Excelsior Tool & Machine Co., East St. Louis, Ill.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis

Regulators, Oxygen & Acetylene
The Alexander Milburn Co., Baltimore, Md.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robertson Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd. Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R I

Rust Preventatives
Oakley Chemical Co., New York, N.Y

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill

Sanding Machinery
Oliver Machine Co. Grand Rapids, Mich

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal Que

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Markworth Machinery Co., Chicago, Ill.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H W., Toronto, Ont

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Bristol Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
William Hamilton Tool Co., Peterborough, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Roelefson Machine & Tool Co., Toronto,
Rockford Machine Tool Co., Rockford, Ill.
Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Niagara Machine Tool Co., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.
Selson Engineering Co., New York, N.Y.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Excelsior Tool & Machine Co., East St.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd, Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Excelsior Tool & Machine Co., East St.
Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio
Wetmore Reamer Co., Milwaukee, Wis.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont.

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

Stamping Machinery
Excelsior Tool & Machine Co., East St.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Garvin Machine Co., New York, N.Y.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Thread Gauges, Special
Wetmore Reamer Co., Milwaukee, Wis.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.
Quaker City Rubber Co., Philadelphia, Pa.
Voorhees Rubber Mfg. Co., Jersey City, N.J.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Company, Wallace, Hamilton,

Watchman's Clocks, Portable and Stationary
Chicago Watchman's Clock Co., Chicago, Ill.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto
The Alexander Milburn Co., Baltimore Md
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

Seven pages printed here each week for your convenience

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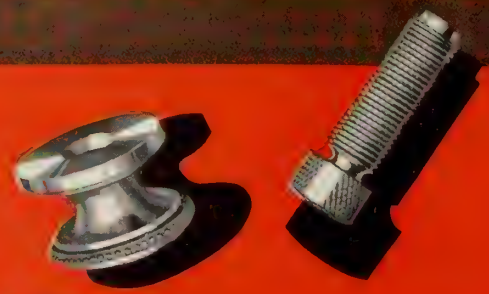
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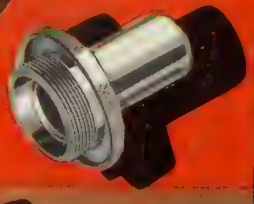
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